



Techno-optimism: an Analysis, an Evaluation and a Modest Defence

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Abstract

What is techno-optimism and how can it be defended? Although techno-optimist views are widely espoused and critiqued, there have been few attempts to systematically analyse what it means to be a techno-optimist and how one might defend this view. This paper attempts to address this oversight by providing a comprehensive analysis and evaluation of techno-optimism. It is argued that techno-optimism is a pluralistic stance that comes in weak and strong forms. These vary along a number of key dimensions but each shares the view that technology plays a key role in ensuring that the good prevails over the bad. Whatever its strength, to defend this stance, one must flesh out an argument with four key premises. Each of these premises is highly controversial and can be subjected to a number of critiques. The paper discusses five such critiques in detail (the values critique, the treadmill critique, the sustainability critique, the irrationality critique and the insufficiency critique). The paper also considers possible responses from the techno-optimist. Finally, it is concluded that although strong forms of techno-optimism are not intellectually defensible, a modest, agency-based version of techno-optimism may be defensible.

Keywords Techno-optimism · Techno-pessimism · Sustainability · Stance · Futurism · Presentism · Agency

1 Introduction

In September 2019, the journalist Brad Stone asked Jeff Bezos — then CEO of Amazon and the world's richest man — what could be done about climate change. Could we use technology to get out of the hole we had dug for ourselves? Here's what Bezos said:

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I really do believe when ingenuity gets involved, when invention gets involved, when people get determined and when passion comes out, when they make strong goals — you can invent your way out of any box. That's what we humans need to do right now. I believe we're going to do it. I'm sure we're going to do it.

(Jeff Bezos, quoted in Stone 2021, 4)

Bezos's statement is a classic example of *techno-optimism*: the view that technology, when combined with human passion and ingenuity, is the key to unlocking a better world. Techno-optimist views are common in industry and policy (Johnston, 2020; McKeown, 2018; Morozov, 2011), but they tend to be treated with suspicion in the academy. Indeed, much of the academic debate about the impacts of technology on society has a pessimistic angle to it, highlighting the ethical harms and unanticipated effects of technology on the environment, social norms and personal well-being.¹ Indeed, many academics see techno-optimism as irrational and superstitious — a faith-based initiative with little grounding in reality (Wilson, 2017; Keary, 2016; Krier & Gilette 1985; Alexander & Rutherford, 2019). This scepticism may have deeper roots in intellectual temperament. Some have pointed out that pessimistic views are *de rigueur* among intellectuals, particularly in the post-Enlightenment era (Harris, 2002; Prescott, 2012); optimistic views are, by contrast, “not regarded as intellectually respectable” (Boden, 1966, 291).

This article attempts to push back against this scepticism by developing a philosophical analysis, evaluation and partial defence of techno-optimism. Its aims are, admittedly, modest. For reasons that will be outlined later in this article, it is impossible to provide a robust defence of techno-optimism. To do so would require knowledge to which we have no access. Nevertheless, it is possible to clarify the cluster of views that is picked out by the term ‘techno-optimism’ and to show that some members of this cluster of views are more intellectually respectable than others. Identifying these members is the goal of this article.

To make this case the article proceeds in four parts. First, I clarify the concept of techno-optimism, focusing on both the optimistic and technological aspects of it. In clarifying the concept I seek not to distil the essence of techno-optimism from the existing literature but, rather, to provide an *ameliorative analysis* that gives the concept the structure and rigour it currently lacks. Second, I outline an argumentative framework for assessing techno-optimist views. This framework highlights four key premises — the facts premise, the values premise, the evaluation premise and the technology premise — that need to be defended by the techno-optimist. Third, I explain why this argumentative framework presents significant challenges for the techno-optimist, reviewing some of the psychological, ecological, sociological and, indeed, cosmological reasons for doubting the viability of strong forms of techno-optimism. Fourth, I explain why, despite these formidable obstacles, a modest form of agency-based techno-optimism may remain intellectually viable.

¹ My own work, despite its optimistic overtones, includes long discussions of ethical and social risks associated with technology, e.g. Danaher 2019.

2 What Is Techno-optimism?

Techno-optimism is not one specific view; it is, rather, a cluster of related views that vary along a number of dimensions. In particular, techno-optimistic views vary with respect to the *degree* of optimism (how good can things be), the *temporal orientation* of optimism (past, present or future focused), the *modal (epistemic) robustness* of optimism and the *role of technology* in sustaining optimism. I unpack this idea in more detail in the following two subsections, focusing first on optimism in general and then, more specifically, on the role of technology in the optimistic outlook.

2.1 Optimism

‘**Optimism**’ can be loosely defined as the belief that things are generally pretty good and/or the belief that things will get even better. But this is not to say too much. What are the defining features of optimism vis-a-vis other related beliefs? Is optimism best defined as a belief or should it be seen as a motivation or desire or a ‘can-do’ attitude (Bortolotti, 2018; Jefferson et al., 2017)? Unfortunately, there is very little agreement on these matters. The term ‘**Optimism**’ is often used loosely and without any rigorous attempt to define it. Accepting this, in what follows I do not purport to offer a descriptive analysis of ‘**Optimism**’ — i.e. one that captures our ordinary language usage of the term — but rather an ameliorative one (Haslanger, 2000; Diaz-Leon, 2020).² In other words, I try to provide some structure and rigour to the concept of optimism and then use that as the target of evaluation in the debate about techno-optimism.

How can we provide an ameliorative analysis of ‘**Optimism**’? I suggest we start by extrapolating from philosophical analyses of pessimism. Optimism and pessimism are two ends of the same spectrum. If we have some understanding of pessimism, we can use it to more accurately characterise optimism, and, for better or worse, philosophical analyses of pessimism are more common than analyses of optimism.

Paul Prescott’s analysis of pessimism is a helpful starting point (Prescott, 2012). Prescott defines pessimism as a *stance*: a collection of attitudes and beliefs that entails some commitment over time. A stance is never something that ‘simply happens to a subject’, it ‘involves some degree of active participation’ and in this sense is like a ‘policy or position’ (Prescott, 2012, 3).³ As a stance, Prescott argues that pessimism is best characterised by the commitment to the view that ‘the bad prevails over the good’ (Prescott, 2012, 2 and 8ff). By this, Prescott means that pessimists maintain that badness ‘gains ascendancy or dominance’ over the good, or that badness is ‘pervasive, effective or simply persists’ relative to the good (Prescott, 2012,

² On the descriptive vs ameliorative distinction see Diaz-Leon (2020, 170): ‘The main idea is this: philosophers engaged in a descriptive project aim to reveal the operative concept, that is, the objective type that our usage of a certain term tracks (if any), whereas philosophers engaged in an ameliorative project aim to reveal the target concept, that is, the concept that we should be using, given our purposes and goals in that inquiry.’

³ In saying this, Prescott is drawing upon the work of Bas van Fraassen on stances in philosophy.

8ff). In saying this, Prescott's analysis of pessimism is consistent with Margaret Boden's analysis of optimism, which states that optimism is the view that there is a 'preponderance of good over evil, happiness over misery' (Boden, 1966, 294). This is consistent with the idea that there are relative degrees of pessimism and optimism that depend on how much the bad (or good) prevails. Marginal pessimists might say that the bad just about prevails over the good, but it is a close-run thing. Stronger pessimists might think that the bad prevails by a very long distance. Given that this view calls for the bad or good to prevail, we can call it the 'preponderance view'.

Prescott also says a number of important things about what pessimism is not. Pessimism is not fatalism. Fatalism is the view that the future is fixed and beyond human control. This is consistent with optimism and pessimism. The future might be pre-determined to be very good or very bad. In addition to this, pessimism is not cynicism. Cynicism, according to Prescott,⁴ is the view that human beings are essentially evil or bad. Cynicism often lends support to pessimism, but a pessimist can believe that humans are essentially good whilst maintaining that external factors ensure that badness prevails. Furthermore, pessimism is not the 'affirmation of decline'. Many pessimists think that things are getting worse, but they need not believe this in order to count as pessimists. Things may just be statically bad. Finally, pessimism is not nihilism. Nihilism is not always well-defined (Joyce, 2013) but it comes in at least two forms (i) axiological nihilism (the view that there is no value, no good or bad, in the world) and (ii) pragmatic nihilism (the view that humans are powerless to realise the good). Axiological nihilism is incompatible with pessimism. The pessimist must believe that there is some metric along which the prevalence of badness can be measured and tracked. The axiological nihilist denies the existence of such a metric. Pessimism is compatible with pragmatic nihilism, and pragmatic nihilists often end up as pessimists, but this is not a necessary relationship. A pessimist might think that humans can realise some good through their actions, but that this good is trivial and will fail to counteract the predominance of bad.⁵

We can use all of this to develop an ameliorative analysis of optimism. First, we can adopt the preponderance view and define optimism as the stance that is committed to the idea that the good prevails over the bad by some distance, with that distance varying depending on the strength of the optimistic stance. Optimism, so defined, is compatible with fatalism and cynicism. In fact, as we shall see below, some prominent forms of techno-optimism assume that humans are fatally flawed and that they can only be saved by deterministic processes of technological improvement. Optimism, so defined, tends to be associated with the affirmation of improvement (i.e. the sense that things will get better) but is not necessarily tied to that view. Optimists can be conservative. They might think the good currently prevails over the bad but that there is a serious risk to that prevalence being sustained in the future.

⁴ The classical school of philosophy that originates the name has, of course, a different meaning. For present purposes, it suffices to adopt Prescott's alternative/stipulative definition of cynicism.

⁵ Prescott says some other things in his article too. He looks at the link between pessimism and philosophical scepticism and pessimism and despair. I don't consider these here because they are not relevant to this discussion.

They might believe that we must work hard to maintain the status quo to prevent that from happening. Finally, optimism is not compatible with axiological nihilism, since the optimist must believe in a metric of value along which the prevalence of the good can be measured and tracked, but it is consistent with pragmatic nihilism. Many religious optimists, for instance, believe that humans cannot ensure an optimistic future and that intervention from a divine agent is needed for this (Harris, 2002; Wilson, 2017). Techno-optimists sometimes adopt a similar view, holding out that technology is some kind of elemental force that will save us from ourselves. That said, optimism can also be associated with a ‘can-do’ attitude and a belief that human agency can make a positive difference to the future (Bortolotti, 2018).

If we accept this view of optimism, three issues arise. The first concerns the scope of optimism. If we say that the good must prevail over the bad, do we mean what is good for the individual, for a particular society or population of humans, for humanity as whole or for the universe as a whole (sub specie aeternitas)? In the literature to date, people have distinguished between *personal* and *impersonal* forms of optimism (Boden, 1966; Harris, 2002; Jefferson et al., 2017; Prescott, 2012). Personal optimism is the view that goodness prevails for the individual; impersonal optimism is the view that it prevails in general, where this can be defined in different ways. It could refer to what is generally good for humanity (in the aggregate) or it could be what is good for everything in existence. I accept that one can plausibly claim to be an optimist at any given scope. One can be optimistic about one’s own life, but not the lives of others. One can be optimistic about the prospects for humanity as a whole, but not for one’s own life. Or one can be an optimist at every level. There are many possible configurations of optimistic and pessimistic stances. That said, in what follows, I will tend to presume we are dealing with some impersonal form of optimism when we discuss techno-optimism. The impersonal forms tend to be more philosophically interesting and contentious than the individual forms. I will equivocate somewhat between forms of impersonal optimism that focus on humanity in general and forms that extend the scope beyond humanity. The reason for this is that some forms of techno-optimism presume that we will transcend the human condition and that our future offspring will be non-human or post-human (e.g. reference omitted). I do not wish to exclude those views from the analysis.

The second issue that arises is the temporal orientation of optimism. We can distinguish between *presentist* and *futurist* forms of optimism.⁶ Presentists think that goodness prevails right now; futurists think that goodness will prevail in the future. It’s possible to be both a present and future optimist, but it’s also possible to be one or the other. In its futurist orientation,⁷ it is worth distinguishing between different

⁶ I discount the idea that there is a form of historic or past optimism. It is certainly true that some people think the past was better than the present, perhaps even a lot better (we might call these ‘golden age’ views), but it would seem odd to suggest that such a view counts as optimistic. On the contrary, it seems more appropriate to say that it is a pessimistic view. This is one place where a counterfactual form of optimism/pessimism might be useful.

⁷ Strictly speaking, it is possible to distinguish these forms of optimism in the presentist form too. Leibnizian optimism, for instance, is the view that this is, necessarily and already, the best of all possible worlds (Wilson 1983). Our degree of belief in presentist optimism may also be probabilistic — the evidence might suggest that optimism is highly likely to be true, or only a bare possibility.

modal epistemic forms of optimism. A futurist might be very certain about their optimism and believe that the good will *necessarily* prevail over the bad, but they might also have different degrees of belief, thinking that it is very *likely* or *probable* that things will get better, or simply that it is *possible* (perhaps with a good deal of hard work and luck) for this to happen. Again, there might be different strengths of optimism associated with different degrees of modal epistemic robustness. *Strong futurist optimism* will be premised on necessity or high probability; *weak futurist optimism* will be premised on low probability or possibility. Sutherland argues that possibility-based optimism is an ‘attenuated’ but genuine form of optimism (Sutherland, 1981, 542). We might question this on the grounds that the mere possibility of goodness prevailing is not enough to sustain an optimistic stance, but, on the other hand, the mere possibility gives at least some reason for hope and action. In this sense, there could be a curious asymmetry between optimistic and pessimistic views. If it is possible that the good could prevail, and if human agency can play some role in this, then maybe we ought to actively maintain an optimistic stance, at least in the futurist orientation, because that will encourage us to work toward that possibility (and hence for that future to become a self-fulfilling prophecy)? This is an argument I will return to later in this article.

The third issue that needs to be addressed is whether the preponderance view is really the correct way to think about optimism. You could argue that a ‘mere improvement’ or ‘counterfactual’ view of optimism tracks more closely with our everyday use of the term ‘[optimism](#)’.⁸ On this view, an optimist is defined as a person who thinks things that are better than they might otherwise have been, or that they are improving relative to what they once were — the glass-half-full type; contrariwise, a pessimist is defined as someone who thinks things are worse than they might have been. To assess whether this outlook is correct you compare our present world with some other (close) possible world and see if our world is better or worse relative to that other world. There are, however, problems with the counterfactual view of optimism and hence reasons to favour the preponderance view. First, the counterfactual view has counterintuitive and perverse implications. For example, if things were very good in the present world (preponderantly so), one could still count as a pessimist if one thought things could be marginally better in some close possible world. This seems perverse. The mere fact that things could be better does not seem a reason to discount the goodness of the present world. Second, this problem is compounded by the fact that there are often multiple possible worlds with which we can compare the present one. In some worlds, things are a lot better than they are in the present one; in others, things are a lot worse. Whether one is an optimist or pessimist then depends on the set of comparator worlds one chooses. This provides too fickle or unstable a basis for the stance.

One might argue that futurist forms of optimism are necessarily counterfactual in nature. The futurist is, after all, comparing the present with some possible future world. They ground their optimistic stance in the belief that we can get to

⁸ I am indebted to an anonymous reviewer for pushing me to defend my view from these alternatives conceptions of optimism.

that possible future world and things will be better there. This is the ‘improvement’ variation on the counterfactual view. This idea that things will improve is common, as we shall see, in the techno-optimist literature. But even in its futurist orientation, there are reasons to think that the preponderance view is the correct one. One reason for this is that the futurist isn’t simply comparing the present (actual) world with a set of future possible worlds; they are, crucially, assuming some plausible causal pathway between the present and a possible future. More importantly, even if a future possible world were marginally better than the present world, this would not be enough to sustain optimism *unless the preponderance threshold has already been crossed*. For example, things might be pretty bad in the present (preponderantly so) but a futurist could point to some possible future in which everything remains the same but we each get an extra ice cream every week. This might make the future marginally better than the present, but it is not enough to make us optimistic if things remain below the preponderance threshold.

One could argue that the improvement/counterfactual view could be repaired by distinguishing between *mere* improvement and *substantial* improvement. The argument would run like this: the perverse implications of the counterfactual view are largely tied to the idea that minor or trivial improvements (‘mere’ improvements) would be enough to sustain an optimistic outlook. We could eliminate this perverse implication by stipulating that only substantial improvements relative to the present world are enough to sustain an optimistic outlook. This doesn’t remove the problem of excessive counterfactual comparison but it does make the view more plausible, particularly if we limit ourselves to futurist forms of optimism. But then the question arises: what counts as a substantial improvement? Is it one that makes things (for humanity or for the world as a whole) 10 times better than they are in the present world? 100 times better? In addition to being extremely difficult to measure, any choice we make between different degrees of improvement seems arbitrary. I would suggest that the most plausible and least arbitrary conceptualisation of a ‘substantial’ improvement is simply ‘one that results in us crossing the preponderance threshold’, with different degrees of optimism then being linked to the degree to which we exceed that threshold. In other words, the substantial improvement view would, in its most plausible rendition, reduce to the preponderance view. This doesn’t imply we cannot talk about some worlds being *better than* others or claim that they represent an improvement over the present world. We cannot eliminate all counterfactual comparisons and all mentions of ‘improvement’ from the debate about optimism. But we can say that the crossing of the preponderance threshold is the key to justifying an optimistic outlook. We need at least that in order to count a view as optimistic. We can then be more or less optimistic depending on the degree to which we cross the threshold. Admittedly, it will be very difficult to determine whether we have crossed the threshold. I will return to this difficulty when I discuss the *values critique* of techno-optimism later in this paper. But since any conceptualisation of optimism will face a similar measurement problem, I remain convinced that an ameliorative conceptualisation of ‘**optimism**’ is one that adopts the preponderance view.

Finally, it is worth noting that if optimism and pessimism are two ends of the same spectrum, they may not be jointly exhaustive stances. It might be possible to develop a stance that lies somewhere in between the two poles of optimism and

pessimism. Perhaps we could call this a ‘neutralist’ stance: neither good nor bad prevails. Nevertheless, unless one embraces axiological nihilism, it may be practically difficult to maintain a perfectly neutral stance for a long period of time. The slightest nudge in perspective would tend to push one into some degree of optimism or pessimism.

2.2 Technology

So much for optimism. What is the distinctive form of optimism called ‘techno-optimism’? Following the preceding analysis, we can say that techno-optimism is the stance that holds that technology plays a key role in ensuring that the good prevails over the bad. But there are some problems with that simple extrapolation from the analysis of optimism. The term ‘key role’, for instance, is deliberately vague. It may be that technology is a *necessary* element in ensuring that the good prevails, or a *sufficient* one, or an *important catalyst* of for this state of affairs. The exact mechanics might vary depending on the type of techno-optimism under consideration. Just as there are weak and strong forms of optimism in general, there might also be weak and strong forms of techno-optimism. We need to clarify the concept a bit more.

We can do this by asking and answering some important questions. First, what is this thing called ‘[technology](#)’ that plays a key role in [optimism](#)? Eric Schatzberg (2018) has written an extensive history of the concept of technology and suggests that there is one dominant school of thought about what technology is. This school of thought is *instrumentalism*, which holds that technology is an expression of instrumental (means-end) reasoning. Technology is thus understood to be a set of tools that humans use to solve problems and achieve goals. Individual technologies might be single or multi-use, and they may take on some broader cultural meaning or significance, but they are all ultimately a means to some set of ends. Schatzberg contrasts the instrumentalist school of thought with his own, preferred, *cultural* school of thought. According to this, technology is not just a means to an end but also an expression of creative or expressive agency. It is a cultural product imbued with meaning and value. For Schatzberg, the cultural understanding of technology is the superior one because the instrumentalist understanding tends to downplay the role that values play in shaping the content and form of technology, and also tends toward techno-determinism. Against Schatzberg, the historian Jon Agar (2019) argues that the cultural understanding of technology is ‘so capacious as to be almost useless’, insofar as it blurs the line between technology and other cultural products (like art). He also argues that instrumentalism is not necessarily associated with the vices of value-neutrality and determinism.

The merits of this conceptual debate are beyond the capacity of this article to resolve. For present purposes, however, I will side with Agar and approach technology in largely *instrumentalist* terms. When I consider the merits of techno-optimism it will be with the instrumentalist understanding in mind. This, however, doesn’t preclude the belief that technology is often imbued with human values and biases and, indeed, that such values and biases need to be factored into any account of techno-optimism. It also doesn’t preclude the belief that technologies are expressions of

creative agency and can take on broader cultural meaning and significance. The automobile, for instance, is a means to an end (transport) but it also has many cultural meanings attached to it. It would be hard to appreciate the songs of Bruce Springsteen without appreciating those cultural meanings. Finally, it doesn't preclude the possibility that some forms of technology (e.g. automating technologies such as robotics and AI) are not best thought of as simple tools of human agency but, rather, replacements of or substitutes for human agency (Gunkel, 2020).

This instrumentalist understanding of technology still leaves three issues to be resolved. The first is the relationship between technology and *materiality*. Must technology take some material form⁹ or can it include immaterial things like ideas or cultural institutions? Both the material and immaterial forms can be used in means-end reasoning, but do they both deserve to be called 'technologies'? This is something that has detained many technology theorists. The debate arises out of a desire to avoid over and under-inclusiveness in the definition of technology. Agar favours materialism, as does the technology critic Evgeny Morozov (2011). Both worry that by expanding the definition of technology to include institutions and ideas we stretch it to the point of absurdity. What about ideas and institutions that are anti-technology? Are they, perversely, just another form of technology? It would seem odd to say so. On the other hand, there are those that think there is merit to including ideas and institutions within the definition of technology. Brian Arthur, in his book *The Nature of Technology* (2009), favours materialism in the first instance but also accepts that there can be organisational technologies (institutions) that have many features in common with material technology. Similarly, the psychologist Cecilia Heyes (2018) argues that humans have created many 'cognitive gadgets' that improve our learning and rates of innovation. In elucidating this concept, she explicitly draws upon the analogy between physical technology and mental technology (Heyes, 2018, 1).

Again, it is not possible to resolve the debate between the materialists and immaterialists in this article. There is merit to both views and it may be that explicitly labelling them as two different kinds of technology, with blurry boundaries between them, is the best solution to the problem. What I will suggest, however, is that it would be hard for techno-optimism to be defensible if it only focused on material technologies. Ensuring that we have the right institutions for selecting and validating technologies is essential if one is to sustain optimism about material technologies. In a sense, then, techno-optimism is most credible when it is *conditional* upon social institutions. I will elaborate on this in greater detail below when discussing criticisms of techno-optimism.

The second issue that needs to be resolved is the *level of abstraction* at which we understand the idea of technology. We can talk about technology in terms of specific gadgets or artefacts: penicillin, the cell phone, the chain saw. We can also talk about

⁹ Information technologies might be thought to trouble a materialist understanding of technology but this is not the case. All information technologies have some kind of material instantiation, e.g. in CPUs and server farms. At the same time, all institutional technologies have a material instantiation too so this isn't an obvious differentiating property.

assemblies of technologies with the same material basis or operating principle, e.g. electrical technologies, digital technologies, biotechnologies, artificial intelligence (Arthur, 2009). Many of these assemblies of technologies fit together in complex webs of inter-dependencies or, as some have called them, technology ‘stacks’ (Barley, 2020, ch. 3). For instance, new forms of artificial intelligence are stacked on top of digital technologies, electrical technologies, fossil fuel technologies and so on. Taking this idea to the extreme, the author Kevin Kelly has argued that we should refer to the total set of technologies as ‘The Technium’ (Kelly, 2010), which he sees as an emergent superorganism consisting of all assemblies of technology, and the associated institutions, which has an internal momentum and logic of its own.

Kelly may go too far (Morozov, 2011) but, when it comes to understanding techno-optimism, the idea that technology is more than just particular gadgets or particular assemblies is an important one. It is, of course, possible to be optimistic about the role that the cell phone or CRISPR might play in the future of humanity (in the sense that, properly harnessed, they will contribute to ensuring the good prevails at some relevant scale). But limiting techno-optimism to particular forms of technology would make it a less interesting stance to defend. Techno-optimism is at its most unique and interesting when it is intended to capture optimism about the totality of technology, i.e. optimism not just about particular gadgets but about the total collection of processes and outputs of technological production in society.

The third issue that needs to be resolved is the relationship between technology and determinism. Techno-determinism is a multi-layered concept (Dafoe, 2015) but can be loosely characterised as the view that at least some of the processes of technological formation and development are beyond human control. This can be contrasted with non-deterministic or agency-based theories of technological formation and development. Strictly speaking, techno-optimism is compatible with both determinism and non-determinism. That said, there may be a tendency for techno-optimists to lean into determinism. Given the messy contingencies of human choice and action, it might be difficult to anchor optimism in any view that gives humans control over the process of technological development, particularly if we have a cynical view of human nature. Nevertheless, it is possible to defend an agency-based theory of techno-optimism and I will attempt to defend such a view later on.

One final issue, not linked to the definition of technology, is whether there is a substantive objection to applying the preponderance view of optimism to techno-optimism. Someone might argue that although optimists in general have to think that the good prevails over the bad, techno-optimists need not. They just need to think that technology is a positive force in the world: that it makes things better (perhaps substantially better) than they might otherwise have been. This seems to raise the spectre of counterfactual/improvement optimism, once again. In response, I would argue that this form of techno-optimism is implausible for the same reasons that the counterfactual form of optimism is implausible. It is not enough for the techno-optimist to think that technology can make things better because things overall could still be very bad overall; it is not enough for the techno-optimist to think that technology can make things substantially better, because then, the question remains as to what counts as ‘substantially’ better. The most plausible version of techno-optimism is one that incorporates the preponderance view.

To briefly sum up, optimism is the stance that holds good does or will prevail over the bad. Optimistic stances vary along several dimensions the most important of which, for present purposes, concern the relative degree of optimism (by how much the good prevails over the bad), the temporal orientation of optimism (presentism or futurism) and the modal robustness of optimism (is a preponderance of good over bad necessary, probable or merely possible). Optimistic views also apply at different scales and scopes: we can be optimistic at a personal or impersonal level. This article focuses on impersonal forms of optimism. Techno-optimism is the stance that holds that technology, defined here in largely material and instrumental terms, plays a key role in ensuring that the good does or will prevail over the bad. To make this interesting, ‘[technology](#)’ has to be understood at a reasonably high level of abstraction — not just particular gadgets but the totality of processes of technological production. There are stronger and weaker forms of techno-optimism. The strongest forms of techno-optimism claim that technology plays (or will play) a necessary and sufficient role in ensuring that the good prevails over the bad by a considerable distance; the weakest forms of techno-optimism will claim that technology plays (or will play) an important role in ensuring that we cross the preponderance threshold by some marginal distance. Moderate stances lie in between these two extremes. In addition to this, the strength and weakness of the techno-optimistic stance may vary depending on the degree of modal robustness, particularly in the futurist orientation. Table 1 tries to capture some, but not all, of the different possible forms of techno-optimism. It is provided for illustrative purposes only. It is possible to mix and match different commitments to generate distinct forms of techno-optimism.

3 The Argument for Techno-optimism

Boden (1966) claims that there are three things that any optimist must have in order to develop a rationally sensible form of optimism. First, they must have some statement of the relevant facts (present or future). Second, they must have a list of value criteria that they will use to evaluate those facts — these criteria are used to determine whether the good does predominate over the bad. And third, they must have some positive evaluation of the facts in light of the value criteria — i.e. some claim to the effect that, with respect to these value criteria, the good does in fact prevail over the bad. These three things form the backbone of any argument in favour of optimism. That argument will consist of (i) a facts premise, (ii) a value premise and (iii) an evaluation premise.

That’s optimism in general. What about techno-optimism? Techno-optimism needs these three premises too, but must add a fourth: (iv) the technological premise, which states that technology plays a key role in ensuring that the positive evaluation (iii) of the facts (i) holds up in light of the values (ii).

With some minor modifications, this can be used to form an argument template for techno-optimism. The minor modifications regard the modal epistemic nature of the optimism in question. We already noted this as an important element of any fully worked out optimistic stance. Since our judgements of fact or value are often

Table 1 Possible forms of techno-optimism

	Degree of preponderance	Modal epistemic robustness	Role of technology
Strong Techno-optimism	The good prevails over the bad by a long distance	The good will certainly/necessarily prevail	Technology plays a necessary and sufficient role in ensuring that the good prevails
Moderate Techno-optimism	The good prevails over the bad by a moderate distance	It is more probable than not that that the good will prevail over the bad	Technology plays an important role in ensuring that the good prevails
Weak Techno-optimism	The good prevails over the bad by a marginal distance	It is possible that the good will prevail by some marginal distance	Technology plays an important, but not decisive or sufficient, role in ensuring the good prevails

probabilistic in nature, some epistemic humility seems appropriate for any thesis that purports to justify a general stance one takes to the world. We can be optimists to *the best of our knowledge*, or on the basis of the currently available evidence, and so on. This epistemic humility is reflected in the template given below.

Argument Template for Techno-optimism

- (1) If (a) the good probably does or probably will prevail over the bad and (b) if technology probably plays a key role in ensuring this, then techno-optimism is the correct stance.
- (2) The probable current and/or future facts are $F1 \dots F_n$ [*Facts Premise*]
- (3) The agreed upon value criteria for determining whether the good prevails over the bad are $V1 \dots V_n$ [*Value Premise*]
- (4) The good probably prevails over the bad, given $F1 \dots F_n$ evaluated in light of $V1 \dots V_n$ [*Evaluation Premise*]
- (5) Technology probably plays a key role in ensuring that (4) is true (*Technology Premise*).
- (6) Therefore, techno-optimism is the correct stance.

Specific arguments in favour of techno-optimism can vary in terms of how they flesh out this template but they should follow it. Furthermore, since pessimism is just the opposite of optimism, this template can be used to form arguments in favour of techno-pessimism.

With this template in place, we begin to see the formidable hurdles facing any strong form of techno-optimism. Premise (1) is relatively uncontroversial. It arises from the definition of techno-optimism that was given in the previous section. You might challenge that definition, but it is not the most likely source of opposition. The other four premises, however, can be contested and there are some powerful arguments that can be offered against them. In the next section, I will review some standard criticisms of these premises and consider possible responses that the techno-optimist can give. For now, however, I want to flesh out the argument template by considering some recent defences of techno-optimism. Bear in mind, however, that given my ameliorative analysis of the concept of techno-optimism, I am not claiming that any of the sources I mention follow the argument template precisely. My goal, rather, is to show how the arguments can be made to fit this template.

Let's consider, first, an argument in favour of present techno-optimism. In the recent past, a number of books have been written defending an unapologetic form of present optimism. It would be impossible to list every example of this, but prominent ones include works by Steven Pinker (2011, 2018), Ramez Naam (2013), Andrew McAfee (2019), Rosling et al. (2018), Ridley (2010) and Angus Deaton (2013).¹⁰ Many of these books cite similar facts and similar studies to justify their optimism. Steven Pinker's, 2018 book *Enlightenment Now* may be the paradigm case. It brings

¹⁰ Vaclav Smil's *Grand Transitions* (2021) may deserve an honourable mention here too. It cites many of the same facts but does so in a less optimistic tone.

together many different arguments and lines of evidence that are common to the other books. Pinker considers a wide range of value criteria, including life expectancy, childhood mortality, equal rights, democratic governance, infectious disease, happiness, poverty, GDP and pollution and environmental degradation (to name just a few). He argues that the facts have gotten significantly better along each of these dimensions over the past 250–300 years. The resulting conclusion seems to be that the good now prevails by a long distance over the bad (at least with respect to these value criteria).

The optimism outlined in these books is not always directly attributed to technology, but technology and innovation usually play a central part. Most of these books see [technology](#) as a proximate cause of present goodness, whilst at the same time accepting that technology may ultimately be sustained by other processes and forces. Pinker, for example, thanks the Enlightenment¹¹ (more specifically, the rise of reason, science and humanism) for our present condition. Pinker sees this ideology as the underlying cause of the proximate social and technical innovations that made progress possible, e.g. breakthroughs in agricultural technology to reduce hunger, breakthroughs in medical technology to reduce childhood mortality and infectious disease. Ramez Naam (2013) presents a similar case, crediting specific innovations in energy production, agriculture and medicine for our present condition, which he thinks were made possible by science and the free exchange of ideas. What is interesting about these arguments is that they see an important connection between what I earlier called immaterial technologies (ideas and social institutions) and material technologies (physical artefacts) in making the present such a wonderful time to be alive.

What about future techno-optimism? As noted earlier, present optimism need not entail future optimism. The present might be wonderful but things might be about to get much worse. The authors of the books cited above tend to be future optimists, but many of them acknowledge that our present success is fragile and hard won. Environmental degradation and climate change are perhaps the most obvious clouds on the horizon. But there are others too, including a range of existential threats (Bostrom, 2014; Ord, 2020; Persson & Savulescu, 2012; Smil, 2021). Sensitivity to these threats can make present optimists a conservative bunch, trying to maintain the present state of affairs without necessarily transforming it into something radically better. To find people that are more radically optimistic about the future, you often have to look elsewhere.

Transhumanists and techno-utopianists tend to be the most optimistic about the future and, in particular, the power of technology to radically improve the human (or post-human) condition. Authors that have defended such an optimistic view of the future include More and Vita-More (2013), Ray Kurzweil (2005), Wood (2021), David Pearce (1995), Ramez Naam (2005) and Peter Diamandis and Steven Kotler (2015). Newton Lee's *The Transhumanism Handbook* (2019) is a good compendium of transhumanist ideas and arguments. The arguments from transhumanists

¹¹ Whether Pinker accurately characterises Enlightenment thinking is dubious but, as I have argued elsewhere, the central argument of the book is largely dissociable from this historical grounding [reference omitted].

are idiosyncratic and appeal to a diverse range of value criteria. Nevertheless, the gist of transhumanist argument tends to be that for any given value such as longevity (Wood, 2021), intelligence (Kurzeil 2005), happiness (Pearce, 1995), leisure and play (Danaher, 2019), material abundance and wealth (Diamandis & Kotler, 2015) there are reasons to think that future technologies, which are tantalisingly close, can radically improve things for humanity such that the good (for humanity) can prevail by a considerable margin over the bad. In other words, transhumanists predict that future facts (premise 2) will enable a significant preponderance of the good over the bad (premise 4) due to hypothetical but realistic technological improvements (premise 5). Ironically, this optimism about the future is often linked to profound pessimism about the present. Mark O'Connell (2017), in his journalistic survey of the contemporary transhumanist movement, references several self-confessed transhumanists expressing pessimism about the present predicament of mankind. For example, the fact that humans currently degrade and die is a source of great sorrow and anxiety for transhumanists. Still, the core belief of transhumanists is that technology can help us to overcome these limitations and ensure that the good does prevail over the bad in the long run.

If you were to combine present optimism of the sort espoused by Pinker et al., with future optimism of the sort espoused by transhumanists, you would have a clear argument for techno-optimism. But would such an argument hold up to scrutiny?

4 Critiques of Techno-optimism and Possible Replies

There are many critiques of techno-optimism. Some of these critiques target specific premises of the template outlined in the previous section. Others target multiple premises. In this section, I will discuss five common criticisms. Some of these are tied to specific authors. Some are my own extrapolations from prevailing debates and orthodoxies. I will present the criticisms, explain which premise(s) of the argument they target and consider potential responses from a techno-optimist. My goal is not to defend techno-optimism from each and every criticism. As we shall see, I ultimately concede that the critics have some valid objections, particularly to strong forms of techno-optimism. Still, I believe that techno-optimists have some viable strategies for responding to these objections and that, when considered collectively, it is possible to make the case for a moderate form of techno-optimism. In particular, I will argue that an agency-based form of techno-optimism is plausible and can avoid the critique, often thrown at techno-optimism, of being irrational or superstitious.

4.1 The Values Critique

The values premise is an obvious target for the critic of techno-optimism. Values are crucial to determining whether the good prevails over the bad and values are often controversial and contested. People have different conceptions of what the good life consists in and critics use this disagreement to challenge optimistic arguments. For instance, a present optimist might argue that it is wonderful that people have more

disposable income and a richer set of consumer goods and services from which to choose. A critic can respond by saying that more income and more choice is not necessarily a good thing. A simple life, of simple pleasures, is better. Similarly, critics of transhumanism and its particular brand of techno-optimism can argue that transhumanists overprioritise certain values or fail to appreciate the tradeoffs between different values. For instance, the pursuit of life extension or increased intelligence, they will argue, might have unwelcome consequences for other values. We might become bored or ethically reckless if we live for too long; we might be riddled with anxieties if we become too intelligent; we might create an unequal, two-tiered society if some people have access to technologies that boost life extension and others do not.

It is hard to respond to a values-based critique in the abstract. There are many point-by-point responses in the literature. For instance, transhumanists will regularly defend their prioritisation of certain values from critics by arguing that the negative consequences for other values are overstated, or that the critic has misconstrued or misunderstood the value that is being prioritised (see Danaher, 2019, ch 6, for a discussion of some of these arguments and responses). These point-by-point analyses are important and can reveal a lot about the nature of different value commitments.

Nevertheless, there are some general strategies that the techno-optimist can adopt in response to the critique. One strategy is something we can call *pluralistic overwhelm* — i.e. pick a large set of values and argue that things are good, and will get better, along each of these value dimensions. This is, in essence, the strategy that Pinker (2018) adopts. He does not simply argue that things are good (and getting better) because of increased life expectancy, he argues that they are better because of life expectancy and reduced illness, increased wealth, increased education, reduced inequalities and so forth. Transhumanists often attempt a similar strategy by arguing that things will get better along multiple different dimensions of value (Danaher, 2019; Wood, 2021). The strategy of pluralistic overwhelm, if successful, forces the critic to either (a) concede that optimism is warranted because goodness does or will prevail no matter which value they happen to care about or (b) embrace a form of axiological nihilism (nothing is ultimately valuable), which, as we already saw, is compatible with neither optimism nor pessimism.

4.2 The Treadmill Critique

A more subtle variation on the values critique is the treadmill critique. This critique concedes that things may be getting better along particular dimensions of value, but that this has a perverse effect on our metrics. Instead of this resulting in life being preponderantly good (perhaps by a large margin) for everyone, it actually just shifts the goalposts for what we think we need for good to prevail over bad. As things get better, we adjust to a new baseline or norm. We then start to think things are bad because they are not better than this new baseline. This criticism can draw upon the philosophical pessimism

of Arthur Schopenhauer. Schopenhauer's pessimism was grounded in the insatiability of human desire (Fernández, 2006). As soon as we satisfy one desire we move on to the next. We are never truly happy or in a state of equanimity. We are relentless and listless, always looking for something more: our awareness of the possibility of more makes our present state of affairs bad. It is as if we are on a treadmill, always racing to a standstill.

Nicholas Agar (2015) uses the treadmill argument to critique certain forms of radical techno-optimism. He argues, for instance, that radical optimists about the future of human well-being overlook the problem of hedonic adaptation or normalisation. Human psychology is such that whatever our current state of well-being, given enough time, we tend to adapt to it as a new baseline or norm. In order for the good to prevail, we need improvements relative to this new baseline. This adaptation is known to happen at an individual level and Agar argues that it can also happen at a societal or population level. If such hedonic normalisation takes place, there are no grounds for thinking that the good will prevail in the long run. Drugs and robots will not make us radically happier. We will simply adapt to the new technological reality and become dissatisfied with it.

Like the values critique, the treadmill critique takes aim at the values premise and the evaluation premise of the argument for techno-optimism. It has some credibility given the well-documented phenomenon of hedonic adaptation. However, it cannot be the basis for a robust or sustained critique of techno-optimism. There are two reasons for this. First, not every value is susceptible to a treadmill critique. For some values, more really is better, and even if it is not, there is no obvious adaptation to a new baseline that undermines the good-making properties of improvement. For example, longer lives, less absolute poverty, fewer life-threatening illness, more equality of opportunity (and so on), all seem like values that are not subject to baseline adaptation. For the most part, more of each of them is a good thing such that the more we add the more likely we are to cross the preponderance threshold. This is not to deny that there may be upper limits to these values, or that there may be a point beyond which increases lead to reversals in the overall ratio of good to bad, but that is not the same thing as saying that we adapt to a new baseline for each of those values. For example, there may be some upper limit to how many extra years we can live, and there may be diminishing marginal returns from each extra year we add to lifespan, but this does not mean that a person that lives to be 150 is not in a better position, all things considered, than a person that only lives to 70. Indeed, as Agar concedes, subjective satisfaction and subjective well-being may be the only examples of values that are susceptible to this critique. Second, the hedonic treadmill may not be an essential or necessary feature of the human condition (contra Schopenhauer). There are some techno-optimists — David Pearce (1995) being the most prominent — that argue that a tendency toward baseline adaptation is itself susceptible to technological manipulation and enhancement: we can shift some people's hedonic baselines up. And raising these baselines, even if it results in adaptation, is a good thing to do. From an objective standpoint, there is more good in a world in which everyone has a higher hedonic baseline than in a world in which everyone has a lower baseline.

4.3 The Unsustainability Critique

The idea that progress and continuous improvement are unsustainable is a popular one and it is usually taken to undermine techno-optimism. The gist of the critique is that human flourishing is dependent on finite resources (particularly energy in its various forms). These resources are being depleted and will eventually be exhausted. At this point in time, or before it, any prevalence of the good over the bad will be reversed.

There are two distinct ways to make the unsustainability critique. The first is to focus on the *carrying capacity* of the natural environment. This version of the argument is at the heart of most environmental critiques of techno-optimism (Alexander & Rutherford, 2019; Mann, 2019). The basic idea is that, to the extent that optimism depends on present or continued economic growth, it also depends on the continued technological exploitation of natural resources. All natural resources are finite and have some upper limit of exploitability. If we seek continued growth and expansion, we will inevitably butt up against these upper limits and enter into some period of critical decline or reversal. Thus, there is no reason to be optimistic about the role of technology in human life. On the contrary, there is reason to be pessimistic about it. So much so, in fact, that some proponents of environmental pessimism will argue that irreversible damage has already been done as a result of technologically mediated growth of the earth and decline is inevitable. This version of the unsustainability critique takes direct aim at the technological premise and the evaluation premise of the argument for techno-optimism.

This version of the unsustainability critique is challenged by some techno-optimists. For instance, Ramez Naam (2013) and Andrew McAfee (2019) (among many others, see Keary, 2016 for additional examples), have argued that technology is becoming less exploitative over time. Increased efficiencies in energy production and product manufacturing mean that fewer resources need to be used to produce the same output. McAfee refers to this as the ‘dematerialization’ phenomenon; it can also be called the ‘decoupling’ phenomenon (growth is being decoupled from exploitation). A simple illustration of this is the amount of aluminium used in food and drink cans. Quoting work by Vaclav Smil, McAfee (2019, 101) points out that the first aluminium drinks cans (produced in the 1950s) weighed 85 g. By the year 2011, they weighed 12.75 g. This massive reduction was made possible by computer-aided design processes that enabled thinner cans with the same structural integrity. This is an example of a trend that is repeated across industries. This trend gives us some reason for optimism when it comes to the role of technology in maintaining (and possibly increasing) the preponderance of the good over the bad.

Critics will counter that these examples of dematerialization are misleading. Optimists, they claim, tend to focus on the per unit costs of production (i.e. how much aluminium per can) as opposed to the aggregate costs (i.e. how much aluminium in total is being exploited by the production of cans). The aggregate costs often go up even when the per unit costs go down. Alexander and Rutherford (2019), for instance, argue that whilst there are some local cases of ‘relative decoupling’ there is very little absolute decoupling. On the contrary, on most measures of resource exploitation, with carbon emissions being the most disturbing, aggregate levels of exploitation continue to go up. In this way, proponents of the unsustainability

critique also take direct aim at some of the facts (present and predicted) used by proponents of techno-optimism.

The other way of making the unsustainability critique is more general. It focuses on the phenomenon of *entropy*, i.e. the fact that everything is, ultimately, tending towards chaos and disorder (more formally: the fact that the amount of energy available for useful work is decreasing over time). As far as we know, this is an iron-clad law of nature. Ultimately, all atoms in the universe will drift apart and the universe will become cold and lifeless (the so-called ‘heat death’ of the universe). This entropy version of the critique is aimed at futurist optimism and undermines the evaluation premise by stipulating an important fact. It does not focus specifically on the role of technology in maintaining the prevalence of the good over the bad. A proponent of this critique could accept that technology will play some temporary role in achieving a preponderance of good over bad. The point they wish to make is, rather, that any such achievement will be ephemeral: eventually everything will decline and fade to dust. Because of this, there is an interesting tension between the carrying capacity critique and the entropy critique. The proponent of the former is usually seeking some reversal of the technological exploitation of nature in order to ensure the ongoing viability of human civilisation (in perhaps a simpler and less technologically sophisticated form). For the proponent of the entropy critique this desire for reversal is, itself, ultimately futile. In a sense then, a proponent of the entropy critique could be a temporary techno-optimist. If the ship is ultimately going to sink, why not make the most of the cruise whilst we have time? Technology could help us to do that.

Again, it is difficult to offer an abstract evaluation of the unsustainability critique. There is much to be learned from specific debates about particular versions of the carrying capacity critique. It may turn out, for example, that there is reason to think we can decouple some, but not all, growth processes from environmental exploitation. Nevertheless, there are some general strategies of response that are worth discussing.

Three strategies can be adopted in response to the carrying capacity critique. The first is to argue that techno-optimism is not necessarily tied to economic growth in the traditional sense. We could, for instance, argue that technology will play a crucial role in reducing exploitation and enabling a shift to an alternative economic model (e.g. the steady-state economy). This could then give grounds for optimism. Ironically, some critics of techno-optimism embrace something like this view, arguing that technology will play a necessary role in ensuring a better future for humanity, but adding the caveat that it will not be sufficient to ensure that the good prevails: some change in social institutions will also be required (Alexander & Rutherford, 2019). A second strategy is to argue that growth is not dependent on any particular resource or form of environmental exploitation. On the contrary, growth depends on ideas and ideas are, in principle, infinite. This strategy was first pioneered by Julian Simon in his book *The Ultimate Resource* (1981) and has more recently been echoed by Ramez Naam in his book *The Infinite Resource* (2013). The argument is that economies can, in principle, shift their material base in response to new innovations and ideas. We don’t have to have a carbon economy or an economy dependent on factory farming. We can change and we have changed in the past. A third response

is to argue that whilst the Earth may have limited carrying capacity, there are many other planets and resources in the universe and we could, in principle, exploit them in order to sustain the long-term preponderance of good over bad. That said, in order to access these other resources we will need technology hence this response usually explicitly entails techno-optimism. Indeed, this form of techno-optimism a common among proponents of space exploration (Schwartz, 2011; Zubrin, 2020).

The entropy version of the critique is more challenging. If entropy is a fundamental law of nature then there is little we can do about it. Temporary and restrained future optimism seems like the only possibility. That said, there is an intriguing role for techno-optimism to play in potentially blunting the force of entropy-induced pessimism. The philosopher Dan Weijers (2013) has argued that there are gaps in our existing scientific theories that could allow for cosmological entropy-reversing processes. There are, for instance, various multiverse theories that allow for new universes to branch out from our own, and in which entropy can be reversed or, at least, perpetually abated. The challenge then becomes how we can access these new universes. Weijers argues that technology could play a key role in this:

If [these theories] turn[] out to be true, then the right kinds of advanced technology might enable some form of life to escape into new parts of the universe whenever the existing parts were becoming uninhabitable and thereby persist for infinity.

(Weijers, 2013, 12–13).

Weijers goes on to cite different scientists that have proposed hypothetical technologies that might enable this indefinite existence. This is very speculative stuff. It is unclear how probable the invention of such technologies is, or whether the underlying scientific theories will hold up. But given the apparent irreversibility of cosmic entropy, the merest possibility may be the only thing we have to stave off pessimism. In this sense, a retreat to a weak, possibility-based version of techno-optimism may be the most legitimate response to the entropy critique.

4.4 The Insufficiency Critique

Another critique picks up a thread from earlier on: the distinction between material and immaterial forms of technology. If we are strict materialists, then it looks like we have a problem. Material technology, by itself, seems to be insufficient grounds for optimism. There are two reasons for this. First, material technologies do not just ‘pop’ into existence from nothing. They require human labour and ingenuity. Second, material technologies can often be used for good or ill. For example, few people would argue that the invention of the nuclear bomb heralded in a new era of hope and optimism.¹² Given that destructive technologies can be

¹² You might imagine someone making this argument on the grounds that the logic of mutually assured destruction limited great power wars and that nuclear technology has other benefits. Pinker (2011) makes moves in this direction. Still, it would be a stretch to argue that the nuclear bomb, with its tremendous destructive potential, was good all things considered.

invented, how can we be optimistic about the future solely in virtue of the creation of more such technologies?

The answer is that we can't. I already noted that a number of the optimistic books cited earlier on — in particular the works of Pinker (2011, 2018), Ridley (2010), McAfee (2019) and Naam (2013) — do not give technology, in and of itself, priority in their narratives. Instead, they focus on certain idea-generation and selection methods that have been adopted in the relatively recent past. Ridley and McAfee focus on market-based mechanisms for incentivising and weeding out certain kinds of innovations, Naam follows a similar train of thought but also gives the modern scientific revolution some bit of credit, Pinker is more ecumenical, mentioning the importance of markets, science, Enlightenment reason and liberal democracy. None of these authors denies that material innovations were crucial to progress, but they think the underlying social-institutional mechanisms for innovation were also important.

Thinking about it in abstract terms, any society that desires an optimistic future needs three institutional structures: (i) an idea generation system (which would include some system for the promulgation and exchange of ideas); (ii) an idea selection system (which would select ideas that are most likely to ensure that the good predominates over the bad) and (iii) an idea translation system (which turns the ideas into a material reality that changes how we live). At the moment, we use several different idea selection mechanisms. The most obvious are: *markets*, which select ideas based on whether they are profitable; *democracies*, which select ideas that match with the majority preference; *science/academic institutions*, which select ideas based on whether they are replicable, falsifiable and approved by a community of relevant epistemic peers; and *legal-regulatory institutions*, which select ideas based on whether they are consistent with some official set of rules and standards. Each of these institutional mechanisms has a number of weaknesses. None of them specifically selects for ideas that ensure that the good prevails over the bad. Popular and profitable ideas, for instance, do not always ensure the long-term flourishing of the human condition, even if there is some rough correlation between the two (this is, in effect, the argument of Pinker et al.) and some reason to think that the idea generation and selection mechanisms play a key role in sustaining an optimistic standpoint. To this extent, the critique is correct in stating that material technology, by itself, is insufficient for optimism.

But that is very different from saying that technology is irrelevant or unnecessary. Ideas are inert without material transformation. It would be a stretch to say that Leonardo invented the helicopter just because he did some sketches. The idea itself could not fly. We need ideas, for sure, but we also need mechanisms for translating them into real material artefacts. It is through these real material artefacts that we can change the world, or the human relationship to it, so that the good prevails or that it prevails by a considerable margin. So, the best response to this critique is, I believe, to say that neither immaterial nor material technology is sufficient for optimism; both are necessary. We should think carefully about idea selection mechanisms and ensure that we have the right incentives in place to favour ideas that benefit humankind. At the same time, we shouldn't ignore the need for some mechanism to translate those ideas into material reality. In short, any plausible form of

techno-optimism will be conditional upon the right mix of both material and social technologies.

4.5 The Irrationality Critique

The most significant critique of techno-optimism is the irrationality critique. This critique claims that techno-optimism lacks an appropriate rational or evidential foundation. This critique is usually directed at the facts premise and the technological premise.

One could imagine this critique being directed at present optimism. Someone could, for instance, challenge the work of Pinker (2018) or Ridley (2010) on the grounds that they conveniently ignore or overlook evidence that is contrary to their position. This is a dispute about the credibility of particular authors and their evaluation of the facts as they currently stand. This dispute could, at least in principle, be resolved by collecting more evidence and drawing better inferences from that body of evidence. There is, consequently, nothing fundamentally irrational about present optimism. It is capable of rational assessment and debate.

Future techno-optimism is a different story. It requires predictions about future states of affairs and future technological developments. These things are often unknowable or, at least, cannot be predicted with any high degree of certainty. As a result, future optimism can often end up seeming like a house built on cards. People that espouse this mindset are saying something about their character or outlook and not something about the likely future state of the world.

There are different ways of making this critique. One is to argue that futurists make assumptions about technological development that are unwarranted or based on faulty extrapolations from historical trends in technological development. Michael Keary has developed this critique in response to certain formal models of the impact of climate change on human society (Keary, 2016). People involved in modelling the impacts of climate change try to predict future trends in carbon emission (and their associated effect on the climate). They know that future carbon emissions could be mitigated or reduced by changes in the technology of energy capture and control. So, they try to anticipate these changes. Keary points out that they often do so by assuming that future technological growth will be smooth and linear. This, he argues, ignores the fact that past technological growth has, in fact, been lumpy (some revolutions punctuated by periods of inactivity) and unpredictable (some innovations and breakthroughs are the product of pure luck). This makes it extremely difficult to predict the course of future technological development, which in turn undermines any commitment we might have to an optimistic view of the role of technology in shaping the future.¹³

A stronger way of making this critique is to argue that future optimism is, in essence, akin to a superstition or religious faith. Techno-optimists have faith that the future will be better but they have no reason to be confident of this. This is a very common critique

¹³ Karl Popper also developed a version of this critique in his book *The Poverty of Historicism* (1957).

of transhumanism. Transhumanists are often likened to a religious movement: a group of people that believe technology will come along and save them from the miseries of the human condition (Geraci, 2010). The philosopher Alexander Wilson (2017) has developed a particularly strong version of this critique, arguing that when you scrutinise techno-optimist belief systems, they often rest on a superstitious belief in the possibility of future retrocausation. In other words, optimists think that if they believe the future will be better, the future will somehow reach back into the present and ensure that this happens. Wilson reaches this diagnosis by arguing that future techno-optimism is only plausible if we have some reliable probabilistic measures of relevant future facts. Since we don't have those measures, techno-optimism can only be sustained by ignoring or overlooking this inconvenient truth.

The only way in which such a deliberate overlooking of the facts could have any effect on the turn of events is through a kind of retro-causality that ensures that the right attitudes toward the future are eventually compensated...grand calls to be optimistic about technological progress must implicitly commit to the belief that, somehow, the future retroactively compensates the optimistic stance.

(Wilson, 2017, 8-9)

As Wilson points out, there are some notable examples of futurists seriously engaging with this idea of retrocausation. The online community of 'rationalists', for instance, became embroiled in a bizarre controversy several years ago about a thought experiment involving a hypothetical superpowerful AI that could influence the past. Some people appear to have been seriously worried that merely thinking about such a future AI could cause it to come into existence.

I say this is the most significant critique of techno-optimism because it is, in a sense, unassailable. Our knowledge of future facts, particularly facts about technological developments, rests on very shaky foundations. We may be able to peer a few years into the future, and make some plausible predictions, but any more than that is dubious.

Nevertheless, the critique does not completely undermine techno-optimism. There are two plausible strategies of response. First, it may be possible to connect present optimism to future optimism and argue that if optimism is rationally justified now (i.e. there is presently a preponderance of the good) then this can be sustained into the future *as long as we can ensure that society does not deviate too far from the current position*. Ensuring such stability is, of course, a challenge but committing to resolve a practical challenge of this sort is not akin to believing that magical future technologies will reach back into the past and save us: the goal is just to maintain the current positive state of affairs. Second, to the extent that this irrationality is a problem for optimism it is also a problem for pessimism about the future. In the absence of reliable probabilities neither stance is fully warranted. This is true even if we factor in the entropy critique outlined in the previous section. Given the incompleteness of our current scientific theories, we cannot know for sure that entropy is fated to continue indefinitely. It is possible that it is not. This is where the modal nature of our optimism becomes crucial. As noted earlier, some scholars (Sutherland, 1981) think that the mere possibility that goodness will prevail is enough to sustain a genuine, if weak, form of optimism. That can sound like a stretch, but

given the uncertainty about the future, we at least have that mere possibility. So, if possibility is enough, then we can be weak techno-optimists.

But I think we can say more than that. Being an optimist and determinist about future technological development may be irrational. But believing that human agency — which encompasses our attitudes, our goals, our actions and our collective institutions — has some role to play in ensuring a positive future need not be. Wilson might make it sound ridiculous — like some New Age self-help philosophy: if you believe in it, it will happen — but there is evidence from psychology to suggest that people with optimistic outlooks achieve better outcomes across a number of domains. There are a number of studies revealing that people with positive beliefs about their goals and their capacity to influence them tend to do better than people with more pessimistic or (so-called) realistic beliefs (for a systematic review, see Schiavon et al. (2017)). In this sense, personal optimism can be a kind of self-fulfilling prophecy: if you believe that the good will prevail for you, this is more likely to happen. Real-world examples of this self-fulfilling prophecy in action come from studies by Sandra Murray and her colleagues on people with idealising beliefs about their romantic partners (Murray et al., 1996a and 1996b; Murray & Holmes, 1997) and studies by Shelley Taylor and her colleagues on patients with HIV and breast cancer (Taylor & Brown, 1994; Taylor et al., 1984, 1992). In both cases, the researchers found that people with positive beliefs about their agency — i.e. their capacity to ensure that they do well — tended to have better outcomes in these domains. These studies go on to claim that there are some mechanisms that could explain this tendency. For example, in the case of HIV and breast cancer, people with positive beliefs may experience less stress and anxiety (which may be linked to negative health outcomes) and are more inclined to behave in ways that are protective of their health.

The philosopher Lisa Bortolotti uses these findings to develop an agency-based theory of optimism (2018). This is a theory that is carefully defined and cautiously held. As Bortolotti points out, it is not simply the case that cultivating positive beliefs about yourself and your goals will necessarily lead to better outcomes. In particular, you should not cultivate the belief that everything will be okay and that you can sit back and enjoy the ride. You have to do something. It is both belief and action that are necessary. Having positive agency-related beliefs helps with action by motivating you to make realistic plans to achieve good (and better than good) outcomes, even if only marginally and probabilistically.

This modest, agency-based optimism can, I believe, provide a credible response to the irrationality critique. The key difference is that, when applied to techno-optimism, the agency-based theory cannot simply be about the individual. It may start with the individual but it has to build into a stance that applies at the impersonal level, particularly to collective human agency, in our power, as a collective, to create social institutions and material technologies that will allow the good to prevail (in the long run). On this view, the techno-optimist ought not to be a determinist that assumes things will get better without human control or input. Rather, they should cultivate the belief that humanity can, as a collective, (a) select valuable goals (i.e. goals that will ensure a preponderance of good over bad) and (b) use technology in a way that will help us to achieve those goals. They should then work, individually and socially, to take active steps to ensure that this is the case. This requires a commitment to a *contingent, techno-social* form of optimism. It requires positive beliefs

Table 2 Critiques of techno-optimism and possible responses

Name	Explanation	Premises targeted	Responses
The values critique	The value metric being used to support techno-optimism is flawed (e.g. growth is good, more of everything is good) or there is an alternative, equally plausible metric that supports a different evaluation	Values premise; evaluation premise	<i>Pluralistic overwhelm</i> — defend the optimistic stance by using multiple different value criteria
The treadmill critique	As we gain more through technology, our values shift and we become less satisfied with what we once thought was better	Values premise; evaluation premise	Treadmill critique only applies to a limited set of values, particularly subject happiness or well-being; objective values are less susceptible to this critique
The unsustainability critique	<i>Carrying capacity version</i> — technologically mediated growth will exhaust the carrying capacity of the earth and everything will get worse <i>Entropy version</i> — ultimately, everything is tending towards entropy — there is no way to reverse the inevitable decline. Current optimism will be short-lived and cannot be sustained in the long run	Factual premise; technological premise; evaluation premise	<i>Carry-capacity version</i> — (i) techno-optimism not necessarily linked to growth; (ii) growth not necessarily linked to a particular form of material exploitation (ideas and innovations are what matter) and (iii) the universe is a big place, there are other resources to exploit, we just need technology to access them <i>Entropy version</i> — epistemic limitations in our current scientific models allow for some possibility of universal entropy-reversal — need technology to access entropy-reversing portions of the universe
The insufficiency critique	Technology is not the key or decisive variable in ensuring that the good prevails over the bad — social organisations (etc.) are	Technological premise	There is some validity to this — idea selection mechanisms do matter a lot — but material technology is also critical. Both are necessary neither is sufficient
The irrationality critique	Techno-optimism rests on an unjustified faith in future technologies that cannot be predicted or known	Factual premise; technological premise	Appeal to a conservative form of techno-optimism: we do not hope for unknown future technologies but just try to maintain what we now have Argument applies just as well as any future techno-pessimism Agency-based techno-optimism can restore the credibility of techno-optimistic stances

about ourselves and our ability to use our agency to build institutions that generate and select optimistic ideas and transform them into technologies that can, marginally and probabilistically, improve the future. It also requires active steps be taken to build those institutions and technologies.

To be more precise, a modest, agency-based view of techno-optimism entails the following four claims.¹⁴ First, it is epistemically rational to believe that it is at least possible (perhaps probable) that technology plays a key role in ensuring that the good prevails over the bad. Second, whether this possibility materialises depends to some meaningful extent on the power of collective human agency. If we select the right goals, make a concerted effort and build the necessary institutions, there is a chance that the possibility materialises. Third, by believing that we can, collectively, achieve this, we increase the likelihood of this possibility materialising because we make it more likely that we will act in ways that ensure the desired outcomes (this is the adaptation of Bortolotti's agency-based optimism to the case for techno-optimism). Fourth, it follows that we should cultivate the belief that we can achieve this and act upon that belief. In other words, our optimism should not simply be an inert belief but, rather, a belief that actually motivates our collective human agency.

If the agency-based view is incorporated into it, techno-optimism can then be an intellectually defensible view. It need not be an irrational faith in the inexorable march of technology but, rather, a realistic stance grounded in the transformational power of collective human agency to forge the right social institutions and to translate the right ideas into material technologies.

4.6 Summary of Critiques

This concludes the summary and analysis of standard critiques of techno-optimism (Table 2). As is clear, techno-optimism faces some stiff criticisms. Whether it can fend off those criticisms depends, to some extent, on the details of specific arguments. Strong forms of techno-optimism, particularly about the future, seem implausible. Nevertheless, modest and weaker forms of techno-optimism seem to remain viable. This is because the techno-optimist has some plausible responses to each critique. Deployed effectively, whilst leaning into an agency-based model of techno-optimism and acknowledging our present epistemic limitations, these strategies can sustain the intellectual credibility of techno-optimism.

5 Conclusion

In this article, I have attempted to analyse, evaluate and defend (a modest form of) techno-optimism. I have developed an ameliorative analysis of the concept of techno-optimism. According to this, techno-optimism is best understood as a stance (a collection of beliefs undergirded by a commitment) that incorporates the view that technology plays a key role in ensuring that the good prevails over the bad.

¹⁴ I am indebted to an anonymous reviewer for suggesting this clarification to me. The wording of the four commitments is taken, with some adaptations, from their suggested text.

Techno-optimism, so understood, is not a single view but, rather, a cluster of views that vary along a number of dimensions (degrees of goodness, temporal orientation, modal robustness, role of technology). I have also argued that anyone making a case for techno-optimism would need to follow an argument template with four key premises (a values premise, a facts premise, an evaluation premise and a technology premise). Each of these premises is open to a number of substantial critiques, and consequently, it would be impossible to defend a strong form of techno-optimism. Despite this, however, I have concluded that a modest form of techno-optimism, one that does not assume that technology will save humanity by itself, nor that technology is sufficient for the good to prevail, is defensible. This modest form of techno-optimism has collective human agency at its heart and maintains that believing we have the power to create the right institutions for generating, selecting and creating material technologies, and acting on that belief in a cautious and sensible manner can make it more likely that the good will prevail over the bad. In this way, contrary to what critics claim, it is not irrational for techno-optimists to assume that the techno-optimistic stance is a sort of a self-fulfilling prophecy.

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