# 1AC – Capitalist Realism

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#### We have reached the end of history. Capitalism has universalized itself – destroying all alternatives and constraining political imaginaries to false solutions and short-term fixes like space colonization.

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3.2. Capitalist realism

Capitalist realism is a concept introduced to describe the “widespread sense that not only is capitalism the only viable political and economic system, but also that it is now impossible even to imagine a coherent alternative to it,” an “invisible barrier constraining thought and action” (Fisher, 2008: 2, 16) embodied in the slogan that it is “easier to imagine the end of the world than to imagine the end of capitalism” (Jameson, 2003: 73). Capitalist realism is an anti-ideology ideology of lowered expectations, one that implicitly justifies capitalism negatively and indirectly: “capitalism may not be perfect,” the typically unstated legitimation goes, “but it is the only possible socio-economic system that protects us from terror and totalitarianism of past political projects.” Post-Fordist work- er-consumers are assured that it is far better to be a disengaged cynical spectator than, what is assumed to be the only alternative, a fanatic dogmatist.

Capitalist realism is distinct from postmodernism—when the latter term is understood as an objective cultural condition birthed by consumer capitalism, rather than a viable theory—because: (1) a more ubiquitous and profound “cultural and political sterility” has hardened as there are now no “really existing” political alternatives (i.e., state “socialism”) (Fisher, 2008: 7); (2) modernist cultural forms are no longer confronted and commodified as they were in postmodernism, but, instead, modernism is irrevocably lost; and, most importantly, (3) capitalism has already absorbed everything “external.” There are no longer any outside opposing forces to absorb: “[c]apitalism **seamlessly occupies** the horizons of the thinkable” (Fisher, 2008: 9). There is no longer an interplay between alternative oppositional potentials and their incorporation into capitalism via commodification. Instead, there is a “precorporation” of subversion: “the pre-emptive formatting and shaping of desires, aspirations, and hopes by capitalist culture” (Fisher, 2008: 10).

Social conditions today, Fisher (2008: 16ff) reasons, cannot be challenged through moral critique because capitalism now swiftly offers immediate solutions, many false solutions to be sure, for its alleged moral shortcomings (e.g., humanitarian rock concerts to address poverty). The only potentially successful ideology critique of capitalist realism is “if it is shown to be in some way inconsistent or untenable; if, that is to say, capitalism’s ostensible ‘realism’ turns out to be nothing of the sort” by confronting the pseudo-natural reality of capitalism with the Real, “a traumatic void that can only be glimpsed in the fractures and inconsistencies in the field of apparent reality” (Fisher, 2008: 16, 18). Looming environmental catastrophe is a key example. On the one hand, capitalist realism assumes that any environmental problem can be solved through capitalist processes (e.g., green consumerism) and always assumes that resources are infinite. On the other hand, the real consequences of a prospect of environmental catastrophe for capitalism are “too traumatic to be assimilated into the system” (Fisher, 2008: 18) precisely because environmental problems like climate change are endemic to the basic processes of capitalism, namely its need for constant growth (see also Foster, Clark, & York, 2010; Stuart, Gunderson, & Petersen, 2020). In this paper, we argue that the case for space colonization as a survival strategy is best understood in the context of capitalist realism. Paraphrasing Jameson, the notion of capitalist realism can help illuminate why **it is easier to imagine McDonald’s on Mars than to imagine the end of capitalism.**

#### Capitalist realism creates the irrational rationality of space colonization. It is irrational because of the existential risks it creates, and it replicates capitalism which is the root cause of crises on earth.

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4.1. The irrational rationality of space colonization

While there are incredible challenges that could potentially limit visions of space colonization, our focus is to examine if space colonization is rational in terms of preserving the human species from the escalating existential threats on Earth. From what we know, does space colonization represent an effective and efficient way to protect the human species? How rational are the justifications for space colonization to save the human species on their own instrumental grounds? We argue the following: (1) that alternatives to Earth are obviously far more inhospitable for human life than Earth and, thus, preserving Earth is more instrumentally rational; (2) if the goal of space colonization is to preserve the human species, then it is more instrumentally rational to save many more lives on Earth than create space colonies for a small population who can afford the ticket; and, most importantly, (3) there is reason to predict that humans would take an irrational rational logic with them to space, the same rationality that oversaw the destruction of Earth and brought them off-planet in the first place. The point is to develop an immanent critique of the instrumental case for space colonization to show the extent to which this form of logic is still unreasonable, even judged by its own means-oriented criteria.

While space colonization is justified to avoid risks and threats on Earth, there will be new risks and threats in space – some that are even more severe. Kovic (2020) discusses some of these risks and in certain scenarios the risks of space travel and colonization greatly outweigh the risks of staying on Earth and the benefits of colonizing space. Kovic (2020): 3) explains,

[i]n general, there are two ways in which space colonization-related risks might affect the long-term future of humankind. First, humankind might become more susceptible to existing (existential) risks. Second, space colonization itself might create new (existential) risks that could result in highly undesirable or even catastrophic outcomes.

Kovic (2020) in the end argues that prioritizing space colonization as a survival strategy overlooks or ignores the high probability of existential threats and risks in space. The rapid creation of new technologies for space living may also create unexpected consequences and risks that could undermine or threaten space colonization. For example, on Mars, hostile conditions including dust storms, sub-freezing night time temperatures, and lack of water or carbon-dioxide to grow plants (Szocik, Wo ́jtowicz, Rappaport, & Corbally, 2020) could result in death, starvation, cannibalism and extremely stressful survival decisions causing “astronomical amounts” of suffering (Torres, 2018: 75).

In addition, the space colonies currently proposed still would not protect humans from large-scale stellular events like supernovae or an expansion of the sun. As explained by Stoner (2017) in the context of a Mars colony, the same risks as well as new risks make the colony very dangerous and protective measures would be immensely expensive in a cost-benefit analysis:

[i]f the goal is species survival, and given that the Martian environment is much less survivable than even a post-strike Earth would be, then there is no remotely realistic budget point at which the marginal dollar would be more effectively spent on Mars colonization than on protecting Earth and the creatures and civilizations that evolved to live within its shelters.

Stoner (2017) goes on to argue that the analysis for the operations of projects like those of SpaceX, “only appears rational because they have carefully loaded the comparison scenarios in a way that guarantees a pro-colonization conclusion.” While space colonization may be a better preservation strategy than doing nothing, there are many more options that are less risky and more likely to preserve a greater number of human lives.

Another commonly overlooked aspect of space colonization as a species survival strategy is the fact that not everyone will be able to go, and many of Earth’s commoners and poor will likely be left on Earth. Only a portion of the human population would be able to live off-planet, perhaps only the economic elite. It is not unreasonable to assume that, if there are large inequalities in power and wealth, that the most wealthy will be in power and that these elites will decide to be the “lucky” few space settlers. It is not possible for Mars, for example, to provide a safe habitat for all humans on Earth. Thus, a possible scenario is economic elites leaving behind the vast majority of humans on an inhospitable Earth. As Billings (2019: 45) questions,

“how many poverty-stricken Bangladeshis, how many sub-Saharan Africans, how many permanently displaced Syrian refugees, how many disabled and unemployable workers could come up with $200,000 – or $2,000,000 for that matter – to move to another planet and start a new life. What are the ethics of giving the rich yet another advantage over the poor? What are the ethics of ignoring the need to check the rapid pace of climate change on our own planet?”

Under capitalism, any solution to crises on Earth focused on moving off-planet will likely exclude the masses and the poor. Are these lives not worth saving? Are there other strategies that would save more lives?

Saving the most present and future human lives would require addressing the threats on Earth, including climate change, biodi- versity loss, poverty, disease, and famine. As stated by Kovic (2020: 6), “[g]iven these acute problems, pursuing space colonization today could be a misguided use of limited resources.” He poses the following question: If the goal is to save as many lives and to maximize overall wellbeing, then why focus on an alternative that only benefits a very small population, while the vast majority struggle to survive or perish? Others argue that much more than human lives need to be saved to live successfully off-planet; we need a diversity of other organisms and a measurable portion of the Earth’s biodiversity (Johnson, 2019). Given the rate of existential threats like climate change, how much time is there to develop this technology and transport all people and enough other organisms off-planet? If the goal is species survival, the time (and the immense resources required) could be spent in more effective ways to benefit all people and species. However, these alternatives are unseen or considered impossible in the context of capitalist realism (see proceeding section).

Lastly, the current social order dominating human-human and human-material relations (capitalism) is likely to result in negative outcomes and problems even off-planet. For example, mining and development on Mars would very likely be environmentally destructive as colonization is unlikely to have a light impact on the planet (Stoner, 2017). We would bring these relations and the associated problems with us. As Marino (2019: 15) explains,

[i]n Musk’s view we need a back-up planet. But he doesn’t acknowledge that we ourselves are the cause of this dire situation. And therein lies the problem and the reason we, as a species, have no business trying to colonize another planet. Musk’s reason for wanting to colonize Mars is to save ourselves from ourselves and it is self-evident that this alone recommends we should not be going anywhere.

There is no reason to assume that we have learned our lesson on Earth and will create a new civilization with better outcomes, when the same system and drivers (namely, capital accumulation) continue to dominate the social order.

#### Capitalist realism prompts us to look towards space colonization as the solution to existential threats while denouncing political changes that would be faster and easier.

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4.2. Capitalist realism underpins the contemporary case for space colonization

This section continues the sociological examination of the case for space colonization by drawing on Fisher’s (2008) concept of capitalist realism. The social context of capitalist realism helps illuminate the case for space colonization in three ways:

(1) Capitalist goals inform contemporary justifications for space colonization and, more fundamentally, the assumption that capitalism will carry on in the long-term is unquestioned.

(2) The future fantasy of space colonization deters attention from more effective and just solutions to the ecological crisis.

(3) The case for space colonization is only viable if there are no alternatives to capitalism. In other words, when social alternatives

to capitalism are considered, space colonization as a climate change strategy is unjustifiable.

We discuss each point in turn.

That capitalism as a system is taken-for-granted in the case for space colonization, and capitalist priorities inform motives to colonize space, is not surprising when space colonization is framed as a solution to future ecological collapse. The only climate change solution strategies being widely adopted or seriously considered in policy circles and international organizations are solutions in line with capitalist goals. Project Drawdown (2021), for example, claims to offer the most comprehensive set of solutions to minimize global warming. Their mission is simple: “stopping catastrophic climate change — as quickly, safely, and equitably as possible.” Yet, all their solutions must meet five specific criteria, the second one being: “Is it economically viable? In other words, is there a business case?” (quoted in DiCaprio 2019). Only solutions that fit this “win-win” model are supported. Those that might be more effective but will not result in profits are discarded.

Project Drawdown is only one example of the norm: solutions to the ecological crisis that reproduce rather than challenge the current social order (e.g., Foster et al., 2010; Stuart et al., 2020a). In a paradigm where all solutions must adapt to capitalism, we find justification for space colonization if other technological strategies are not enough to save humanity. Indeed, although rationalized by aspirations to save humanity, those who actually have control over the plans for space colonization seem to be focused more on maintaining the current system and chasing profit. Not only could a space colony unintentionally recreate the same social conditions that lead to its formation (see preceding section), but there is evidence that this may be precisely why space colonies would be formed in the first place. For example**, Bezos envisions the Moon as the future “manufacturing sector** of the universe” (Liberto, 2019). Or take the case of keeping a Martian colony warm: fossil fuels extracted on Earth could be burned in space transport and at colony sites, increasing fossil fuel profits. Relatedly, there are plans to mine Mars and the Moon for minerals to increase wealth accumulation. In addition, the companies working on space colonization projects are private companies with “pecuniary reasons” for their projects beyond saving (some of) humanity (Kovic, 2020: 5). As affluence represents a primary driver of the existential threats humans face (Wiedmann, Lenzen, & Keyßer, 2020), it is not surprising that the primary supporters of space exploration are billionaires trying to flee problems of the system that lined their pockets.

The case for space colonization is not only a social-reproduction strategy in the sense that, if successful, it could maintain the current system and even allow those profiting from the current system to continue to benefit as Earth faces increasing threats. It is also a social-reproduction strategy because it deters attention from social alternatives that have the potential to address the ecological crisis. Like other “false solutions” to climate change that deter attention and resources from the need for systemic change to reduce emissions (Stuart, Gunderson, & Petersen, 2020b), hopes of escaping Earth’s problems through a future home on a space colony weakens the case for solving Earth’s problems. Why not trash the planet if a Golden Ticket to live in an “outdoorsy, fun atmosphere” on Mars awaits? In other words, the case for space colonization is another silver bullet narrative that delays concrete action and maintains the current system. Fisher would add here that the case for space colonization further allows ideology to escape from the contradiction that ecological collapse is built into the basic processes of capitalism. This reality is “too traumatic to be assimilated into the system” (Fisher, 2008: 18) and space colonization is a comforting futuristic fantasy to flee this trauma.

Our claim that the case for space colonization is ~~blind~~ [ignorant] to social alternatives is illustrated by the extreme techniques necessary to make Mars colonization a real possibility, especially biotechnological alterations of the human body. As explained by Szocik et al. (2020), because the Martian environment is exceptionally harsh and different than Earth, we may need to change the human genome and characteristics to be more suitable for colonization. Mars has less gravity but much more radiation, which could inhibit main- taining human civilizations on Mars. Protective gear would be necessary, but sterility could still result. Szocik et al. (2020) also explain that living in isolated conditions is psychologically stressful and the human psyche may not be able to stand up to the pressures. Therefore, we may need a “radical modification and interference with ‘human nature,’ psychology, and anatomy” to cope with these new conditions and we also may need to modify ethical and moral standards (Szocik et al., 2020: 10). With all of the modification that may be necessary, Szocik et al. (2020: 12) asks, “Is there a sufficiently strong reason to go to space which justifies the enhancement of future astronauts?”

In other words, it is easier to imagine the modification of the human genome to live on Mars than to imagine the end of capitalism. Such proposals are considered because changing the system continues to be an unattractive solution and to many, a “non-starter.” Kovic (2020: 5) explains that given the potential economic gains of technological development, space colonization “could be perceived as the more attractive option.” Green (2019: 37) makes this argument clear:

considering the relative difficulties of establishing world peace and regulating the development of all dangerous technologies, settling on Mars may actually be relatively easy. It certainly has fewer political difficulties, though the technical ones remain immense.

Green (2019: 37), therefore, concludes that space colonization is the “relatively-easiest solution to the problem of saving at least some of humanity.” In the eyes of most decision-makers, challenging the dominant social order, profits, and wealth accumulation simply is not an option. Capitalism remains inevitable and unquestioned: “there is no alternative.”

Skeptical readers may agree that capitalism is typically taken for granted in cases for space colonization but find this a moot point because perhaps there really is no alternative to capitalism. The prospects for an alternative to capitalism are grim. The concept of capitalist realism is meant to shine light on an ideology and real social conditions. In other words, capitalist realism does not arise from distorted beliefs, but is a response to social conditions that (seem to) close off the possibility for a better world. There is a genuine difficulty in imagining alternatives to capitalism in part because there is not a functioning political infrastructure or global social movement to alter current conditions. In this context, it is tempting to openly affirm or cynically accept the thought that the continuation of business as usual off-planet for those who can afford it really is easier to envision than the far simpler task of altering the social relations that drive climate change. Indeed, the fact that the case for space colonization strikes contemporary consciousness as a more realistic strategy than transitioning out of capitalism speaks to the helplessness and hopelessness of our times.

Despite the political-economic barriers obstructing social alternatives to the system driving climate change (capitalism), there are alternatives, and they should be kept in constant view. For example, the case for “degrowth” aims to keep energy and resource use within planetary limits by purposefully limiting material and energy throughput in wealthy countries through means such as worker, consumer, and energy cooperatives, work time reduction, deliberative democracy, and other means (e.g., Kallis, 2018; Hickel, 2020; Stuart et al., 2020b). Increasing economic growth is associated with greenhouse gas emissions, does not make humans happier after basic needs are met, and is an ecological impossibility in the long-term. Downscaling overall material and energy throughput to avoid catastrophic climate change is possible and can be achieved through desirable social changes that increase equality and happiness. Some will reasonably ask, “Could this work in the real world?”

We reply to the question “Isn’t ‘degrowth’ utopian (in the sense of unrealistic and unachievable)?” with a different question: Why is ceasing to produce and consume for the sake of production and consumption less realistic than space colonization? To make the proposal for degrowth more concrete, the following strategies are often proposed by “degrowthers” and related activists (e.g., “eco- socialists”): Using productivity gains to reduce the amount of time spent at work, upscaling renewable energy through cooperative ownership (and other forms of public ownership), and nationalizing fossil fuel companies in order to phase out most fossil fuel extraction while reemploying fossil fuel workers in renewable energy efforts (for summary, see Stuart et al., 2020a). On what grounds are these proposals unrealistic relative to space colonization? In comparison to space colonization, work time reduction, fossil fuel nationalization, and cooperative/public renewable systems are arguably more rational, realistic, and just strategies to address the threat of species extinction through ecological collapse. One reason these proposals may seem unrealistic is that they are labeled “political” while space colonization is considered an apological, merely “technical” approach. We disagree with this premise. One goal of this paper is to highlight how space colonization is necessarily political. From the seemingly purely technical decisions of space scientists to the sources and allocation of funding for colonization projects, the entire endeavor has a constant political-economic context, though one that is typically taken for granted, and will have social impacts. Thus, any of the questions leveled at “political” approaches to address the ecological crisis should also be directed toward those advocating space colonization: Is there a guarantee that this plan can be implemented? How are you going to gain mass support? The strategy is untested - what if it fails? Etc.

Ideological norms are another basis for deeming work time reduction, fossil fuel nationalization, and publicly-owned renewable unrealistic. Indeed, capitalist realism sees all alternative models for the future as dogmatic and dangerous (Fisher, 2008). Further, these proposals go against the hegemonic notion that growth is good at all costs. In a recent piece, Tim Jackson (2021) argues that the billionaire space race is the “ultimate symbol of capitalism’s flawed obsession with growth” and highlights an irony: the quest for space colonization implicitly acknowledges that unlimited growth is impossible, yet simultaneously assumes that the solution to natural limits is more growth (into space). Yet ideology always has a social context. An accelerating capitalist “treadmill of production,” for example, provides historical validity to that idea that “growth is good” (Schnaiberg, 1980).

A third and more serious basis for labeling these strategies unrealistic relative to space colonization is discussed above: the problem of real political helplessness in developing a viable alternative to capitalism. We agree that the latter is an enormous obstacle to forming alternative social futures. Helplessness is one social cause of capitalist-realist ideology (Gunderson, under review). However, the awareness of possible social alternatives, and organizing social movements to achieve them, will remain a thorn in the side of capitalist realism, not to mention the only route to avoid climate catastrophe.

The continuation of capitalism assumed in the case for space colonization and capitalist priorities also explicitly inform motives to colonize space (e.g., it is supported by some billionaires precisely because it is a mean to increase profits). Focusing on space colo- nization detracts attention, resources, and energy away from the need to rapidly adopt systemic changes to save Earth. The case for space colonization is untenable when social alternatives to the structural drivers of possible ecological collapse are considered.

#### Vote aff to engage in post-capitalist realism. By making the normative statement that private appropriation of outer space is unjust, we invert capitalist realism and reveal the necessity of a post-capitalist society.

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**Post-capitalist realism is, in short, an inversion of capitalist realism:** ‘the widespread sense that not only is [post-capitalism] the only viable political and economic system, but also that it is now impossible even to imagine a coherent alternative to it’.111 Its radicality lies in declaring that there is no longer a choice between socialism or barbarism, because there is only post-capitalism. This realism takes as its starting point the real potentiality of the ought, a potentiality that has a force of necessity. It interprets and critiques that which is on the terms of that which is not yet. Which is to say, from the standpoint of the potentialities which are immanent to the established reality. Here, the theory of post-capitalist realism takes its lessons from the dialectical method and hence from the negative. In particular, it holds on to the critical tension between the is and the ought, alongside appearance and reality. But it also goes beyond this tension. In apprehending that the possible is contingent on the actual, post-capitalist realism posits a necessary reality in accordance with the real possibilities that are opened up by the material and intellectual conditions of the existing state of affairs.112

Negativity is thus the precondition of post-capitalist realism insofar as it is ‘freedom from the oppressive and ideological power of given facts’.113 **It renders impossible the elimination, absorption, and flattening out of the tensions and contradictions which serve as the preconditions for refusal and two-dimensional thought.** The state of estrangement, alienation, and antagonism to the rational appearance of the given reality evoked by the negative recognises this same rationality for what it is, utterly irrational. All its negative features come to light: repression, insecurity, waste, overproduction, starvation, unemployment, and the like. This recognition is not, however, from the standpoint of capital, but from the standpoint of post-capitalism which apprehends the human potentials capitalism technologically opens up.

For Marcuse however, the negative does not stop short at what is, it reaches beyond – toward transcendence. While the established order militates against negativity, and in so doing forecloses liberatory potentialities which are immanent to it, the negative nevertheless returns and unconceals two-dimensional society and thought, rendering these possibilities intelligible. **Recognising that the existing world possesses but withholds the means for qualitative transformation toward the new**, the negative presses on the limits of the former to break open the latter. The negative once again **rekindles the disposition for the alternative.** It is out of this space between the is and the ought, the given reality and the one which lies beyond, that post-capitalist realism emerges. This is why the realism is that of post-capitalism. It recognises that any transcendence begins on the basis of what is and keeps the future open for that which lies beyond.

Where the negative processes the outside, the ought, through the limits and gaps of the inside, the is, post-capitalist realism can simultaneously make the opposite move: processing the limits and gaps of the inside, the is, through the perspective of the outside, the ought. In other words, beginning from the standpoint of post-capitalism, as the only viable and realistic system, to recognise the irrationality of the established order as well as the necessity of that which lies beyond it. Ursula K. Le Guin’s The Dispossessed is one example of such an inversion.114 Shevek, the protagonist of the story, travels to Urras, an administered capitalist state, from his anarchosyndicalist home Anarres. Despite doing so to break the isolation between the two places, Shevek gradually witnesses and understands the toils and misery of a state that he originally idealised while living on Anarres. Arguably, he is able to do so as a result of his upbringing in a truly equal, albeit not perfect, society. Although two different worlds, Urras serves as an analogy of the is and Anarres of the ought in Le Guin’s novel, representing the very act of constructing an outside, a new world, from which to apprehend the inside, the existing one. It is this act which denotes post-capitalist realism – positing the possibilities of the outside as an absolute necessity in and against the oppressive world of the inside.

Critique of the inside via the outside is not only possible on an aesthetic or artistic realm, but on a political one, in the very social forces of people. This language of inside and outside is derived both from Marcuse and Fisher, neither for whom is it reducible to art, such as a work of literature. It is understood not as a spatial category but as a qualitative difference between that which is and that which ought to be. For Marcuse, the integration of the working class into one-dimensional society and the stifling of political consciousness among the masses requires the catalysts of transformation to operate from the outside, from ‘without’ the capitalist system.115 **This outside is constituted by social forces that are still not contained by the administered society, whose aims and needs represent what is suppressed and barred from development in the established order**. It is this social force, as one which is utmost excluded and oppressed, that not only has ‘nothing to lose but their chains’,116 but, **precisely because of this social standing, has the capacity to break through subjective repression and imagine a qualitatively new society.** The outside, while not necessarily the revolutionary force in the traditional sense of a working class nor the masses, is nevertheless a force of negation which ‘testifies to the truth of the alternative – the real need, and the real possibility of a free society’.117

In his text The Weird and the Eerie, Fisher distinguishes between the two terms of the title, both of which process the inside via the outside but produce a different set of affects.118 The weird is constituted by a presence of that which does not belong, bringing to the familiar something which ordinarily lies beyond it.119 Entailing a certain relationship to realism, the weird signifies the previously familiar and conventional as outmoded and obsolete. Something from the outside irrupts into the inner, into this world, denaturalising the inner.120 The outer therein evokes a sense of the weird when confronted with the negative features of the inner, of the established reality. The eerie, on the other hand, is constituted by a failure of presence or a failure of absence. 121 Marked by the unknown, it elicits a sense of alterity which is either obscured in mundane reality or lies beyond common experience.122 There is a suspense to the eerie which pushes one to engage with it and explore the outside, at times providing access to a space beyond the mundane of everyday reality altogether. In other words, it reveals what the inner would ordinarily foreclose and keep out of reach.

For both Marcuse and Fisher then, the outside is a productive concept for both critique and transcendence. However, where Marcuse, rightly, demarcates this outside to the limits of the periphery or the margins, post-capitalist realism extends and expands this outside for all, most especially to the revolutionary subject. The outside becomes a concept which foregrounds postcapitalist realism to apprehend not only the irrationality and unfreedom of the inner, but equally the necessity of the qualitatively new as conceptualised by the outer. It unplugs the individual from the circuit of the administered society, including its mass media and culture, resurrecting the alienatory function of the I as that which stands apart from its given reality. Post-capitalist realism hence fractures capitalist realism in the psyche of those who are faced by the outside. By bringing to the fore the inconsistencies and unrealised potentialities, ‘capitalism’s ostensible ‘realism’ turns out to be nothing of the sort’.123

Insofar as the experimental and creative material of the imagination is derived from sensuous experience, post-capitalist realism is bound to be restrained and guided by existing concepts and sensibilities.124 The images of a qualitatively new world and new ways of life are, in other words, historically determined. This historical determination, rather than confining the imagination, foregrounds post-capitalist realism in the immanent possibilities of the given reality. With the outside filled by the content of repressed potentialities contained in the inner, post-capitalism realism transgresses the limits of the established order, unconcealing and rendering intelligible that which can and ought to be. In so doing, revealing the possibility not only of the satisfaction of vital needs but equally the formation and fulfilment of new ones – both of which are irreconcilable with and stifled by the administered society.125 The outside henceforth, as employed by postcapitalist realism, marks the capacity to anticipate needs and sensibilities that are no longer tied to the administrative society of repression and domination, attesting not only to the plasticity of our brains but equally to the mutability of any given system.

Where the negative both exposes the falsity of the rational appearance of the given reality and orients itself toward a future which is contained in the present, post-capitalist realism builds on this orientation to propose a new and true way of life, one which is free from the negative aspects of the repression and oppression that is necessitated by the administered society. Since negativity is oriented toward transcendence out of the given possibilities, it is in this sense ‘positive’. This positivity however is not one of the happy consciousness which affirms the existing state of affairs but one which, against hopelessness and defeatism, apprehends a qualitatively new future which enlarges the realm of freedom.127 Hence, when Fisher states that capitalist realism is ‘analogous to the deflationary perspective of a depressive who believes that any positive state, any hope, is a dangerous illusion’128 it is precisely the positive state which is vital to Marcuse’s negativity, one which not only negates the established reality, but negates this negation. Put simply, the negative serves as a precondition for determinate negation and as such for change. It recognises the irrationality of reality and on this account **grapples with the ought** to be of the world.129 The very same negativity which is called for by Fisher himself.130

In this spirit of the negative, the realism of post-capitalism here, contrary both to Fisher and Marcuse’s rejection of realism for a post-capitalist project,131 functions to presuppose and represent reality for what it could be. The realism of post-capitalism thus differentiates itself from that of capitalism. While capitalist realism provides only a mediated access to reality by obfuscating both the negative aspects as well as its possibilities for liberation – ‘there is no alternative’ – postcapitalist realism is a direct access to reality, representing the unmediated reality of the qualitatively new.132 Post-capitalist realism:

is about soberly and pragmatically assessing the resources that are available to us here and now, and thinking about how we can best use and increase those resources. It is about moving — perhaps slowly, but certainly purposively — from where we are now to somewhere very different.133

It infers a determinate negation, a movement which negates the is while upholding the ought that is contained within it which passes away into a new is. Post-capitalist realism thereby apprehends and anticipates the absolute necessary process of a movement and creation of qualitatively new modes of relations, needs, sensibilities, and non-repressive sublimation, with the destruction of the old which ‘sustain the present system of domination and the negation of the values on which they are based’.134 In other words, bringing to consciousness the actuality of these possibilities and the forces which hinder and deny them. But it does not stop short as simply puncturing the pervasive atmosphere of capitalist realism. On the contrary, post-capitalist realism further stands as capitalist realism’s opposite. By unveiling the alternatives which exist and are contained with the given reality, it declares that it is not capitalism which is the realism of today, but post-capitalism.

Becoming conscious of the freedom that is nowhere already in existence – a utopia in the etymological sense of ‘no place’ – human beings nevertheless recognise that because the real possibility of liberation is contained within the present historical moment, the objective factors no longer stand in the way of transformation.135 As a universe of thought and practice against and within the existing one, post-capitalist realism, by evoking the outside, testifies to the validity of its images – apprehending that the so-called utopian possibilities are no longer at all utopian. This realism instils into the very psyche and sensibility of the masses the widespread sense that postcapitalist is the one and only viable option. It becomes a normative horizon through which everything shows up in the world. And, as Hegel reminds us, **once a change has taken hold in thought, reality cannot resist.**136

Situated outside of the cave, what was hitherto invisible in the darkness of it is revealed as a new meaning of the world. From this perspective of the outside, post-capitalist realism unconceals the truth of the world in its twofold negativity and positivity. In exposing the oppressive and illusive condition of the inner, as well as the exit which leads to the outer, post-capitalist realism reconciles the discrepancy between the in-itself and the for-itself, the objective and the subjective. Lost futures are recovered, and the future once more opens itself up to us. Freed from the darkness of the cave, it becomes a duty, akin to the prisoner, to return to the cave in order to free the rest and organise an exit of the great masses of people.137 It is, in other words, the work of political practice – to deliberate, educate, and agitate – to finally translate the real potentialities evoked by post capitalist realism into actuality proper.138 And it is in this struggle that the masses come to be finally and fully constituted as a for-itself, defending and realising the interests of freedom and liberation on an objective scale.139

Capitalism hides under the myth of ‘short term’ sustainability to mask its major contribution to ecological crises:

1. Growth is unsustainable---no backing for negative emissions or decoupling, renewables ensure ecological crises, and increases in efficiency cause more consumption and production.

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Phillips acknowledges that we need to stay within planetary boundaries. But as an ecomodernist, he believes that all environmental problems can be solved by a shift in technology. All we need to do is become more efficient. This version of post-environmentalism has received a lot of support, as it aligns well with existing powerful interests in the economy. But it is problematic for many reasons. First, there is no evidence for this claim. The potential of our current technology is limited. And the potential of future innovation is uncertain. As Phillips acknowledges himself, it will take considerable time until new technology arrives. We should not gamble away our future on ideas with such a low (if even known at all) probability of success. Let us illustrate this in relation to climate change. The latest IPCC report to limit global warming to 1.5° presents four scenarios. Three of them strongly depend on negative emission technologies, which are highly controversial as they have not been proven to work at the required scale and represent an “unjust and high-stakes gamble”. The IPCC also provides a fourth scenario that does not rely on negative emissions, but which notably requires that “global material production and consumption declines significantly”. Some demand reduction could be achieved through efficiency improvements. But these might be less effective than they appear. As long as we keep pursuing growth, such improvements will be used for further expansion. This can counteract possible environmental gains. Simply put, efficiency improvements make things cheaper and therefore push up consumption. Such a rebound effect has been found both in different countries and industries. What is more, technological shifts always come at an environmental cost. Every sector of our economy is still based on some form of extraction, pollution, and waste. And all of them depend on carbon. Renewable energy, in particular, requires a great amount of rare minerals and land-use. The same goes for nuclear energy, which demands considerable resources in order to mine uranium, construct power plants, and deal with its waste. Even digital technology has environmental impacts. Phillips tries to argue against this by pointing at past solutions to environmental problems, like the ozone layer or deforestation. However, he does acknowledge that those examples do not compare well to a bigger challenge like climate change. Some of those **challenges were solvable because they only affected a single sector** and an easy technological replacement was available. Additionally, many past environmental challenges have not been overcome, but have simply been reshaped and displaced. Philips points towards the fact that net deforestation ceases in rich countries. But this is mainly because agricultural production is outsourced to poorer ones. The study he uses to show the increase in global tree-cover also shows an alarming reduction in tropical areas. The recent Amazon fires in Brazil, for example, are connected to increased deforestation efforts for agricultural expansion in the territory of the world’s 22nd largest export economy. The total amount of environmental degradation caused by our economy remains coupled to economic activity. Finally, it is important to understand that environmental issues are all interrelated. Even the successful ozone depletion is nowadays under threat as climate change could reverse the recovery of the ozone layer. The deforestation study mentioned above shows that climate change has contributed to both increases and decreases of vegetation in different parts of the world. Mass extinction is another serious threat that our planet is experiencing at the moment, which is also connected to deforestation. And we know that most mass extinctions of the past “had something to do with rapid climate changes”. All this means that it is hard to see a way around a reduction of economic activity. Of course it is theoretically possible that we could grow and produce more within our limits if technology improves. But so far this hasn’t happened, there is little to show that it will, and as long as it doesn’t, we need a practical plan. The logic of eco-modernism – to ~~blindly~~ [ignorantly] bet on future innovation – has already caused us to delay action for more than thirty years, and there is simply no time left. We need to act now, and within our current technological means.

#### 2. Environmental degradation and warming lead to extinction – unknown feedback loops acidify oceans and kill freshwater – pursuing growth worsens effects.

Kareiva 18, Ph.D. in ecology and applied mathematics from Cornell University, director of the Institute of the Environment and Sustainability at UCLA, Pritzker Distinguished Professor in Environment & Sustainability at UCLA, et al. (Peter, “Existential risk due to ecosystem collapse: Nature strikes back,” *Futures*, 102)

In summary, six of the nine proposed planetary boundaries (phosphorous, nitrogen, biodiversity, land use, atmospheric aerosol loading, and chemical pollution) are unlikely to be associated with existential risks. They all correspond to a degraded environment, but in our assessment do not represent existential risks. However, the three remaining boundaries (climate change, global freshwater cycle, and ocean acidification) do pose existential risks. This is because of intrinsic positive feedback loops, substantial lag times between system change and experiencing the consequences of that change, and the fact these different boundaries interact with one another in ways that yield surprises. In addition, climate, freshwater, and ocean acidification are all directly connected to the provision of food and water, and shortages of food and water can create conflict and social unrest. Climate change has a long history of disrupting civilizations and sometimes precipitating the collapse of cultures or mass emigrations (McMichael, 2017). For example, the 12th century drought in the North American Southwest is held responsible for the collapse of the Anasazi pueblo culture. More recently, the infamous potato famine of 1846–1849 and the large migration of Irish to the U.S. can be traced to a combination of factors, one of which was climate. Specifically, 1846 was an unusually warm and moist year in Ireland, providing the climatic conditions favorable to the fungus that caused the potato blight. As is so often the case, poor government had a role as well—as the British government forbade the import of grains from outside Britain (imports that could have helped to redress the ravaged potato yields). Climate change intersects with freshwater resources because it is expected to exacerbate drought and water scarcity, as well as flooding. Climate change can even impair water quality because it is associated with heavy rains that overwhelm sewage treatment facilities, or because it results in higher concentrations of pollutants in groundwater as a result of enhanced evaporation and reduced groundwater recharge. Ample clean water is not a luxury—it is essential for human survival. Consequently, cities, regions and nations that lack clean freshwater are vulnerable to social disruption and disease. Finally, ocean acidification is linked to climate change because it is driven by CO2 emissions just as global warming is. With close to 20% of the world’s protein coming from oceans (FAO, 2016), the potential for severe impacts due to acidification is obvious. Less obvious, but perhaps more insidious, is the interaction between climate change and the loss of oyster and coral reefs due to acidification. Acidification is known to interfere with oyster reef building and coral reefs. Climate change also increases storm frequency and severity. Coral reefs and oyster reefs provide protection from storm surge because they reduce wave energy (Spalding et al., 2014). If these reefs are lost due to acidification at the same time as storms become more severe and sea level rises, coastal communities will be exposed to unprecedented storm surge—and may be ravaged by recurrent storms. A key feature of the risk associated with climate change is that mean annual temperature and mean annual rainfall are not the variables of interest. Rather it is extreme episodic events that place nations and entire regions of the world at risk. These extreme events are by definition “rare” (once every hundred years), and changes in their likelihood are challenging to detect because of their rarity, but are exactly the manifestations of climate change that we must get better at anticipating (Diffenbaugh et al., 2017). Society will have a hard time responding to shorter intervals between rare extreme events because in the lifespan of an individual human, a person might experience as few as two or three extreme events. How likely is it that you would notice a change in the interval between events that are separated by decades, especially given that the interval is not regular but varies stochastically? A concrete example of this dilemma can be found in the past and expected future changes in storm-related flooding of New York City. The highly disruptive flooding of New York City associated with Hurricane Sandy represented a flood height that occurred once every 500 years in the 18th century, and that occurs now once every 25 years, but is expected to occur once every 5 years by 2050 (Garner et al., 2017). This change in frequency of extreme floods has profound implications for the measures New York City should take to protect its infrastructure and its population, yet because of the stochastic nature of such events, this shift in flood frequency is an elevated risk that will go unnoticed by most people. 4. The combination of positive feedback loops and societal inertia is fertile ground for global environmental catastrophes Humans are remarkably ingenious, and have adapted to crises throughout their history. Our doom has been repeatedly predicted, only to be averted by innovation (Ridley, 2011). However, the many stories of human ingenuity successfully addressing existential risks such as global famine or extreme air pollution represent environmental challenges that are largely linear, have immediate consequences, and operate without positive feedbacks. For example, the fact that food is in short supply does not increase the rate at which humans consume food—thereby increasing the shortage. Similarly, massive air pollution episodes such as the London fog of 1952 that killed 12,000 people did not make future air pollution events more likely. In fact it was just the opposite—the London fog sent such a clear message that Britain quickly enacted pollution control measures (Stradling, 2016). Food shortages, air pollution, water pollution, etc. send immediate signals to society of harm, which then trigger a negative feedback of society seeking to reduce the harm. In contrast, today’s great environmental crisis of climate change may cause some harm but there are generally long time delays between rising CO2 concentrations and damage to humans. The consequence of these delays are an absence of urgency; thus although 70% of Americans believe global warming is happening, only 40% think it will harm them (http://climatecommunication.yale.edu/visualizations-data/ycom-us-2016/). Secondly, unlike past environmental challenges, the Earth’s climate system is rife with positive feedback loops. In particular, as CO2 increases and the climate warms, that very warming can cause more CO2 release which further increases global warming, and then more CO2, and so on. Table 2 summarizes the best documented positive feedback loops for the Earth’s climate system. These feedbacks can be neatly categorized into carbon cycle, biogeochemical, biogeophysical, cloud, ice-albedo, and water vapor feedbacks. As important as it is to understand these feedbacks individually, it is even more essential to study the interactive nature of these feedbacks. Modeling studies show that when interactions among feedback loops are included, uncertainty increases dramatically and there is a heightened potential for perturbations to be magnified (e.g., Cox, Betts, Jones, Spall, & Totterdell, 2000; Hajima, Tachiiri, Ito, & Kawamiya, 2014; Knutti & Rugenstein, 2015; Rosenfeld, Sherwood, Wood, & Donner, 2014). This produces a wide range of future scenarios. Positive feedbacks in the carbon cycle involves the enhancement of future carbon contributions to the atmosphere due to some initial increase in atmospheric CO2. This happens because as CO2 accumulates, it reduces the efficiency in which oceans and terrestrial ecosystems sequester carbon, which in return feeds back to exacerbate climate change (Friedlingstein et al., 2001). Warming can also increase the rate at which organic matter decays and carbon is released into the atmosphere, thereby causing more warming (Melillo et al., 2017). Increases in food shortages and lack of water is also of major concern when biogeophysical feedback mechanisms perpetuate drought conditions. The underlying mechanism here is that losses in vegetation increases the surface albedo, which suppresses rainfall, and thus enhances future vegetation loss and more suppression of rainfall—thereby initiating or prolonging a drought (Chamey, Stone, & Quirk, 1975). To top it off, overgrazing depletes the soil, leading to augmented vegetation loss (Anderies, Janssen, & Walker, 2002). Climate change often also increases the risk of forest fires, as a result of higher temperatures and persistent drought conditions. The expectation is that forest fires will become more frequent and severe with climate warming and drought (Scholze, Knorr, Arnell, & Prentice, 2006), a trend for which we have already seen evidence (Allen et al., 2010). Tragically, the increased severity and risk of Southern California wildfires recently predicted by climate scientists (Jin et al., 2015), was realized in December 2017, with the largest fire in the history of California (the “Thomas fire” that burned 282,000 acres, https://www.vox.com/2017/12/27/16822180/thomas-fire-california-largest-wildfire). This catastrophic fire embodies the sorts of positive feedbacks and interacting factors that could catch humanity off-guard and produce a true apocalyptic event. Record-breaking rains produced an extraordinary flush of new vegetation, that then dried out as record heat waves and dry conditions took hold, coupled with stronger than normal winds, and ignition. Of course the record-fire released CO2 into the atmosphere, thereby contributing to future warming. Out of all types of feedbacks, water vapor and the ice-albedo feedbacks are the most clearly understood mechanisms. Losses in reflective snow and ice cover drive up surface temperatures, leading to even more melting of snow and ice cover—this is known as the ice-albedo feedback (Curry, Schramm, & Ebert, 1995). As snow and ice continue to melt at a more rapid pace, millions of people may be displaced by flooding risks as a consequence of sea level rise near coastal communities (Biermann & Boas, 2010; Myers, 2002; Nicholls et al., 2011). The water vapor feedback operates when warmer atmospheric conditions strengthen the saturation vapor pressure, which creates a warming effect given water vapor’s strong greenhouse gas properties (Manabe & Wetherald, 1967). Global warming tends to increase cloud formation because warmer temperatures lead to more evaporation of water into the atmosphere, and warmer temperature also allows the atmosphere to hold more water. The key question is whether this increase in clouds associated with global warming will result in a positive feedback loop (more warming) or a negative feedback loop (less warming). For decades, scientists have sought to answer this question and understand the net role clouds play in future climate projections (Schneider et al., 2017). Clouds are complex because they both have a cooling (reflecting incoming solar radiation) and warming (absorbing incoming solar radiation) effect (Lashof, DeAngelo, Saleska, & Harte, 1997). The type of cloud, altitude, and optical properties combine to determine how these countervailing effects balance out. Although still under debate, it appears that in most circumstances the cloud feedback is likely positive (Boucher et al., 2013). For example, models and observations show that increasing greenhouse gas concentrations reduces the low-level cloud fraction in the Northeast Pacific at decadal time scales. This then has a positive feedback effect and enhances climate warming since less solar radiation is reflected by the atmosphere (Clement, Burgman, & Norris, 2009). The key lesson from the long list of potentially positive feedbacks and their interactions is that runaway climate change, and runaway perturbations have to be taken as a serious possibility. Table 2 is just a snapshot of the type of feedbacks that have been identified (see Supplementary material for a more thorough explanation of positive feedback loops). However, this list is not exhaustive and the possibility of undiscovered positive feedbacks portends even greater existential risks. The many environmental crises humankind has previously averted (famine, ozone depletion, London fog, water pollution, etc.) were averted because of political will based on solid scientific understanding. **We cannot count on complete scientific understanding when it comes to positive feedback loops and climate change**

#### 3. Phosphorus – shortages existential – trends show they’re coming now due to human short-circuiting of the phosphorus cycle

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In the course of these exploits, humans reached across vast distances to secure phosphorus. The discovery of coprolites in British fields allowed humans to reach back in time, too, **seizing nutrients from another era** and short-circuiting the geologic phosphorus cycle altogether. We saw a way to turn the stubborn trickle into a torrent, and that’s exactly what we did. Until the late 1800s, the “stinking stones” that dotted the fields of South Carolina were considered a nuisance. But as the cost of imported guano soared and the Civil War reshaped southern agriculture, scientists discovered that these nodules of phosphate rock could be processed into decent fertilizer. By 1870, the first U.S. phosphate mines opened near Charleston and along the coast, tearing up fields, forests, and swamps to reach the bedrock below. A decade later, geologists discovered even larger deposits in Florida. (To this day, most of the phosphorus on American fields and plates comes from the southeastern U.S.) Other massive formations of phosphate rock have since been identified in the American West, China, the Middle East, and northern Africa. These deposits became increasingly important in the 20th century, during the Green Revolution (the third revolution in agriculture, if you’re keeping track). Plant breeders developed more productive crops to feed the world and farmers nourished them with nitrogen fertilizer, which became readily available after scientists discovered a way of making it from the nitrogen in air. Now, **the main limit to crop growth was phosphorus**—and as long as the phosphate mines hummed, that was no limit at all. Between 1950 and 2000, global phosphate-rock production increased sixfold, and helped the human population more than double. But for as long as scientists have understood the importance of phosphorus, people have worried about **running out of it**. These fears sparked the fertilizer races of the 19th century as well as a series of anxious reports in the 20th century, including one as early as 1939, after President Franklin D. Roosevelt asked Congress to assess the country’s phosphate resources so that “continuous and adequate supplies be insured.” There were also cautionary tales: Large deposits of phosphate rock on the tiny Pacific island of Nauru bolstered Australia and New Zealand’s agricultural progress during the 20th century. But by the 1990s, Nauru’s mines had run low, leaving its 10,000 residents destitute and the island in ecological ruins. (In recent years, Nauru has housed a controversial immigrant detention center for Australia.) These events raised a terrifying possibility: What if the phosphorus floodgates were to suddenly slam shut, relegating humanity once more to the confines of their parochial phosphorus loops? What if our liberation from the geologic phosphorus cycle is only temporary? In recent years, Cordell has voiced concerns that **we are fast consuming our richest and most accessible reserves**. **U.S. phosphate production has fallen by about 50 percent since 1980**, and the country—once the world’s largest exporter—**has become a net importer**. According to some estimates, China, now the leading producer, might have only a few decades of supply left. And under current projections, global production of phosphate rock could start to decline well before the end of the century. This represents an existential threat, Cordell says: “**We now have** **a** massive population **that is dependent on those phosphorus supplies**.” Many experts dispute these dire predictions. They argue that peak phosphorus—like peak oil—is a specter that always seems to recede just before its prophecy is fulfilled. Humans will never extract all of the phosphorus from the Earth’s crust, they say, and whenever we have needed more in the past, mining companies have found it. “I don’t think anybody really knows how much there is,” says Achim Dobermann, the chief scientist at the International Fertilizer Association, an industry group. But Dobermann, whose job involves forecasting phosphorus demand, is confident that “whatever it is is going to last several hundred more years.” Simply extracting more phosphate rock might not solve all of our problems, Cordell says. Already, one in six farmers worldwide **can’t afford fertilizer**, **and phosphate prices have started to rise**. Due to a tragic quirk of geology, many tropical soils also lock away phosphorus efficiently, forcing farmers to apply more fertilizer than their counterparts in other areas of the world. The grossly unequal distribution of phosphate-rock resources adds an additional layer of geopolitical complexity. Morocco and its disputed territory, Western Sahara, contain about three-quarters of the world’s known reserves of phosphate rock, while India, the nations of the European Union, and many other countries depend largely on phosphorus imports. (In 2014, the EU added phosphate rock to its list of critical raw materials with high supply risk and economic importance.) And as U.S. and Chinese deposits dwindle, the world will increasingly rely on Morocco’s mines. We have already glimpsed how the phosphorus supply chain can go haywire. In 2008, at the height of a global food crisis, the cost of phosphate rock spiked by almost 800 percent before dropping again over the next several months. The causes were numerous: a collapsing global economy, increased imports of phosphorus by India, and decreased exports by China. But the lesson was clear: Practically speaking, phosphorus is an undeniably finite resource. I first heard about the potential for a phosphorus catastrophe a few years later, when a farmer friend mentioned casually that we consume mined phosphorus every day and that those mines are running out. The more I learned, the more fascinated I became by the story, not only because of its surprising and arcane details—eating rocks! mining poop!—but because of its universality. Phosphorus is a classic natural-resource parable: Humans strain against some kind of scarcity for centuries, then finally find a way to overcome it. We extract more and more of what we need—often in the name of improving the human condition, sometimes transforming society through celebrated revolutions. But eventually, and usually **too late**, **we discover the cost of overextraction**. And the cost of breaking the phosphorus cycle is not just looming scarcity, but also rampant pollution. “We have a too-little-too-much problem,” says Geneviève Metson, an environmental scientist at Linköping University in Sweden, “which is what makes this conversation very difficult.”

#### 4. Deforestation causes extinction in the next two decades.

Maxwell, 7/28 (Jamie Maxwell, The paper is written by career physicists Dr Gerardo Aquino, a research associate at the Alan Turing Institute in London currently working on political, economic and cultural complex system modeling to predict conflicts; and Professor Mauro Bologna of the Department of Electronic Engineering at the University of Tarapaca in Chile."Theoretical Physicists Say 90% Chance of Societal Collapse Within Several Decades," No Publication, https://www.vice.com/en\_us/article/akzn5a/theoretical-physicists-say-90-chance-of-societal-collapse-within-several-decades, 7-28-2020) //ILake-NC [Hari recut some] [[ty neo xx]]

Two theoretical physicists specializing in complex systems conclude that global deforestation due to human activities is on track to trigger the “irreversible collapse” of human civilization within the next two to four decades. If we continue destroying and degrading the world’s forests, Earth will no longer be able to sustain a large human population, according to a peer-reviewed paper published this May in Nature Scientific Reports. They say that if the rate of deforestation continues, "all the forests would disappear approximately in 100–200 years.” "Clearly it is unrealistic to imagine that the human society would start to be affected by the deforestation only when the last tree would be cut down," they write. This trajectory would make the collapse of human civilization take place much earlier due to the escalating impacts of deforestation on the planetary life-support systems necessary for human survival—including carbon storage, oxygen production, soil conservation, water cycle regulation, support for natural and human food systems, and homes for countless species.

#### 5. Ocean acidification kills plankton – extinction in 2-3 years.

**Holthaus, 15** (Eric Holthaus, cites Dutkiewicz, who has a Ph.D. from the University of Rhode Island (1997), has been at MIT since 1998. She became a Principal Research Scientist in 2012. And cites Jacquelyn Gill who is an Associate Professor of Paleoecology & Plant Ecology, School of Biology and Ecology and Climate Change Institute "The Point of No Return: Climate Change Nightmares Are Here," Rolling Stone, https://www.rollingstone.com/politics/politics-news/the-point-of-no-return-climate-change-nightmares-are-already-here-37626/, 8-5-2015) //ILake-NC

Attendant with this weird wildlife behavior is a stunning drop in the number of plankton **— the basis of the ocean’s food chain**. In July, another major study concluded that acidifying oceans are likely to have a “quite traumatic” impact on plankton diversity, with some species dying out while others flourish. As the oceans absorb carbon dioxide from the atmosphere, it’s converted into carbonic acid — and the pH of seawater declines. According to lead author Stephanie Dutkiewicz of MIT, that trend means “the whole food chain is going to be different.” The Hansen study may have gotten more attention, but the Dutkiewicz study, and others like **it, could have even more dire implications for our future**. The rapid changes Dutkiewicz and her colleagues are observing have shocked some of their fellow scientists into thinking that yes, actually, we’re heading toward the worst-case scenario. Unlike a prediction of massive sea-level rise just decades away, the warming and acidifying oceans represent a problem that seems to have **kick-started a mass extinction** on the same time scale. Jacquelyn Gill is a paleoecologist at the University of Maine. She knows a lot about extinction, and her work is more relevant than ever. Essentially, she’s trying to save the species that are alive right now by learning more about what killed off the ones that aren’t. The ancient data she studies shows “really **compelling evidence that there can be events of abrupt climate change** that can happen well within human life spans. **We’re talking less than a decade**.”

#### Finally, be skeptical of long-term sustainability – several, structural, factors ensure capitalism’s collapse:

#### 1. Financialization and speculation.

Foster et al. 21 [John Bellamy Foster, R. Jamil Jonna, and Brett Clark, \* professor of sociology at the University of Oregon, \*\*\* professor of sociology at the University of Utah, “The Contagion of Capital: Financialized Capitalism, COVID-19, and the Great Divide,” 2021, *Monthly Review*, Vol. 27, Issue 8, https://monthlyreview.org/2021/01/01/the-contagion-of-capital/, Accessed: 04/04/21, EA – Charts Omitted]

Free Cash and the Financialization of Capital

“Capitalism,” as left economist Robert Heilbroner wrote in The Nature and Logic of Capitalism in 1985, is “a social formation in which the accumulation of capital becomes the organizing basis for socioeconomic life.”1 Economic crises in capitalism, whether short term or long term, are primarily crises of accumulation, that is, of the savings-and-investment (or surplus-and-investment) dynamics. Investment in new productive capacity in new or existing businesses is what determines growth. Such investment decisions are governed by expected profits on new investments.

Viewed in these terms, the decline in the long-term growth rate experienced by the mature, monopolistic economies of the United States, Europe, and Japan over the last half century can be seen as related principally to the atrophy of net investment.2 Existing excess capacity in plant and equipment, a product of the monopolistic structure of accumulation, tends to decrease expected profits on new investment.3 The U.S. economy has seen a long-term decline in capacity utilization in manufacturing, which has averaged 78 percent from 1972 to 2019—well below levels that stimulate net investment.4 As a result, the capital accumulation process within production has stagnated, with existing idle capacity tending to shut off the creation of new capacity. From 1960 to 1980, it was common for private net investment to constitute around 40 percent of private gross investment. Since 2000, this has dropped to around 20 percent, even as gross investment has weakened relative to national income.5

The significance of the atrophy of net investment in the core capitalist countries cannot be exaggerated. As the foremost emerging economy in the world today, China has what economist Zhun Xu calls a “high Baran ratio,” standing for investment as a share of economic surplus. Conceptually, economic surplus—the difference between national output and wage income or essential consumption—is gross property income (profit, rent, interest). Zhun uses the income of the top 10 percent as a proxy for economic surplus. On this basis, he explains, China has invested around 80 percent of its economic surplus, leading to high growth rates of 7 percent or higher. In contrast, mature, monopolistic economies such as the Group of 7 (the United States, Japan, Germany, the United Kingdom, France, Italy, and Canada) typically have relatively low Baran ratios, investing less than 50 percent of economic surplus, resulting in what for decades have been weak and declining average annual growth rates.6

Given these conditions, it is important to ask: What happens to that part of the economic surplus held by corporations and individual capitalists that is not invested in new capacity?7 Some of it is used for capitalist consumption, but this has inherent limits. The vast economic surplus (actual and potential) generated by the system of economic exploitation far exceeds what can be spent in the luxury consumption of the wealthy, however ostentatious. More importantly, capitalists do not desire to consume the larger part of the economic surplus at their disposal, since, above all else, they seek to amass wealth.

Government spending absorbs some of the economic surplus, as does waste in the business process. However, government deficit spending also increases corporate profits after taxes above the level determined by capitalist spending on consumption and investment.8 Hence, with both the growth of the federal deficit and the stagnation of investment, the amount of free cash in corporate coffers has dramatically expanded. This free cash plays a central role in the financialization of capital and the resulting extreme polarization of society.9

As stipulated by Craig Medlen in Free Cash, Capital Accumulation and Inequality, free cash equals corporate profits after taxes plus depreciation minus investment. (In national income accounting, corporate profits after taxes plus depreciation is known as corporate cash flow. The funds associated with depreciation [or capital consumption] are part of the gross surplus available to corporations.)10

A wider conception of free cash, utilized in this article, also includes net interest. Hence, in the wide version, Free Cash = Corporate Profits After Taxes + Depreciation + Net Interest – Investment.11 This free cash is held by corporations or is distributed to stockholders through dividend payouts and/or stock buybacks.12

Building on the research of Michał Kalecki, Medlen demonstrates that the amount of free cash is identical to the federal government deficit minus the excess of savings over investment of the noncorporate sector (now usually negative) plus the current account balance. The three factors of (1) the federal deficit, (2) the country’s current account balance (or the trade deficit), and (3) the deficit spending of the noncorporate sector (encompassing noncorporate business, housing, and personal finance) can therefore be seen as underpinning free cash.13

Chart 1 shows the growth of corporate free cash in the U.S. economy from the period immediately after the Second World War to the present. Free cash, as non-invested surplus, became a much bigger and bigger factor in the U.S. economy beginning in the 1980s due mainly to the combined effects of a long-term decline in corporate taxation, the increasing federal deficit, and the atrophy of net investment.14 Free cash falls in recessions (due to lower business activity and income), but then rockets up soon afterward due to investment not keeping up with increasing economic activity, freeing up more cash after investment. This sudden rebound in cash is also a product of the fact that the Federal Reserve Board now steps in during every recession, at precisely such “Minsky Moments” when the prospects for investment are at their worst, with lavish provision of low-interest credit.

Another way of looking at this phenomenon is to chart the total cash or liquid funds that corporations actually have ready at hand, if they were to choose to invest (or otherwise productively use) the surplus at their disposal. Of course, corporate investment is not dependent on the prior availability of savings/surplus, since capitalism, as Joseph Schumpeter long ago explained, is a system that creates “credit ad hoc”; while John Maynard Keynes and Kalecki taught that investment determines savings, not the other way around.15 Nevertheless, it is significant that the cash funds of corporations in the current phase of monopoly-finance capital far exceed profitable investment outlets. At the beginning of 2020, nonfinancial corporations were sitting on over $4 trillion dollars in cash; before the end of 2020 this had risen to over $5 trillion.16 According to the Federal Reserve Flow of Funds data, shown in Chart 2, total cash held by U.S. nonfinancial corporations as a share of gross domestic product (GDP)—much of it parked abroad in tax havens—has almost tripled between the early 1990s and the present.17

The total cash holdings of nonfinancial corporations on hand at any given time are not to be confused with free cash, which is that part of the corporate cash flow left over after investment in a given year—much of which is not held as cash deposits but instead spent on mergers and acquisitions, stock buybacks, and other financial instruments. Rather, total cash on hand, as defined by the Federal Reserve Flow of Funds, simply measures the actual cash deposits sitting in the accounts of nonfinancial corporations presented as annual averages based on quarterly data. Still, the rapid growth of total cash currently held by nonfinancial corporations in the form of ready monies, both absolutely and as a proportion of GDP (as shown in Chart 2), is a further indication of an economy that has shifted from capital formation to speculation.

As we have seen, when corporations do not invest their economic surplus in new capital formation—primarily due to vanishing investment opportunities in an economy characterized by excess capacity—they are left with abundant free cash that is partly returned to the shareholders through share buybacks and, to a lesser degree, dividends. It is also used for speculation, including mergers, acquisitions, and the panoply of corporate “cash management” techniques that amount to the leveraging of free cash to enhance returns.18 This gives rise to a whole alphabet soup of financial instruments, in which corporations use the cash at their disposal partly as collateral for debt leverage, with nonfinancial corporate debt rising rapidly as a share of national income. Predictably recurring internal corporate funds in the form of free cash constitute a “flow collateral” allowing for further leverage, feeding speculation. A speculative economy relies on borrowed funds for leverage, backed up in part by cash. Expanding cash reserves are also needed as hedges in case of financial defaults. The whole system is a house of cards.

The progressive financialization of the capitalist economy, whereby the financial superstructure continues to expand as a share of the underlying productive economy, has led to ever-greater asset price bubbles and growing threats of world economic meltdown. So far, a complete meltdown has been headed off by central banks, as in the 2000 and 2008 financial crashes. At every major recurring disturbance, and with serious economic repercussions, the monetary authorities pump massive amounts of cash into the financial superstructure of the economy only to give rise to greater bubbles in the future.

Theoretically, stock values represent future expected streams of earnings arising primarily from production.19 Nowadays, however, finance has become increasingly autonomous from production (or the “real economy”), relying on its own speculative “self-financing,” leading to financial bubbles, contagions, and crashes, with the monetary authorities intervening to keep the whole house of cards from collapsing. This serves to reduce the risk to speculators, thereby keeping the value of stocks and other financial assets rising on a long-term basis, along with the overall wealth/income ratio. In these circumstances, so-called asset accumulation by speculative means has replaced actual accumulation or productive investment as a route to the increase of wealth, generating a condition of “profits without production.”20

In order to grasp the full significance of the financialization of the economy, it is useful to look at the two conceptions of capital (relative to national income) depicted in Chart 3.21 One of these, the numerator of the lower line, is the traditional conception of capital as fixed investment stock (physical structures and equipment) at historical cost minus depreciation. This is called the fixed capital stock of the nation and is tied directly to economic growth.22 It represents what economic theorists from Adam Smith to Karl Marx to Keynes have referred to as the accumulation of capital. Capital formation and national income are closely related, generally rising and falling together, producing the relatively flat line, representing the ratio of fixed capital stock to national income, shown in Chart 3.

Yet, capital, as Marx noted very early in the process, has more and more taken on the “duplicate” form of “fictitious capital,” that is, the structure of financial claims (in monetary values) produced by the formal title to this real capital. Insofar as economic activity is directed to the appreciation of such financial claims to wealth relatively independently of the accumulation of capital at the level of production, it has metamorphosed into a largely speculative form.23

This can be seen by looking again at Chart 3. In contrast to the lower line, the upper line depicts what is traditionally seen as the wealth/income ratio (which some economic theorists, such as Thomas Piketty, conflate with the capital/income ratio, treating wealth as capital).24 The numerator here is the value of corporate stocks. Since the mid–1980s, the ratio of stock value to national income has increased more than 300 percent. This marks an enormous growth of financial wealth, with speculation-induced asset growth sidelining the role of productive investment or capital accumulation as such in the amassing of wealth. This is associated with a massive redistribution of wealth to the top of society. The top 10 percent of the U.S. population owns 88 percent of the value of stocks, while the top 1 percent owns 56 percent.25 Rising stock values relative to national income thus mean, all other things being equal, rapidly rising wealth (and income) inequality.26

The existence of the two conceptions of capital (and of capital/income ratios) presented here—one representing historical investment cost minus depreciation, and conforming to the notion of accumulated capital stock, the other the monetary value of stock equities (in economics traditionally treated as wealth rather than capital)—is often downplayed within establishment economics under the assumption that in the long run they will simply fall in line with each other, and with national income. As leading mainstream economic growth theorist Robert Solow writes: “Stock market values, the financial counterpart of corporate productive capital, can fluctuate violently, more violently than national income. In a recession the wealth-income ratio may fall noticeably, although the stock of productive capital, and even its expected future earning power, may have changed very little or not at all. But as long as we stick to longer-run trends…this difficulty can safely be disregarded.”27

But can the divergence of stock values from income (and from fixed capital stock) in reality be so easily disregarded? Chart 3 depicts a sharp increase in stock values relative to national income, which has now continued for over a third of a century, with decreases in total stock values as a ratio of national income (output) occurring during recessions, then rebounding during recoveries.28 The overall movement is clearly in the direction of compounded financial hyperextension. This conforms to the general pattern of the financialization of the capitalist economy, constituting a structural change in the system associated with the growth of monopoly-finance capital. This has gone hand in hand with a bubblier economy, with financial bubbles bursting in 1987, 1991, 2001, and 2008, but ultimately shored up by the Federal Reserve and other central banks.

Today, vast amounts of free cash are spilling over into waves of mergers and acquisitions, typically aimed at acquiring megamonopoly positions in the economy. A major focus is the tech sector, much of which is directed at commodifying all information in society, in the form of a ubiquitous surveillance capitalism.29 All financial bubbles derive their animus from some common rationale, which claims that this time is different, discounting the reality of a bubble. In the present case, the rationale is that the advance of the FAANG stocks (Facebook, Apple, Amazon, Netflix, and Google), which now comprise almost a quarter of the value of Standard and Poor 500’s total capitalization, is unstoppable, reflecting the dominance of technology. Apple alone has reached a stock market valuation of $2 trillion. All of this is feeding a massive increase in income and wealth inequality in the United States, as the gains from financial assets rise relative to income. Yet, like all previous bubbles, this one too will burst.30

Kalecki determined that the export surplus on the U.S. current account increased free cash, as did the federal deficit.31 However, the current account deficit cannot be seen, in today’s overall structural context, as simply reducing free cash, because of the changed role of multinational corporations in late imperialism, which alters other parts of the equation. Due to globalization and the rise of the global labor arbitrage, U.S. multinational corporations in their intrafirm relations have in effect substituted production overseas by their affiliates for parent company exports, thereby decreasing their investment in fixed capital in the United States.32 The sales abroad of goods by majority-owned affiliates of U.S. multinational corporations in 2018 were 14.5 times the exports of goods to majority-owned affiliates.33 Foreign profits of U.S. corporations as a proportion of U.S. domestic corporate profits rose from 4 percent in 1950 to 9 percent in 1970 to 29 percent in 2019. This mainly reflects the shift in production to low unit labor cost countries in the Global South. Samir Amin described the vast expropriation of surplus from the Global South, based on the global labor arbitrage, as a form of “imperialist rent.”34

This expansion of global labor-value chains is also associated with an epochal increase in what is called the non-equity mode of production, or arm’s length production. Companies like Apple and Nike rely not on foreign direct investment abroad, but instead draw on subcontractors overseas to produce their goods at extremely low unit labor costs, often generating gross profit margins on shipping prices on the order of 50 to 60 percent.35

The loss of investment in the United States, as U.S. multinational corporations have substituted production overseas, coupled with the growth of foreign profits of U.S. megafirms, has further increased the free cash at the disposal of corporations (even with a growing deficit in the current account), thereby intensifying the all-around contradictions of overaccumulation, stagnation, and financialization in the U.S. economy. Much of this free cash is parked in tax havens overseas to escape U.S. taxes.36

Washington uses its printing press, through the federal deficit, to compensate for the U.S. current account deficit. Foreign governments cooperate, providing the “giant gift” of accepting dollars in lieu of goods, thereby acquiring massive dollar reserves.37 At some point, however, these contradictions are bound to undermine the hegemony of the dollar as the world’s reserve currency, with dire ramifications for the U.S.-based world empire.

The COVID-19 Crisis and the Great Divide

Received economic ideology, with its compartmentalized view, treats the COVID-19 pandemic as simply an external shock to the economy emanating from the natural environment and thus unrelated to capitalism. However, as Rob Wallace and his colleagues have shown, contagions like COVID-19 arise from the worldwide circuits of capital associated with the global labor arbitrage and the accelerated extraction of the planet’s resources.38 This is tied especially to global agribusiness, which displaces, often forcibly, subsistence farmers while advancing into wilderness areas, destroying ecosystems, and disrupting wildlife. The result is a growing spillover of zoonoses (or diseases from other animals that are capable of being transmitted to human populations). From the standpoint of the Structural One Health tradition in epidemiology, the COVID-19 pandemic can therefore be seen as part of the larger planetary ecological crisis or metabolic rift engendered by twenty-first-century capitalism.39

In March 2020, the U.S. stock market saw a sharp dip as COVID-19 spread in the United States. The Federal Reserve immediately brought out its firehose to flood the market with liquidity, purchasing, from March to June 2020, $1.6 trillion in U.S. Treasuries and $700 billion in mortgage-backed securities, and letting markets know that there was virtually no limit to the trillions that they were ready to pour into markets.40 The result was that—just as social distancing and lockdowns were being instituted and unemployment was soaring to the highest levels since the Great Depression, reaching almost seventeen million—the U.S. stock market experienced its biggest increase since 1974 in the week of April 6 to 10.41 Wall Street profits rose in the first half of 2020 by 82 percent over the year before.42 The total wealth of U.S. billionaires skyrocketed by $700 billion between March and July 2020, even as the number of those dying from COVID-19 in the United States continued to mount and as millions of U.S. workers found themselves hit hard by the crisis.43 Amazon centi-billionaire Jeff Bezos experienced an increase in his total wealth by more than $74 billion in 2020, while Tesla megacapitalist Elon Musk saw his wealth increase in 2020 by $76 billion, making him too a centi-billionaire. (For comparison, the Supplemental Nutrition Assistance Program benefits provided by the federal government in Fiscal Year 2019, aiding tens of millions of low-income families, seniors on fixed incomes, and disabled people, amounted to $62.3 billion.)44 All of this points to the continuing operation of what Marx termed “the absolute general law of capitalist accumulation,” polarizing wealth and poverty, or what Solow, commenting on the work of Piketty, calls “the rich-get-richer dynamic.”45

The wreckage inflicted on the U.S. population as a whole has been enormous. In mid–October 2020, more than 25 million workers in the United States were hurt in the pandemic crisis. According to official unemployment figures, 11.1 million workers in the United States were officially unemployed; another 3.1 million had lost their jobs but were misclassified as a result of the lockdowns; 4.5 million had dropped out of the labor force since the pandemic; and 7 million were still employed but experiencing cuts in pay and hours due to the coronavirus crisis. The number claiming unemployment compensation in all programs in October equaled 21.5 million people.46 Millions are behind in payments for rent, home mortgages, and student loans while food insecurity has grown from 35 million to over 50 million as a result of insufficient government help during the pandemic.47

According to the 2020 U.S. Financial Health Pulse Report, published by the U.S. Financial Network, more than two-thirds of the U.S. population at present are in a financially unhealthy condition. Of these, more than 20 percent are concerned about not having enough food, while more than a quarter are worried about their ability to pay their next month’s rent or mortgage. Ironically, the financial health of the bottom two-thirds of the population at the time the survey was completed (August 2020) was slightly improved compared to 2019 (prior to the present economic and epidemiological crisis), due to the temporary relief mainly in the form of unemployment compensation provided by the federal government in response to the pandemic.48 In the third quarter of 2020, the U.S. economy was still 3.5 percent smaller than in the fourth quarter of 2019, with tens of millions of people suffering as a result of the crisis.49

Exploiting these conditions, the richest 1 percent saw their financial assets skyrocketing as a share of national income. FAANG stocks led the way as corporations and the wealthy turned increasingly from investment to speculative outlets, focusing on the big tech monopolies. By October 2020, Facebook, Apple, Amazon, Netflix, and Google had seen the value of their shares rise year-to-date by 29, 61, 77, 64, and 61 percent respectively.50

Such frenetic speculation naturally carries with it the growing danger of a financial meltdown. At present, the U.S. economy is faced with a stock market bubble that is threatening to burst. Two of the more influential ways of ascertaining whether a financial crisis centered on the stock market is imminent are: (1) the stock price to company earnings ratios (P/E) of stocks, and (2) Warren Buffett’s Expensive Market Rule. The historical average P/E ratio, according to the Shiller Index, is 16. In August 2020, the U.S. stock market was priced at more than twice that, at 35. On Black Tuesday during the 1929 stock market crash, which led to the Great Depression, the P/E ratio had reached 30. The 2000 stock market crash that ended the tech boom of the 1990s occurred when the P/E ratio reached 43.51

According to Buffett’s Expensive Market Rule, the mean average of stock values (measured by Wilshire 5000 market-value capitalization index) as a ratio of GDP is 80 percent. The 2000 tech crash occurred when the stock to income ratio, measured in this way, reached 130 percent, while the 2007 Great Financial Crisis occurred when it reached 110 percent. In August 2020, the ratio was at 180 percent.52

Another key indicator of growing financial instability is the ratio of nonfinancial corporate debt to GDP, depicted in Chart 4. Corporations flush with free cash have taken on debt, available at very low interest rates, in order to further pursue nonproductive ventures such as mergers, acquisitions, and various forms of speculation, using the free cash as flow collateral. In each of the three previous economic crises of 1991, 2000, and 2008, nonfinancial corporate debt reached cyclical peaks in the range of 43 to 45 percent of national income. In 2020, nonfinancial corporate debt in relation to national income reached a record 56 percent. This is a sure sign of a financial bubble stretched beyond its limits.

The entire world economy, apart from China, is now in crisis, with over a million and a half lives lost worldwide to COVID-19 as of the beginning of December, disrupting normal production relations. The International Monetary Fund has projected a -5.8 percent rate of growth in the advanced economies in 2020 and a -4.4 percent rate of growth in the world.53 In these circumstances, there will be no fast recovery from the current capitalist crisis. Heavy storm winds will continue. The U.S. ability to print dollars to stave off financial crises as well as its capacity to devalue its currency so as to increase its exports (thereby reducing the value of dollar reserves held by countries around the world) may both come up against mounting resistance to the dollar system, further hastening the decline of U.S. hegemony. As in other areas, the contagion of capital, which spreads like a virus, ultimately undermining its own basis, is operative here.54 Washington’s attempt to create trade pacts that will ensure the continued dominance of U.S.-centered global commodity chains is running into increasing competition from Beijing. The 2020 Regional Comprehensive Economic Partnership, the largest trade bloc in the world, accounting for around 30 percent of the global economy, has China as its center of gravity.

Faced with economic stagnation, periodic financial crises, and declining economic hegemony, and confronted with rapid Chinese growth, the United States is heading toward a New Cold War with China. This was made clear in the November 2020 U.S. State Department report, The Elements of the China Challenge, accusing the “People’s Republic of China of authoritarian goals and hegemonic ambitions.” The State Department report proceeded to outline a strategy for the defeat of China by targeting the Chinese Communist Party (CCP), exploiting the CCP’s economic and other “vulnerabilities.”55

Here, the chief economic weapon of the United States is its dominance over world finance. Former Chinese Finance Minister, Lou Jiwei, recently indicated that the United States is preparing to launch a “financial war” against China. U.S. attempts at “the suppression of China” by financial means under a Joe Biden administration, he says, “will be inevitable.” Under these circumstances, Lou insists, China’s earlier goals of internationalizing its currency and initiating full capital account convertibility, which would lead to the loss of its control of state finance, are “no longer safe options.” If Washington were to use its power over the world financial system to smother Chinese growth, Beijing, according to Chen Yuan, a former Chinese central bank deputy governor, could be forced to weaponize its holdings of U.S. sovereign debt (totaling $1.2 trillion) in response. This is viewed as the financial equivalent of nuclear war. A financial (not to mention military) war between the United States and China, driven by U.S. attempts to shore up its declining economic hegemony by attempting to derail its emerging rival, could well spell utter disaster for the global capitalist economy and humanity as a whole.56

The Boundary Line and the Contagion of Capital

The crisis of the U.S. system and of late capitalism as a whole is one of overaccumulation. Economic surplus is generated beyond what can profitably be absorbed in a mature, monopolistic system. This dynamic is associated with high levels of idle capacity, the atrophy of net investment, continuing slow growth (secular stagnation), enhanced military spending, and financial hyperexpansion. The inability of private investment (and capitalist consumption) to absorb all of the surplus actually and potentially available, coupled with government deficit spending, leads to growing amounts of free cash in the hands of corporations. The result is the rise of a system of asset speculation that partially stimulates the economy due to the wealth effect (increases in capitalist consumption fed by a part of the increased returns on wealth), but which is unable to overcome the underlying tendency toward stagnation.57

Hence, monopoly-finance capital of today is a deeply irrational system, in which money is seen as begetting more money without the mediation of production, or what Marx characterized as M-M’ (Money-Money + Δm or surplus value).58 “The viability of today’s money manager capitalism,” as the heterodox economist Hyman Minsky called it,

depends upon not having a serious depression: the continued absence of a serious depression fosters experimentation with portfolio managing techniques that increases the likelihood of system threatening crises, that is, increases the likelihood of depressions. There is a basic contradiction in money manager capitalism which makes continued success ever more dependent upon an apt structure of supportive government interventions. Money manager capitalism rests upon the power of government to prevent a sharp decline in aggregate business profits.… We can expect future crises to be met with some form of ad hoc intervention which will in part reflect an unwillingness by policy makers to appreciate that once again capitalism has changed.59

A rational strategy with which to escape this trap—if only partially—would be to increase the direct U.S. governmental role in investment and consumption in order to address the multiple crises of society, including public spending in response to: (1) the climate emergency; (2) the public health crisis; (3) the shortage of adequate housing for much of the population; (4) the deterioration of the public education system under neoliberalism; (5) the absence of a national mass transit system, and so on. Yet, for the government to enter directly into such areas would involve crossing the private sector-government boundary line, which ensures the present near-complete dominance of the economy by the private sector, a phenomenon first critically diagnosed by Marxist economists Paul A. Baran and Paul M. Sweezy in Monopoly Capital in 1966.60 As Medlen writes, “the institutional arrangements for profit-seeking investment are simply taken for granted as a boundary line that is not to be violated.”61

So strict is the boundary line in the U.S. economy that outside of the Tennessee Valley Authority, as well as various municipal utilities and land leases, government-owned productive facilities cannot be said to produce internal revenues sufficient to compensate for costs of production. “This is primarily because the government, outside a considerable land mass, the public school system, the U.S. Postal Service and toll-free roads, owns essentially nothing.”62 The bulk of federal government discretionary spending goes to the military, which constitutes a huge subsidy to private capital while avoiding any intrusions on the private sector. Meanwhile, the privatization of public health infrastructure and public education is further pushing the boundary line in the direction of the complete dominance of a private sector already prone to overaccumulation and the contagion of capital.

A little more than forty years ago in “Whither U.S. Capitalism?,” Sweezy, writing in Monthly Review, questioned the then common view that the United States, caught in economic stagnation, was headed inevitably to “an American version of the corporate state, authoritarian and repressive internally, increasingly militaristic and aggressive externally.”63 His reasoning is worth recalling today:

There are at least two problems with this “solution” to the crisis of U.S. capitalism. First, it assumes that because the working class has never yet organized itself for effective independent political action it never will in the future either. In my view this reflects a simplistic view of the history of class struggles in the United States and quite unjustifiably rules out the emergence of new patterns of behavior and forms of struggle. Second, it assumes that the capitalists will be united behind a fascist-type policy of repression, and this seems to me doubtful too. Not only is a strategy of this kind costly to large elements of the middle and upper classes, as the whole history of fascism shows, but even more important, it is no solution at all to the real problems of U.S. capitalism. The basic disease of monopoly capitalism is an increasingly powerful tendency to overaccumulate. At anything approaching full employment, the surplus accruing to the propertied classes is far more than they can profitably invest. An attempt to remedy this by further curtailing the standard of living of the lower-income groups can only make things worse. What is needed, in fact, is the exact opposite, a substantial and increasing standard of living of the lower-income groups, not necessarily in the form of more individual consumption: more important at this stage of capitalist development is a greater improvement in collective consumption and the quality of life.64

Sweezy followed this up with the notion of building a “cross-class alliance” between those suffering most from monopoly capitalism and the more far-seeing elements of the ruling class, a kind of new New Deal, but with the working class as the organizing and hegemonic force. This was consistent with a political praxis emphasizing protecting the population in the immediate present while working toward the long-run revolutionary reconstitution of society at large.

More than four decades later, in 2021, the basic conditions are similar, if more serious and threatening. The current struggle for a People’s Green New Deal, based on a just transition, is a call for a cross-class movement to protect humanity as a whole, one which, however, can only be successful by going against the logic of capital and establishing the basis for a new society geared to substantive equality and environmental sustainability: the historical struggle for socialism. If the danger of “a fascist-type policy of repression” of the kind that Sweezy pointed to has reemerged in the twenty-first century in the context of the contagion of capital, so has a new socialist movement from below aimed at ensuring a world of sustainable human development. Predictions as to the future are meaningless in this context. The point is to struggle.

#### 2. Resources – growth will cause complete societal collapse by 2050. Finite resources and the jevons paradox mean decoupling is impossible – their impact scenarios are terminally non uq.

Kallis et. al. ‘18 [Giorgos Kallis, Vasilis Kostakis, Steffen Lange, Barbara Muraca, Susan Paulson, Matthias Schmelzer. “Research on Degrowth.” Annual Review of Environment and Resources 2018 43:1, 291-316. WMK]

Although driven by political, institutional, and discursive processes, growth is also biophysical. The economic process converts energy, resources, and matter to goods, services, and waste (34). In theory, it seems possible to decouple material throughput from economic output by improving the resource efficiency of production. Ecological economists, however, argue that in practice absolute decoupling is unlikely, even though relative decoupling is common (34). Efficiency should not be confused with scale (35): The more efficiently we use resources, the lower they cost, and the more of them we end up using (36). This is, in essence, growth. Just as increases in labor productivity lead to growth and new jobs, not to less employment, increases in resource productivity increase output and resource use (37). Capitalist economies grow by using more resources and more people, more intensively. Accelerating this is unlikely to spare resources. Growth can become “cleaner” or “greener” by substituting, for example, fossil fuels with solar power, or scarce, environmentally intensive metals with more abundant and less intensive metals. But new substitutes have resource requirements, and life-cycle impacts that cross space and time. Energy is a vital source of useful work (38); growth has been possible because fossil fuels did things human labor alone could not do. Ending the use of fossil fuels is likely to reduce labor productivity and limit output (34). Solar and wind power are constrained only by their rate of flow, but unlike fossil fuels, they are diffuse—more like rain than a lake (3). To collect and concentrate a diffuse flow of energy, more energy is necessary and more land is required. The EROIs (energy returns on energy investment) of renewable energies are between 10:1 and 20:1, compared to more than 50:1 for earlier deposits of oil and coal (39). An economy powered by a diffuse energy flow is then likely to be an economy of lower net energy and lower output than one powered by concentrated stocks (3). Land use for solar or wind also competes with the use of land for food production, and rare materials are necessary for infrastructures and batteries that store their intermittent flows, with significant environmental effects. Historical data corroborate ecological economic theory (40). Ayres & Warr (38) find that the use of net energy after conversion losses explains a big portion of the United States’ total factor productivity and economic growth. At the global level, GDP and material use have increased approximately 1:1. Carbon emissions have increased somewhat slower than GDP, but still have increased (34). This is unlikely to be a coincidence. Exceptions may exist, but cross-panel data analysis shows that overall, 1% growth of a national economy is associated with 0.6% to 0.8% increase in its carbon emissions (41) and 0.8% growth in its resource use (42). Global resource use follows currently the “collapse by 2050” scenario foreseen in the “Limits to Growth” 1971 report (43–45). Domestic material use in some developed OECD economies has reached a plateau, but this is because of globalization and trade. If we take into account imported goods, then the material requirements of products and services consumed in OECD countries have grown hand in hand with GDP, with no decoupling (46). For water use, the effects of growth overwhelm any realistic savings from technologies and efficiency (47); water footprints have increased even in regions such as California where water withdrawals were stabilized (40). Carbon emissions in some EU (European Union) countries have been declining, even after trade is taken into account, suggesting some substitution of fossil fuels by cleaner energies. [Although recession also played a role (34).] These declines are nowhere near the 8–10%, year-afteryear reductions in carbon emissions required for developed nations under scenarios compatible with a 50% chance of limiting warming to 2◦C (48). Further reductions will be harder to sustain once one-off substitutions of oil or coal with natural gas are exhausted (34). Resource use or carbon emissions are a product of the scale of the economy (GDP) times its resource or carbon intensity (kg/GDP or kgCO2/GDP). With 1.5% annual increase in global income per capita, carbon intensity has to decline 4.4% each year for staying within 2◦C; with 0% growth, carbon intensity has to fall 2.9% each year (49). In the period 1970–2013, the average annual reduction rate for carbon intensity was less than 1.5%—and this gets harder to sustain as the share of carbon-intensive economies in global output increases (49). As Jackson (50) showed in his seminal work, it is practically impossible to envisage viable climate mitigation scenarios that involve growth. This calls for research on managing, or prospering, without growth (50, 51). Some scenarios deem possible meeting climate targets while sustaining growth, but these generally assume after 2050 some sort of “negative emissions technology,” geo-engineering or otherwise. According to a recent Nature editorial, these technologies remain currently “magical thinking” (52). Clean energy investments can stimulate the economy in the short run, but in the long run growth may be limited by their low EROIs. Studies suggest that economic growth requires a minimum EROI of close to 11:1 (53). Less EROI means less labor productivity, and hence less growth. Indeed, “Limits to Growth” scenarios do not predict growth ending when resources are exhausted but, rather, when the quality of resources declines to such an extent that further extraction diverts more and more investment away from productive industry (44). Degrowth is defined by ecological economists as an equitable downscaling of throughput, with a concomitant securing of wellbeing. If there is a fundamental coupling of economic activity and resource use, as ecological economics suggests there is, then serious environmental or climate policies will slow down the economy. Vice versa, a slower economy will use fewer resources and emit less carbon (40). This is not the same as saying that the degrowth goal is to reduce GDP (54); slowing down the economy is not an end but a likely outcome in a transition toward equitable wellbeing and environmental sustainability. Advancing a position of “a-growth,” van den Bergh (54) proposes ignoring GDP and implementing a global carbon price, indifferent to what its effect on growth turns out to be. Ignoring GDP is a normative position—but in the end, the economy will either grow or not, and if it does not, then there should be plans for managing without growth. Given how entrenched GDP growth is in existing institutional and political structures, a-growth approaches must be advanced as part of broader systemic change (55).

#### 3. Structural factors prevent war now and humanity will survive but exponential growth means future war will be existential

Jaime L. **McGaughran 13**, Jaime L. McGaughran received a PhD in environmental studies from the University of Colorado, Boulder. 7-2013, "(PDF) Future War Will Likely Be Unsustainable for the Survival and Continuation of Humanity and the Earth’s Biosphere," ResearchGate, https://www.researchgate.net/publication/251232595\_Future\_War\_Will\_Likely\_Be\_Unsustainable\_for\_the\_Survival\_and\_Continuation\_of\_Humanity\_and\_the\_Earth%27s\_Biosphere [Graphs Omitted]

**War is quickly becoming unsustainable. If we are to survive as a species** and preserve and maintain the natural and livable biosphere that planet Earth provides, transcending war and mass violence in the coming decades is imperative. War as Usual (WAU) will not be sustainable as it has been for the past millennia due to the exponential increase in information and development of technology. This is particularly observable in the fields of robotics, artificial intelligence, bioinformatics/genetics and nanotechnology. At the rate that we are technologically advancing as a species, war’s continued existence in the coming decades will not be biospherically containable or able to exist within our planetary biological support system. In examining the trends of growth of these emerging sciences, it seems logical to hypothesize that future weapons will be too technologically powerful to employ as a solution for socio-political problems and disagreements. We often perceive and experience technological advancement in the macro world with items ranging from pocket computers, to Mars probes, and the International Space Station. Yet it is in the micro world in which the biggest changes are yet to come. **Future weapons such as super viruses and self-replicating nanobots (microscopic robots) could cause disaster** to humans and our biosphere if used by any actor or agent. In the case of **a virus, it would likely be lethal towards a specific target, such as people**, however, in the case of runaway, **self replicating, environment consuming nanobots, we could literally be facing the obliteration of the biosphere**. Because war technology is slated to advance so rapidly, future warfare will literally look very different than it currently does. Future combat scenarios will be more involved than just robots sweeping the ground and air alongside soldiers, which are currently in the beginning stages with the U.S. wars in Iraq, Afghanistan and Pakistan. Future war will likely be simultaneously waged on a microscopic level, where a whole new and lethal battlefront will be 6 potentially fought. On the micro level of war many possibilities may **become unmanageable** under certain circumstances as will be discussed in chapter three of this paper. At our present rate of technological advancement, war’s mere existence in the coming decades may likely bring endangerment to our species as well as our biological support system. It is likely that future war will hold the destructive power to eliminate the biosphere several times over employing a varied and diverse hi-tech arsenal. The difference between linear and exponential growth is huge. An example of linear growth could be seen in growing at 1 unit per year over a 10 year period. Starting at 0 one would end up with 10 units in 10 years. An example of exponential growth in this same example in the case of doubling each year yields a far higher result of 512. The difference between these two growth rates can be orders of magnitude and in fact is in terms of technology. A prime example of exponential advance is Moore’s Law as seen in figure 1. Moore’s Law is based on the doubling of transistors in a microprocessor every 1.5 to 2 years. The microprocessor acts as the brain of a computer and through Moore’s Law has continued to increase its calculations at ever faster rates, while, consuming less energy per unit of computing power. 7 Figure 1 Moore's Law CPU Transistor Counts 1971-2008 (MacHugh, 2009) Author, inventor and futurist Ray Kurzweil has been studying exponentiality, forming models and making predictions from them for more than two decades. Kurzweil asserts that around the year 2020, a one thousand dollar computer will be as powerful as a human brain and within a decade or so after that it will be more powerful than all human brains combined (Kurzweil, 2005). Figure 2 projects a timeframe from 1900 through 2100 in relation to the power of exponential growth in computing. 8 Figure 2 Calculations Per Second Per $1000 Computer (Kurzweil, 2005) Currently, we hold the power to destroy the world’s surface with nuclear weapons technology several times over and still the revolutions occurring in bioinformatics (information technology applied to biology) and nanotechnology (technology smaller than 100 nanometers) promise to reshape human civilization and warfare in the coming decades. In addition, technology such as computers will likely be in and around our body connecting us internally and biologically to the future Internet (Kurzweil, 2005). The future will likely include **teleportation, invisibility, super lasers, molecular manufacture and much** more (Kurzweil, 2005). Because of the severe consequences of **extremely powerful future technologies** we can no longer afford to use war as a 9 tool or option to solve political, social or cultural conflicts. Assertive solutions must be implemented between states, regions, cultures and people in order to cease war and continue human civilization. Therefore, future war will likely be unsustainable for the survival and continuation of humanity and the Earth’s biosphere. War So Far Has Been Biospherically Sustainable Throughout the ages, war by Homo sapiens has been sustainable. Historically, regardless of the loss of a particular people or civilization, empires and societies waged war year after year and life would go on continuously changing leaders and governments. However, during the 20th century human ingenuity became so great that we discovered ways to destroy our Homo sapien civilization. By the 1940’s the nuclear age had begun and soon enough bombs were produced that could theoretically destroy much of the Earth’s surface. **Currently, we lack the capability to destroy earth’s biosphere in its entirety** (considering microbes living several miles deep in the Earth’s crust being out of human range), but we are conceivably very close when viewed through the lens of exponential advance. This is most likely due to the fact that there are microbes deep in the crust of the earth that we to date would not feasibly be able to completely eradicate thus **leaving the possibility of continued life rather than biospheric extinction** (Roach, 2004). **Historically most nations have ignored any set code of rules in the conduct of war.** Still, rules have been devised by communities, peoples and nations throughout history. Treaties and rules ultimately are just individuals and/or States words printed on paper. The fact is they can be broken, manipulated or abolished at any time by any actor. Some rules have had a longer shelf life than others; however, war has never had rules that have stood the test of time. War ultimately only has means. Empires, States and Nations that claim there are rules and guidelines to war 10 readily break those if need be in order to win, even if it is to merely win more quickly and/or with fewer causalities on their side. As an example the United States simply does whatever is necessary in order to win including implementing the use of torture, which is internationally recognized as amoral and illegal. The U.S. has also used banned substances such as white phosphorus on combatants in Fallujah, Iraq, in 2004, when forcing the surrender of their combatant foes there became increasingly difficult (BBC NEWS | Middle East | US used white phosphorus in Iraq, 2005). Amnesty International released a report that claimed to prove there were fragments of U.S. manufactured white phosphorus munitions marked with identifiable and traceable military codes in Fallujah. They called for an immediate arms embargo on both Israel and Palestine and urged the Obama administration to suspend military aid to Israel (McCarthy, 2009). It is also widely documented that the U.S. used depleted uranium munitions in both Iraq wars and indeed the U.S. and other nations did use depleted uranium in their munitions, which is known to have severe ecological and health related repercussions (BBC NEWS | In Depth | US to use depleted uranium, 2003). There are ailments like ‘Gulf War Syndrome’ that Iraqi’s and U.S. GI’s have been suffering now for close to two decades which are attributed to many sources, including depleted uranium (Bertell, 1998). After the initial invasion of Iraq in 2003, Colonel James Naughton of U.S. Army Material Command said “Iraqi complaints about depleted uranium (DU) shells had no medical basis...They want it to go away because we kicked the crap out of them... [and] moves to ban depleted uranium ammunition are just an attempt by America's enemies to blunt its military might" (BBC NEWS | In Depth | US to use depleted uranium, 2003). And still we are told that war has rules. There were rules in 1776 when Britain and the newly founded U.S. were fighting over the fate of the U.S. as an independent nation. An example of this is when General George Washington’s army famously crossed the Delaware River in the 11 middle of the night and attacked a legion of sleeping mercenary Hessians in the early hours of Christmas morning. There is also the example of early American militias shooting British officers and simply refusing to adhere to standard in line warfare as the British and French practiced in the time period prior to the formation of the US. These tactics were against the British rules of war but apparently not the newly christened American’s. The U.S. knowingly broke those rules then just as it breaks rules today. Again, war does have rules but they are bent or ignored when the need arises. And in war, the only goal is to win even if winning is defined by merely surviving. Current day suicidal and homicidal bombers and other violent extremists do not play by any rules of conventional war as these conventional rules do not favor them. So ultimately, the rules of war down through the ages have been, for the most part, invented, implemented and broken by those who have waged it. The victors write the rules of war as they do the chronicles of history. This leads to another point: War is not always fought by equals. The concept of asymmetrical advantage entices those who do not have it to seek it through other means to destroy the enemy. The current enemies of the United States such as Al Qaeda are a good example. They cannot compete in the sport of war with the U.S. on the battlefield. They would be overwhelmed and thoroughly defeated like Iraq was in 1991 even though it was the fourth largest army in the world. Al Queda, the Taliban, and other extremist groups are at an asymmetrical disadvantage. Therefore, they openly resort to tactics of destruction or terrorism where their strikes can be violently effective all the while skipping the battlefield and producing casualties. The tragedy of the World Trade Center buildings being hit by planes on 9/11 is an example of this. **Presently this type of destructive potential remains largely unexpressed when you factor in highly and more deadly levels and means of technology**. What desperate groups 12 would be willing to do to inflict damage on their enemies is a very serious issue that we face collectively now and into the future. If a group or State becomes irrational and feels it cannot win, it is possible it may attempt to inflict massive damage even if the outcome is a lose-lose scenario. Some religious groups such as Al Queda look for their treasure in the afterlife and give little thought to preserving life and civilization here on Earth. They have stated that they are ready to die and take anyone and everyone with them in order to achieve their goals. Technology is evolving rapidly with little attention placed upon the consequences this will have on the future of conflict. One of the primary reasons that the nuclear arms race has not gotten out of control and created a worldwide or regional holocaust is because the technology is so difficult to create and that the consequences have so little benefit as compared to conventional warfare because of mass causalities and longstanding environmental degradation. It does not generate incentive to know that the place you claim as yours and wish to take over is uninhabitable for many years to come, particularly with short term interests in mind. Mutually assured destruction is the other major factor in that if one state attacks another with nuclear weapons it can expect a devastating response with no reservations on the limit of destruction. The actors or states that have nuclear weapons are also rational save North Korea through 2010. This is why mutually assured destruction has been the single most successful instrument in staving off nuclear war and attack. During the Cold War when the Soviet Union and U.S. were locked in military competition the main reason no nuclear weapons were ever fired were because of this phenomena. When the U.S. announced it was developing a missle defense shield aka ‘Star Wars’ the Soviet Union announced the Perimeter System dubbed ‘Deadhand’ that would ensure a response if attacked and even obliterated, thus continuing to demonstrate the effectiveness of mutually assured 13 destruction. Thus Star Wars vs Deadhand = MAD (mutually assured destruction) which, is an equation and outcome that would benefit neither side (Thomson, 2009) The Exponential Advance of Technology and Its Implications on the Tool of War Technology is advancing at an extremely rapid rate as has been evidenced by personal computing. One major component of this advance is the size of the technology. As we rapidly progress toward nanoscale technologies and their daily integration, life as we know it will be fundamentally quite different. Some scientists believe that the 21st century is going to be the age of nanotechnology (Kurzweil, 2005). This belief has encouraged many individuals to be thinking and comprehending on a microscale level. Since the advent of the modern microscope in the 19th century, the concept of the microscale of life has been and continues to be an important part of science in our world. For example, rides at Disney World’s Epcot theme park such as the 3D computer generated ride ‘Body Wars’ (a video of this can be seen at http://www.youtube.com/watch?v=ybLGzie1mfU) provide individuals with some understanding of the nanoworld as do pictorial graphics and 3D models of the microworld. Charts such as Figure 3 below provide an in depth understanding of the microworlds on which our reality is based. 14 Figure 3 Cutting it Down to Nano (Misner, 2007) In general, developed countries will be quicker to adapt to nanotechnologies compared to developing countries mainly due to available resources and access to technology. Although, we are in the early stages of developing and implementing nanotechnology, many people remain unaware of this scientific trend. Most people understand the concepts of germs and vaccinations. Many also understand the concept of atoms. Yet, there are many individuals who experience considerable difficulty understanding how billions of nanocomputers will be able to assist and 15 mimic internal bodily functions. Nanotechnology is the next Industrial Revolution and the early formative stages are underway. For many years scientists have looked to create artificial life or synthetic life. Recently scientists have made a break through discovery in the creation of synthetic life. Dr Craig Venter and his team announced this landmark discovery to an understandably mixed reaction. Although this will open up new medical treatments, energy developments, aid in ridding pollution it will also bring a whole range of potential negatives. “We have now accomplished the last piece on the list that was required to do what ethicists called playing God" (Gill, 2010). There are deep seated ethical issues associated with this discovery and because it is so new, there are really no regulations as of yet. Thus weaponizing discoveries in this field immediately become a very dangerous reality (Gill, 2010). One of the Pentagon’s military arms or the Defense Advanced Research Projects Agency (DARPA) is working on creating synthetic organisms with built in kill switches providing evidence that this area of research is already being weaponized with back up kill switches in case the subject decides to quit or switch sides against its creator (Drummond, 2010). Another example of this presently arriving nano-revolution can be seen with Tel Aviv University researcher Yael Hanein [having] succeeded in growing living neurons on a mass of carbon nanotubes that act as an electrode to stimulate the neurons and monitor their electrical activity. [This] foundational research that may give sight to blind eyes, merging retinal nerves with electrodes to stimulate cell growth. Until then, her half-human, half-machine invention can be used by drug developers investigating new compounds or formulations to treat delicate nerve tissues in the brain (American Friends of Tel Aviv University: Seeing a Bionic Eye on Medicine's Horizon, 2010). 16 Other areas of research that overlap here are the development of transistors controlled by adenosine triphosphate (ATP) have been developed by researchers at Lawrence Livermore National Laboratory that include applications such as wiring prosthetic devices directly into the nervous system (Barras, 2010). Looking at how these technologies will affect one another is something we will have to reckon with in order to understand just how different tomorrow’s warfare will be. Noted futurist Kurzweil speculates that within the next two decades we will be living in a world capable of molecular manufacturing on a mass scale (Kurzweil, 2005). “Molecular manufacturing is a future technology that will allow us to build large objects to atomic precision, quickly and cheaply, with virtually no defects. Robotic mechanisms will position and react molecules to build systems to complex atomic specification” (Institute for Molecular Manufacturing, 1997). Progress in numerous prototype situations with nearly endless possibilities are continuously being achieved. In the near future we may see viruses being used as batteries to power artificial immune systems patrolling alongside our natural immune systems within the human body (Researchers Build Tiny Batteries with Viruses, 2006). In consideration of future developments of this nature, the coming decades may look completely alien to our current understanding and perception of reality. Science is fast working on developing artificial immune systems to complement and enhance our very capable natural immune systems (Burke and Kendall, 2010). Our world may seem to be evolving slower than it really is because when these technologies mature and come to market things will operate and look very different in our day to day reality. We could see the weaponization of synthetic organisms complete with artificial immune systems storming the battlefield or worse, civilian areas. 17 Nanotechnology has the potential to radically transform our world and species in the coming decades of the 21st century. Conversely, negative effects have been experienced as a result of new nanotechnologies. For example, a nanotech consumer product claiming an active nanoscale ingredient was recalled in Germany for public health reasons in 2006. “At least 77 people reported severe respiratory problems over a one-week period at the end of March -- including six who were hospitalized with pulmonary edema, or fluid in the lungs -- after using a ‘Magic Nano’ bathroom cleansing product, according to the Federal Institute for Risk Assessment in Berlin” (Thayer, 2006). The good news in nano news is that thus far there is not much bad news in regards to numbers of nano-victims (Talbot, 2006). There will however be unforeseen negative consequences which we will discover and learn about as they pop into existence. If we had given foresight to how the invention or discovery of electricity, factories, automobiles, nuclear power and the Internet might affect people and society, we might have done a much better job in managing their negative consequences - such as economic disruption, urban sprawl, pollution, nuclear arms race and high-tech crimes," explained Patrick Lin, research director for The Nanoethics Group (Rockets, 2006). From my research there are just not many cases that have existed to explore in depth what harm nanotechnologies have brought or will bring. But there is foresight and speculation on what they could bring. “The National Institute for Occupational Safety and Health, which conducts research on workplace safety, has no recommended exposure limit guidelines for nanomaterials, and the Occupational Safety and Health Administration has no permissible exposure limit specific to engineered nanomaterials” (Environmental Health Perspectives: No Small Worry: Airborne Nanomaterials in the Lab Raise Concerns, 2010). “The National Institute for Occupational Safety and Health also reports that some recent animal toxicology studies suggest 18 nanomaterials may cause specific health effects [such as] carbon nanotubes having been shown to induce inflammation and oxidative stress in animal models” (Environmental Health Perspectives: No Small Worry: Airborne Nanomaterials in the Lab Raise Concerns, 2010). Consequently, the question remains whether or not the nano transformation will be a blessing or a curse. Although nanotechnology carries great promise, serious threats to the survival of the human race and well being of the biosphere may arise (Nanotechnology Research, 2010). In an accelerating manner we are moving toward a future with wireless energy and information. Cables used for power transfer will be replaced by energy. An example of this is seen in information transfer via wireless power technologies. New Scientist magazine, among other scientific publications, have published various articles on power cables being phased out and power transfer becoming wireless (Robson, 2010). Concurrently, efforts are in progress toward reverse engineering of the human brain and applying the brain’s capabilities, resources and design to AI, intelligence amplification/augmentation (IA), robotics and computers. Presently there is a documentary underway that is actively filming the reverse engineering of the mammalian brain. One major area of work underway is called The Blue Brain Project. This “is the first comprehensive attempt to reverse-engineer the mammalian brain, in order to understand brain function and dysfunction through detailed simulations” (Blue Brain Project, 2010). When the human brain is successfully reverse engineered, experts predict life as we know it will advance to a significantly higher technological level. Figure 4 shows the implication of this in the growth of supercomputers in exponentially increasing floating point operations. 19 Figure 4 Growth in Supercomputer power via FLOPS or floating point operations (Kurzweil, 2005). In his landmark book, “The Singularity is Near”, Ray Kurzweil purports that there are three overlapping revolutions slated to change the very nature of our reality. According to Kurzweil, these specifically are the exponentially advancing fields of Genetics, Nanotechnology and Robotics. With regard to genetics, it is predicted that the field of bioinformatics will grow exponentially from the integration of the fields of information, technology and biology. In the areas utilizing nanotechnology, we will see the intersection of technology and information with the organic and inorganic world. This will likely lead to biological assembly and molecular manufacturing that may create startling changes on global societies. This will also likely aid in augmenting the intelligence of human beings through methods such as direct connection to the Internet and world bank of knowledge from a connection attached to or within one’s brain , which, in turn, may very well radically transform the concept of ‘humanness’. In addition, there is the third field of Robotics, what Kurzweil and others say will become infused with ‘Strong AI’ 20 (Artificial Intelligence that matches or exceeds human intelligence). Strong AI calculates and forecasts that both computers and machines can reach and surpass human levels of intelligence or ability make decisions based on rational thinking. Strong AI’s existence and validity is hypothesized to be comparably equal to a biological human. When anything, whether biological or non biological, is ‘truly intelligent’, then it can be considered to have mind in the sense that people do (Kurzweil, 2005). Mind being the ability to comprehend, conceptualize, calculate, resourcefully problem solve and be able to pass the famous Turing Test, is then as valid as a human beings. The Turing test is the scientific criterion of interacting with artificial intelligence in which one cannot distinguish whether one is interacting with a human or in fact a robot or artificial intelligence of some form (Harnad, 1992). It is conjectured in some scientific circles that when molecular manufacturing comes of age it will represent a significant technological breakthrough comparable to that of the Industrial Revolution, only accomplished in a much shorter period of time (Nanotechnology: Dangers of Molecular Manufacturing, 2010). The late Nobel Prize winner in physics, Richard Feynman, spoke of wanting to build billions upon billions of tiny factories, exact duplicates of each other, which would ceaselessly manufacture and create anything atom by atom. Feynman is quoted as saying “The principles of physics, as far as I can see, do not speak against the possibility of maneuvering things atom by atom. It is not an attempt to violate any laws; it is something, in principle, that can be done” (Hey, 2002). These types of developments may very well require a new paradigm in thinking. It appears that we are moving into the realm of microscale coherence, intelligence, computing and information storage. Multiple fields such as bioinformatics, robotics and AI are experiencing full scale technological revolutions and opening up new sub fields such as Quantum Computing and molecular manufacturing. Although we continue to see and 21 experience technological advancement in the macro world as illustrated in the continuation of smaller, faster computers, space satellites and the beginnings of commercial space flight, rather, it is in the realm of the microworld in which the biggest changes are yet to come. We have been creating new technologies and refining age old technologies and continue to do so with tremendous will based on the incentives of the interconnectivity and convenience they bring. With each passing year our world becomes more interconnected. Examples include telephones, computers, the Internet, email, social networking sites such as Facebook among others. It appears that not only are we interconnected but we are also interdependent due to these advancements and our state of technological progress. This has resulted in great advantages to people worldwide. An example of global interdependency can be best seen with global trade, transportation and shipping. There are also many companies such as Federal Express and Coca Cola that are present all over the globe. Chinese exports flow to various countries and the presence of U.S. computer operating systems such as Microsoft Windows and Apple Mac OS are in use worldwide. However, downsides exist between interconnectivity and interdependence. Prior to global political organizations such as the United Nations and the World Trade Organization many nations exercised considerable self sufficiency. Many countries were not nearly as interdependent in the past as they currently are and although this economic comparative advantage brings about tremendous benefits, it also brings potential disadvantages. When compared to our present civilization it can be seen that another world war would not only affect everyone on the planet, but most certainly doom countless millions, even possibly billions of people in the event of energy and food lines being disrupted in which all likelihood they would. The point here is simple. We are interconnected and interdependent and this is accompanied with both pros and cons. This was seen in both World Wars I and II. Thus future war can throw 22 economic comparative advantage into a state of disadvantage for many countries, regions, and peoples. This is yet another reason on a long list of how unsustainable and devastating future war will likely be to human and biospheric prosperity. Customarily the most advanced technologies are used in war. They are frequently invented out of the interest of national defense or offense. Exponentially advancing technologies appear to have a destructive aspect in relation to this. These technologies can be used to kill on levels that may very well exceed all other known levels. Presently, the human species engages in war primarily on the macro level. What happens when we open up the microworld of warfare alongside the macro world? Will we conduct war in ways never before seen and in ways unable to be seen physically? Technology ranging from the ability to cloak jets and submarines to insect size and smaller miniature robots storming the battlefield are already operational. The U.S. and UK already have over 8,000 robots in use on the ground and in the air in wars in Iraq and Afghanistan (Bowlby, 2010). There are deadly remote control flying drones that kill insurgents from the sky and bomb disposal robots that save lives by disarming explosives on the ground. Iraq and Afghanistan have been more than battle fronts; they have been technological testing grounds for robotic military hardware. A new prototype currently being developed and tested by the Pentagon is a robot called the Energetically Autonomous Tactical Robot or EATR. “It can refuel itself on long journeys by scavenging for organic material - which raises the haunting spectre of a machine consuming corpses on the battlefield” (Bowlby, 2010). Dr Robert Finkelstein of Robotic Technology Inc, the inventor of the machine, insists it will consume "organic material, but mostly vegetarian” (Bowlby, 2010). At present, we are in a global technological race. There appears to be no limit to how as to how sophisticated and powerful computers will become nor is there an end in sight to how destructive bombs or weapons may become. Moore’s Law is a great example of this as explained earlier. In regards to the macro level, it is commonly understood that there is a continual increase in the power of explosives. Until recently, the U.S. had the most powerful non-nuclear weapon in the history of human civilization. A satellite-guided air bomb named the ‘Massive Ordnance Air Blast’, was unrivaled in non-nuclear explosivity and aptly nicknamed the ‘Mother Of All Bombs’(Russian military uses nanotechnology to build world's most powerful non-nuclear bomb, 2007). In 2007 the Russians developed a significantly more explosive non-nuclear weapon. As with exponential technological advancement, such as seen with computers and robotics, the Russian bomb is smaller in size than its U.S. counterpart while being significantly more powerful. It is reported “that while the Russian bomb contains about 7 tons of high explosives compared with more than 8 tons of explosives in the U.S. bomb, it's four times more powerful because it uses a new, highly efficient type of explosives [that were] developed with the use of nanotechnology” (Russian military uses nanotechnology to build world's most powerful non-nuclear bomb, 2007). It is reported that the blast radius of the Russian bomb is more than twice as large as the U.S. bomb and in terms of TNT explosiveness, the Russian bomb rates at 44 tons of regular explosives compared to 11 tons packed by the U.S. bomb (Russian military uses nanotechnology to build world's most powerful non-nuclear bomb, 2007). This further fuels the race for the most powerful war capabilities. The U.S. is not sitting idle having a defense budget that is nearly as large as the rest of the world combined (List of countries by military expenditures, 2009). The U.S. military will spend about $1.7 billion on ground-based robots in the next five years, covering the 2006-2012 period, according to figures reported by a 24 defense analyst from the National Center for Defense Robotics, a congressionally funded consortium of 160 companies (U.S. will spend $1.7B on military robots, 2007). According to Frank Allen, operations director for Florida State University's High Performance Materials Institute, “the U.S. military is using nanotechnology to make lighter body armor that is more durable, flexible and shellproof. In addition, they are using the same nanofabric in developing a super-strong, extra-light ‘unmanned aerial vehicle’ that could be carried into battle, unfolded and launched over the horizon to spy on [or kill] the enemy. A soldier could carry it in his backpack'' (Tasker, 2009). This nanomaterial is known as “buckypaper made from thin sheets of carbon nanotubes -- carbon that has been vaporized and reformed into particles only a few atoms in size, becoming many times lighter and stronger than steel” (Tasker, 2009). It is also reported that Iran is making advanced attack drones i.e. military robo-planes that are “capable of carrying out assaults with high precision” (Iran to make 'advanced' attack drones – Telegraph, 2010). War as usual on the macro level alone is not sustainable and may lead to severe consequences if it is waged unabated in the coming decades. However, this is not the only threat to humanity and the biosphere. According to this author’s research, war on the micro level potentially looks to be even deadlier by possible orders of magnitude. Figure 4 below provides a look at our technological evolution into the nanoworld.Human technology is moving more towards the nano and micro scales as can be seen from figure 3. According to the Center for Responsible Nanotechnology ‘CRN’ (Nanotechnology: Dangers of Molecular Manufacturing, 2010), when molecular manufacturing begins, this technology has the potential to open an unstable arms race between competing and socially differing nations. The mere overuse of cheap nanoproducts alone could inflict widespread environmental damage. This pales in comparison to using nanotechnology as weaponry with its affects on the environment. Nanofactories would be small enough to fit in a suitcase and unleash an unfathomable amount of payloads. One scenario the CRN raises is the possibility of **a human species extinction nanotechnology**. They use an example of small insects being approximately 200 microns to estimate the plausible size for a nanotech-built antipersonnel weapon capable of seeking and injecting toxin into unprotected humans. **The human lethal dose of botulism toxin [a natural toxin manipulated by humans] is about 100 nanograms** or about 1/100 the volume of the weapon. **As many as 50 billion toxin-carrying devices—theoretically enough to kill every human on earth—could be packed into a single suitcase** (Nanotechnology: Dangers of Molecular Manufacturing, 2010). Nanowarfare will change how war is conducted. Soldiers will not be required to be on the battlefield when micro killing devices can be more effective and potentially remain invisible and mysterious to the enemy forces. As a result of small integrated computers coming into existence, nanoscale weapons could be aimed at remote targets in time and space. Consequently, this will not only impair the targets defense, but also will **reduce post-attack detection and accountability of the attacking party** (Nanotechnology: Dangers of Molecular Manufacturing, 2010). More than just human civilization is threatened with extinction from weaponized nanotechnology. The entire planet could be devastated and our biosphere could be irreversibly damaged. Nanoweapons can generate myriad forms of weaponry. They can be eco-friendly in one attack and eco-devastating in another. According to Admiral David E. Jeremiah, ViceChairman (ret.), U.S. Joint Chiefs of Staff, in an address at the 1995 Foresight Conference on Molecular Nanotechnology, "Military applications of molecular manufacturing have even greater potential than nuclear weapons to radically change the balance of power." He describes nanotechnology’s potential to destabilize international relations. 27 Molecular manufacturing may reduce economic influence and interdependence, encourage targeting of people as opposed to factories and weapons, and reduce the ability of a nation to monitor its potential enemies. It may also, by enabling many nations to be globally destructive, **eliminate the ability of powerful nations to "police" the international arena.** By making small groups self-sufficient, it can encourage the breakup of existing nations (Nanotechnology: Dangers of Molecular Manufacturing, 2010). The Center for Nanotechnology illustrates a comparative analysis of nanotech weaponry vs. nuclear weaponry and their site contains insightful and thought provoking information regarding the future of nanotechnologies. One question addressed by the CNR is the effect of nanotechnology on the global community. They explore whether nanotech weaponry would either stabilize or destabilize the world. A factor that may have prevented a large scale nuclear war post WWII, and during the Cold War between the U.S. and U.S.S.R., appeared to be the global consequences of utilizing nuclear weapons. The devastation and long lasting effects of radiation have been well documented and disseminated to the public. An example of these consequences occurred in Japan in 1945 with the atomic bombing of Hiroshima and Nagasaki. The consequences of nuclear war include the death of innocent people along with devastating radioactive effects that could linger for long periods of time. It is no longer just a military conflict. Civilians will be killed along with the destruction of valuable resources and military targets. Thus, up to the present time, **nuclear weapons controlled by rational acting States have been successful at preventing nuclear war.** “Nuclear weapons perhaps can be credited with preventing major wars since their invention” (Nanotechnology: Dangers of Molecular Manufacturing, 2010). But this is only the case because they have thus far been kept out of the hands of irrational actors. 28 To the general public, **nanotech weapons are not well known or understood.** Currently most nanotech weapons are in the conceptual and prototype stages as opposed to having been developed to their full potential. Nanotech weapons are not very similar in form and function to nuclear weapons other than a nuclear explosion is created in the nanoworld by chain-reacting an explosion outward. Nuclear stability stems from several factors. The most obvious is the massive destructiveness of all-out nuclear war. A major nanotech war is conjectured to be equivalent to a nuclear war, however, nuclear weapons also have long-term consequences such as radiation damage to the environment and population. According to CNR long-term consequences would be less severe in a nanotech war (Nanotechnology: Dangers of Molecular Manufacturing, 2010). It appears that CNR may be failing to take into account the myriad possibilities of nanotechnology applied to weaponry. There appear to be **countless ways that nanoweapons could destroy the world several times over**. Many scenarios of this include the possibilities of nanoscale robots, synthetic or organic life forms that have **the ability to self replicate and destroy at will in a seemingly unstoppable or uncontainable manner**. The recent milestone that occurred in the scientific field whereby humankind has created artificial life in the laboratory is a perfect example of this and where it can logically lead to as technology continues to develop at an exponential pace (Gill, 2010). Although nanotechnology can prove to be clean and environmentally friendly in war, this does not exclude the fact that it can also be extraordinarily dirty, causing rampant environmental chaos and irreversible ecological harm. **If our actions were to cause Earth’s biosphere to become extinct, then we, as a species would most likely become extinct as well**, unless by that time we spread out to other planets and/or inhabited outer space. The question then becomes are these effects reversible? 29 A second factor involving the difference between nuclear and nanotech weapons is “nuclear weapons cause indiscriminate destruction; nanotech weapons could be targeted” (Nanotechnology: Dangers of Molecular Manufacturing, 2010). This concept upholds the factors veracity yet fails to recognize other significant of nanotech weapons. Nanotechnology applied to weaponry can be greatly targeted all the way down to the molecular level and most likely beyond. Once again this does not exclude nanoweaponry from the capability of indiscriminate destructiveness and being uncontainable. Nanotechnology holds great promise but also may also contain the proverbial contents of ‘Pandora’s Box’. It appears to contain more possibilities than all other sources. According to the research nanotechnology remains mysteriously infinite in capability and application. Referring to nanotechnology as being ‘just this’ or ‘just that’ is just not true. It is essentially infinite. According to the CRN, a third factor is that nuclear weapons require massive research effort and industrial development. They can be tracked more easily than nanotech weapons development. On the other hand, **nanotech weapons can be developed much more rapidly due to faster, cheaper prototyping** (Nanotechnology: Dangers of Molecular Manufacturing, 2010). Nuclear weapons actually leave a ‘footprint’ and science is advancing readily in tracing a potential nuclear incident to their originating sources (Ferguson, 2006). Currently, **nanotech appears to be untraceable in many ways.** Most developed nations are working with nanotechnology and expanding the field exponentially through myriad and overlapping applications in science, medicine, energy, agriculture and more. Scientific trends readily forecast that in the near future practically every existing field and category will include some aspect of nanotechnology. We are already working with a variety of nanomaterial technologies and substances such as nanocomposites, nanocrystals, nanoparticles, nanostructured materials, 30 nanoclays, nanotubes, nanocoatings, nanocatalysts, nanofilters and more (Nanotechnology Now - Current Uses, 2010). It’s not hard to imagine in the future a devastating scenario where **an ordinary hobbyist could potentially end the world from their basement** lab **utilizing an inexpensive future nanokit** in which an experiment goes awry and threatens some aspect of our biosphere or civilization; even if right now this is just only insightful speculation. When looking at the technological trends, this is indeed a valid future possibility. The final factor in this comparison between nuclear and nanotech weaponry is that “nuclear weapons cannot easily be delivered in advance of being used; the opposite is true of nanotech. **Greater uncertainty of the capabilities of the adversary, less response time to an attack, and better targeted destruction of an enemy's visible resources during an attack all make nanotech arms races less stable”** (Nanotechnology: Dangers of Molecular Manufacturing, 2010). **Due to nanotechnologies vast applicability, a high level and volume nano-arms race makes stability very difficult.** An example of a future war scenario may see two opposing coalitions warring against one other with nanotechnology. There would inevitably be a learning curve pursuing a continual development and ‘one-upsmanship’ of even more devastating nanoweapons, each aiming to end the conflict and attain lasting victory. This may lead to greater instability in the area of nanotechnology weaponry. The CRN proclaims that “unless nanotech is tightly controlled, **the number of nanotech nations in the world could be much higher than the number of nuclear nations, increasing the chance of a regional conflict blowing up”** (Nanotechnology: Dangers of Molecular Manufacturing, 2010). Almost any form of weapon may conceivably be enhanced by applying nanotechnology. As an example, nanoprojectiles would be more powerful and accurate and perhaps self guided with inbuilt AI technology. Materials such as aerospace hardware, metal 31 vehicles and objects on many scales may be significantly enhanced resulting in lighter, stronger, cheaper end products with far greater capacity and performance. In order to detect nanomaterials, technologies such as radar and remote sensing must continue to develop while keeping these new advances in mind. “Embedded computers would allow **remote activation of any weapon**, and more compact power handling would allow greatly improved robotics. These ideas barely scratch the surface of what's possible” (Nanotechnology: Dangers of Molecular Manufacturing, 2010). Choices are generally construed as good. Choice in the macro world is an everyday reality, whereas, in the world of nanotechnology, there may be an over abundance of choices and this reality is dawning exponentially fast. **Attempts to control these and other risks** may lead to abusive restrictions, or **create demand for a black market that would be very risky and almost impossible to stop**; **small nanofactories will be very easy to smuggle, and [be] fully dangerous**. There are numerous severe risks—including several different kinds of risk—that cannot all be prevented with the same approach. Simple, **one-track solutions cannot work.** The right answer is unlikely to evolve without careful planning (Nanotechnology: Dangers of Molecular Manufacturing, 2010). In the coming decades, the technology to generate and store most of our energy on the nanoscale may become a reality. Intel has announced that it is working on storage technology that will be on the nanoscale (EETimes.com - Intel lab explores nanoscale power storage, 2010). They envision being able to provide nanoscale power storage for electronic devices and the coming SmartGrid, which is akin to the Internet of electricity. In the future, this power storage capability may likely replace our outdated electric infrastructure. “The research targets[that Intel is working towards] are to exceed energy storage of battery technology in terms of energy 32 density and figure out how to assemble these nano-capacitors into ultracapacitors that have useful voltage ranges” (EETimes.com - Intel lab explores nanoscale power storage, 2010). In the future, our current ways of generating, storing and using power are highly likely to change. When applied to war, a clearer understanding may be obtained regarding possible ways future tanks, planes and nanocraft may be powered. Currently, the U.S. is in a heated exchange with Iran over nuclear technology. Former Vice President Dick Cheney openly supports attacking Iran’s nuclear technology facilities using nuclear weapons to prevent Iran’s acquisition and utilization of them. In considering the field of Social Computing, Cheney’s strategy may be illustrated as an equation which espouses hypocrisy. As this crisis continues it may have the potential of employing uncharted avenues of war. Iran is a significant player in nanotechnology and may become stronger in this field as the rest of the world may in the coming decades. Iran already has the Iran Nanotechnology Initiative Council and is researching heavily in the fields of nanotech (INIC Top News, 2010). They are advancing nanotechnology in solar energy and biomedical applications among other developments (Nanotechnology Now - Nanotechnology Columns, 2010). If the U.S. attacks Iran, there may be more repercussions than just battlefield scars. This may lead to cyber and micro wars waged with results that could be disastrous. This leads to yet another grave technological threat humanity may face in the future. Cyber War The lights go off and don’t come back on. In a staged exercise, a group of high-ranking former federal officials scramble to react to mobile phone malware and the failure of the electric grid. "You can't visualize this kind of attack until it happens. The panel agreed we were not sufficiently prepared for an attack of this magnitude. We don't have the systems to deal with [it]." (Montalbano, 2010). Employing cyber war tactics could result in deadly consequences. Currently a state could detonate nuclear ammunition in the atmosphere over an intended target thus crippling its digital and electronic infrastructure. Another non-nuclear way would be in exploding EMP (electromagnetic pulse) ammunitions at high altitudes over a target and devastating the digital and electronic non-shielded infrastructure rendering it useless by this ‘digital age bomb**’** (Wilson, 2002). Whole regions could be thrown back to the pre-electricity era, but this would likely be coupled with horrifying consequences due to loss of all of the services that are provided by electricity and power. The way an EMP detonation works is that “it will just catastrophically fry all electronics and modern electrical systems by inducing staggeringly large and rapid current or voltage surges” (Raloff, 2009). This is a weapon that any nation or network of people could use to inflict major damage on a target. Former engineer and research scientist Representative Roscoe Bartlett has stated that all a person or group would need to wreak massive and highly consequential EMP damage “is a sea-worthy steamer, $100,000 to buy a scud-missile launcher, and a crude nuclear weapon. Then fling the device high into the air and detonate its warhead (Raloff, 2009). Another grave scenario involves the idea of hacking a State’s nuclear weapons networks and launching the weapons. It might appear to one State that it is being attacked by another Nuclear State thus, possibly escalating and initiating a nuclear exchange between these States. Infamous hacker Kevin Mitnick knows that the weakest link in any security system is the person holding the information. Dubbed the ‘most dangerous hacker in the world,’ Mitnick was put in solitary confinement and prevented from using a phone after law enforcement officials convinced a judge that he had the ability to start a nuclear war by whistling into a pay phone (Mills, 2008). Cyber terrorists hacking into and launching nuclear weapons have many security agencies such as the Central Intelligence Agency (CIA) and Federal Bureau of Investigation (FBI) highly concerned. The International Commission on Nuclear Non-proliferation and Disarmament (ICNND) in a recent unclassified report has been exploring the possibility of cyber terrorists hacking into nuclear weapons systems and launching nuclear weapons (Hacking Nuclear Command and Control, 2009). They describe how A traditional large-scale terrorist attack, such as the 2008 Mumbai attacks, could be combined with computer network operations in an attempt to start a nuclear war. Amidst the confusion of the traditional attack, communications could be disrupted, false declarations of war could be issued on both sides, and early warning sensors could be spoofed (Hacking Nuclear Command and Control, 2009). They continue to describe how all of this would be happening in a brief time frame; in some cases as little as 15 minutes, whereby retaliatory nuclear responses must be responded to (Hacking Nuclear Command and Control, 2009). “The amount of firepower that could be unleashed in these 15 minutes would be equivalent to approximately 100,000 Hiroshima bombs” (Hacking Nuclear Command and Control, 2009). The United States is taking cyber warfare very seriously and recently promoted a fourstar general to lead “of the Pentagon's ambitious and controversial new Cyber Command, designed to conduct virtual combat across the world's computer networks” (Beaumont, 2010) “The creation of Cyber Command is in response to increasing anxiety over the vulnerability of the US's military and other networks to a cyber attack” (Beaumont, 2010). 35 This is being done despite fears that it brings about the militarization of cyberspace. Over 30,000 U.S. Air Force troops have also been reassigned from their technical support positions to positions in the frontlines of cyber warfare (Beaumont, 2010). Although to this point the cyber boundaries and regulations are still not fully drawn out, addressed and known, the Pentagon has stated that it could and would use a military response to cyber attacks and hostilities (Pentagon says military response to cyber attack possible, 2010). Still the question remains of what regulations and policy are the U.S. and the world going to implement in the near future to avert and be prepared for cyber attack and war? “War in cyberspace would be like nothing that has come before it, and it would raise difficult legal issues. What does "territory" mean, for example? What is ethical?” (Gjelten, 2010). There is a great need to establish clear rules of engagement that address what we (US) can stop and what we will just monitor (Gjelten, 2010). There are laws of land warfare that the world somewhat follows now but in the light of cyberspace, very few regulations exist and even fewer possibilities have been exercised (Gjelten, 2010). “The design of cyberwar-fighting rules is complicated by the extent to which computer networks are globally interconnected” (Gjelten, 2010). If someone believes that they are under attack from a source in a particular foreign country, can they counteract that source and attack them? And if so how will one know if they only responded and neutralized the attacking source and did not create collateral damage to other innocent or neutral parties? (Gjelten, 2010). One controversial issue is over authorization to identify users who may have malicious intent (Gjelten, 2010). Privacy advocates are already fully objecting to this invasion of liberty and privacy. According to Army General Keith Alexander the key issue is conducting this delicate balance of cyber defense in a manner that holds the public’s confidence (Gjelten, 2010). This is certainly a challenging process and will be continuing to be discussed and enacted in the near future. In many ways this debate 36 and the future of cyber security is looking like the crime fighters (National Security) versus the freedom fighters (Constitutional/Human Liberty Rights Protectors) and there is definitely a conflict of interest between both parties (Gjelten, 2010). The policies are in the process of being formulated at the present time. Aspects of cyber warfare are currently in effect. Millions of computers are infected and attacked annually (Markoff, 2010). Computer infections and malware are self evident acts of future cyber warfare. The current infection is modest compared to some of the largest known botnets, which are automated programs that continuously attack and/or gather information from computers online. For example, a system known as Conficker, created in late 2008, infected as many as 15 million computers at its peak and continues to contaminate more than seven million systems globally through calendar year 2010 (Markoff, 2010). There are endless examples of corporate and government systems being targeted and compromised where login, account, finance and personal information has been willfully stolen. “These large-scale compromises of enterprise networks have reached epidemic levels, said Amit Yoran, chief executive of NetWitness and former director of the National Cyber Security Division of the Department of Homeland Security” (Markoff, 2010). This too is just the beginning of the coming potential cyber wars. Authorities are developing online ‘cyber telescopes’ which aid in tracking malicious cyber sources (Marks, 2010). Again we see how potent the concoction of warfare can be with the combination of these technologies which lay most certainly in the hands of organized States but also with non-state organizations. Is it possible that a bad organization could be formed and if well funded and organized, could potentially wreak havoc on civilization? We see a large amount of material in various forms portraying future war in our daily media, particularly in 37 films, television, and electronic games. The question is, can we learn from what our artists are portraying in the media? In 2009 “the FBI announced it considers cyber attacks to be the third greatest threat to the security of the United States. The only two preceding it are nuclear war and weapons of mass destruction” (Hodgin, 2009). Presently, the goal is often overloading systems and stealing information, however, in the future we face complex and challenging scenarios. Shawn Henry, assistant director of FBI's cyber division, speaks of people potentially creating ‘virtual 9/11s’ or inflicting damage the equivalent through cyber warfare. The term ‘Cybergeddon’ has been coined to categorize large scale cyber crimes (Hodgin, 2009). Future effects of cyber war are not equivalent to its present effects. There is a considerable difference between stolen information and servers going down compared to permanent circuitry damage and lasting outages. One prominent example of a cyber war having been initiated is Russia’s innovative Cyber-War on Estonia in 2007. The head of information technology (IT) security at Estonia's defense ministry, Mikhail Tammet, told BBC News that the attacks had affected a range of government websites, including those of the parliament and governmental institutions. He said the country was particularly vulnerable as much of its government was run online. "Estonia depends largely on the internet. We have e-government, government is so-called paperless... all the bank services are on the internet. We even elect our parliament via the internet," (BBC NEWS | Europe | Estonia hit by 'Moscow cyber war', 2007). Russia has also been accused of attacking Georgian government websites in a cyber war to accompany their military bombardment of 2008. The Georgian Ministry of Foreign Affairs said, "A cyber warfare campaign by Russia is seriously disrupting many Georgian websites, including that of the Ministry of Foreign Affairs" (Swaine, 2008). 38 In addition, in order to gain advantage, the U.S. has employed cyber war practices as well. “In May 2007, President Bush authorized the National Security Agency, based at Fort Meade, Md., to launch a sophisticated attack on an enemy thousands of miles away without firing a bullet or dropping a bomb” (Harris, 2009). The cellular phones and computers that insurgents were using in Iraq to plan attacks such as roadside bombings were targeted with false information, systems overload, and deceiving information to lure insurgents into the live fire of waiting U.S. forces. According to one senior administration official, this cyber operation helped the U.S. take over the Iraqi communications system. (Harris, 2009). There has been international condemnation on many cyber attacks from Russia’s cyber war tactics to the Google attacks in China where Google accused Chinese forces, whether civilian or military, of attacking and compromising its services. As of the time of this research there are no international policies or sanctions in regards to cyber attacks and war other than opting out of doing business with a party which Google has chosen by pulling its search engine out of the Chinese market and country (McConnell, 2010). One retired Navy vice admiral believes he and history hold the answer to winning the cyber war dilemma. Mike McConnell, former National Security Agency Director in the Clinton administration and former director of national intelligence during George W. Bush’s second term in office elaborates that: Ultimately, to build the right strategy to defend cyberspace, we need the equivalent of President Dwight D. Eisenhower’s Project Solarium. That 1953 initiative brought together teams of experts with opposing views to develop alternative strategies on how to wage the Cold War. The teams presented their views to the president, and Eisenhower chose his preferred approach — deterrence. We now need a dialogue among business, civil society and government on the challenges we face in cyberspace — spanning 39 international law, privacy and civil liberties, security, and the architecture of the Internet. The results should shape our cybersecurity strategy (McConnell, 2010). The development and maturity of merely one aspect of warfare could be potentially deadly to humanity and/or the biosphere of the planet. A large thermal nuclear war could be biospherically altering in ways people are now able to comprehend. It is in the days of tomorrow when nanotechnology and cyber knowledge are at new heights, humanity ought to be thinking about abolishing war for the very purpose of survival. Considering the current technological advances, it is likely that humanity, as we know it, may evolve into Cyber sapiens in the 21st century and beyond. Our computers are in our pockets at present. They will be in our bloodstream en mass in the coming decade or two and will be beyond comprehension in some fundamental ways in and around the year 2050 (Kurzweil, 2005). **The amount of ways to disrupt and harm life** **will certainly grow** with our advancing technological tool kit. We are developing tools that can both alleviate most of our pains and hardships while simultaneously **containing the capacity to destroy our world**. War Threatening Ecological Systems **Future war technology may have the potential to hasten the breach of ecological thresholds** and create **dangerous positive feedback loops**. With the birth of various forms of nanotechnology, there may be serious consequences for those used as weapons. Nanotech that targets individuals may have little to no environmental consequences. However, other forms of nanotech such as **‘grey goo’ or little eating machines** could pose an **existential risk to the planet itself as well as the human species and the biosphere.** Grey goo involves molecular nanotechnology in the form of **self-replicating nanorobots** or universal assemblers that could 40 assemble objects of any scale atom by atom. They could **fuel themselves by consuming the base elements of the Earth’s biosphere** just as life has done for billions of years except in this case, this one pathological species of nanobots could **consume all matter on Earth while building more of themselves**, a scenario known as ecophagy (eating the environment). Depending from where the Grey goo tragedy starts, this technological nightmare could **wipe out all life on Earth in a matter of hours** to a matter of days (Kurzweil, 2005). Whether or not they could continue to fuel themselves on the remaining geosphere and consume the entirety of the planet remains unknown. More research is needed in this area. There are other scenarios such as ‘Grey dust’ where these same self-replicating nanobots consume elements available in airborne dust and sunlight for energy and ‘Grey lichens’ where they use carbon and other elements on rocks for power (Kurzweil, 2005). Grey goo must contain five essential characteristics in order to truly be an existential threat. It would require 1) mobility whereby it could travel through the environment; 2) some sort of a shell or defense against chemicals or matter that is not supportive of its existence; 3) control or direction via some type of blueprint and a computer brain for means of interpretation; 4) a metabolism to process and break down chemicals for its feedstock; 5) fabrication or the ability to turn feedstock into new nanosystems (Nanotechnology: Dangers of Molecular Manufacturing, 2010). The continual evolution of technology may aid various fields involved in creating sustainable and ecologically friendly societies. Every day, new techniques and ideas are created and examined by institutions such as Rocky Mountain Institute, Natural Capitalism, The Sustainability Institute, Intergovernmental Panel on Climate Change, and National Renewable Laboratory among others. But beneficial progress towards a sustainable society or community might be destroyed if a technological Armageddon were to occur. Sustainable development and energies appear to have the potential to revolutionize and improve our future. If applied, **sustainability** may bring our ecology into balance with technology in such a way as never before seen or experienced by humanity. Yet these **advances could disappear as a result of future war.** The consequences might not only be deadly but possibly cause extinction such as runaway grey goo technology or other nanotech weapons having similar capabilities. It is highly possible that people all over the world will participate in developing and maintaining sustainable civilization. How tragic if having transformed human civilization into a more fully sustainable one, we were to witness significant setbacks and potential devastation due to war. The media, such as science fiction films and television, often pave the way for the development of various technologies to the general public. A good example is Star Trek which introduced cell phone technology in its 1966 debut television series. This series also introduced the concept of teleportation which is based upon the science of transferring matter from one point to another, more or less instantaneously. Science fiction films often illustrate future weapons that are utterly disastrous. For example, in Star Trek’s latest film the main villain uses a weapon called ‘Red Matter’ in which to kill entire planets. **A frightening aspect of Red Matter is its realistic potential to severely damage or annihilate a planet. The science of Red Matter involves creating a black hole near the center of a planet and thus the planet is consequently consumed in its entirety from within its core.** In actuality there would be no need to drill into a planets core, since with this type of technology it would devour a planet from any angle providing the black hole was significant enough in size and power. In the laboratory, modern day scientists have created extremely small black holes that burn out thus ceasing to exist. Our scientific progress involving black holes will advance along with our scientific knowledge. This is a science that **we do not ever want to go awry or used as warfare in any capacity**. An additional example that illustrates a number of technologies being prototyped, tested and developed by scientists may be seen in the film ‘GI Joe: The Rise of Cobra’(Paramount Pictures, 2009). An ‘exo-suit’, or external computerized armored suit, was used to increase the users speed, strength, defense and leaping ability. It is anticipated that the exo-suit may become the armor of the future. The super soldiers employed by Cobra in this film, and who are mind controlled, are a possible reality for the future as well. This may lead to robotic armies warring against one another in the coming years with potentially horrendous ecological consequences. Another technology that many people are unaware of is also being rapidly developed. This was illustrated by a weapon used by Cobra, which, was shot at a particular object and consequently molecularly devoured, resulting in complete annihilation. This weapon had to be neutralized by a master control switch, otherwise it would continue indefinitely devouring absolutely everything except itself. This technology can be likened to **Grey Goo**, only under a different name as the filmmakers characterized it as being able to metabolize anything. Hypothetically, **if a particular government in a time of war were to utilize a weapon of this sort**, what might be the ramifications? One possibility is that the control switch may become defunct or the weapon could not be neutralized. If this occurred, **it seems likely the weapon would spin out of control potentially devastating the biosphere, geosphere and planet Earth itself**. This technology appears so detrimental to life on Earth, a mere threat to employ it would be a weapon in itself. Consequently, since future nanotech weapons could possibly dissolve or consume things on a molecular level, this could potentially spin out of control. The controller of the technology could lose oversight and/or regulation of an advanced technology which could potentially 43 become unmanageable and destroy the Earth’s ecosystems and Homo sapien civilizations on unprecedented scales (Nanotechnology: Dangers of Molecular Manufacturing, 2010). Theoretically, Homo sapiens and advanced artificial intelligence (AI) sentient intelligence could also cause disasters on extremely microscopic levels of existence that more than rival atomic weapons. According to how Homo sapiens are developing and exponentially advancing our science, information and technology, this is the future reality we are most likely facing in regards to probability. We will be working on the molecular level in ways far beyond the 20th century comprehension of an average person and thus the future promises to look very different from the past. Through the present day we have seen our civilization change rather slowly compared to what the future offers. The future holds the possibility of accessing multiple bodies, morphing our bodies and being constantly connected on a biologically wireless internet (Kurzweil, 2006). The future will involve connecting everyone, everywhere, all the time. Through the fields involving nanotechnology we will be building and traversing new nanoroads. It is on these roads that military might of the future will likely be exercised. These roads are currently being constructed and paved with a variety of nanomaterial technologies and substances such as nanocomposites, nanocrystals, nanoparticles, nanostructured materials, nanoclays, nanotubes, nanocoatings, nanocatalysts, nanofilters and more (Nanotechnology Now - Current Uses, 2009). “Experts now estimate that nano-engineered materials have found their way into as many as 700 plus products” (Bullis, 2005). Nanomaterials are being used by companies such as General Motors and Toyota in the automotive industry to create stronger, scratch-resistant, lightweight, rustproof bumpers and step assists (to get into a truck or sports utility vehicle). “Back in 2001, Toyota started using nanocomposites in a bumper that makes it 60% lighter and twice as resistant to denting and 44 scratching (Nanotechnology Now - Current Uses, 2009). These are truly wonderful advances but there is no stopping their advance and people have already begun to prepare for the downside of nanotechnologies. We as a species and global civilization have a duty to not only explore and develop technology for its advantages but also to consider and prepare for its not-so-desirable aspects. “Omowunmi Sadik, director of Binghamton University's Center for Advanced Sensors and Environmental Systems, is developing sensors that would detect and identify engineered nanoparticles” (Chemist monitors nanotechnology's environmental impact, 2010). If some out of control nanotechnology or nanobiotechnology becomes unstable and spreads quickly throughout the biosphere, the effects could be anywhere from benign to catastrophic. **The future can bring nanotechnology scenarios never before imagined until they are invented and implemented and it is quite possibly too late to stop the damage.** **Examples such as Plants with [engineered] leaves no more efficient than today's solar cells could outcompete real plants, crowding the biosphere with an inedible foliage. Tough omnivorous [engineered] bacteria could out-compete real bacteria: They could spread like blowing pollen, replicate swiftly, and reduce the biosphere to dust [potentially] in a matter of days. Dangerous replicators could easily be too tough, small, and rapidly spreading to stop--at least if we make no preparation.** We have trouble enough controlling viruses, [mosquitoes] and fruit flies (Freitas Jr., 2001). Senior science advisor at the nonpartisan Woodrow Wilson Institute in Washington, DC, Andrew Maynard, sheds some insight on the safety and dangers of nanotechnology. “Individual experiments have indicated that if you develop materials with a nanostructure, they do behave differently in the body and in the environment” (Bullis, 2006). From animal studies it has been shown that very fine particles with high surface area can and do lead to more intense 45 inflammatory response than the very same amount of particles that are simply larger (Bullis, 2006). “We also know that they can enter the lining of the lungs and get through to the blood and enter other organs. There is some evidence that **nanoparticles can move into the brain along the olfactory nerve, so this is completely circumventing the blood-brain barrier”** (Bullis, 2006). One question that is raised is who will regulate the new nanotechnologies that will be life changing? Will the Environmental Protection Agency (EPA) be up to the job? It is highly likely that many of these new nanosubstances will probably fall under existing environmental laws and tap some of the EPA’s funding, however, critics argue that this is far from adequate (Bullis, 2005). According to former senior EPA toxicology official Mark Greenwood, “The EPA program will likely take primarily responsibility for regulating nanotechnology, since the Office of Pollution Prevention and Toxics lacks the funding and personnel for the field offices necessary to monitor manufacturing” (Bullis, 2005). **There is great risk here because if the EPA is not up to par with constant incoming nanotechnologies, some of these emerging nanoproducts that may turn out to be unsafe could still find their way into the mainstream marketplace** (Bullis, 2005). Consumer backlash is also a possibility if even one nanoproduct leads to ill health effects particularly because these are generally new, strange, and many times ill perceived technologies (Bullis, 2005. This could get very challenging with regulations for nanotechnologies including the diverse benefits of helping to aid or cure cancer and cleaning up toxic waste sites (Bullis, 2005). “To be sure, nanotechnology poses a regulatory challenge. Many nanoparticles are made of the same basic chemicals as current products that have already been regulated. But their new physical structures -- which make them so appealing for new applications -- also give them highly different properties” (Bullis, 2005). 46 An additional example of the devastating effects of future war may be illustrated in the following question. What if a State or organization detonated devices over one or both of the poles, negatively contributing to the existing melt? **There are many scenarios ranging from forest fires to poisoning large areas of agriculture that could cripple regions and natural ecosystems. What makes these scenarios so serious is that they can potentially occur without leaving a trace.** Nanotechnology is promising new scientific bridges in many directions and connecting the scientific dots or areas under current study. **Nanotechnology can** also function in a manner so as to **lie dormant for an indefinite period of time. Blackmailing and threatening the ecosystems of States**, regions and communities could be a reality in the future. The tool of blackmail could exert serious consequences such as ‘the fate of the world’ on the line. This can be seen with commodities such as oil, grain, rubber among others used to weaken a State or region. One example is the U.S. denying Japan resources in the years preceding World War II. This caused the Japanese to experience a greater demand for resources critical to its strength, growth and status. In addition this economic stranglehold provoked Japan into attacking other nations in hopes of acquiring more resources and greater power. In the near future, we must prepare for the possibility of nanotech blackmail. If any group or nation obtains nanotech weaponry, it could become a bargaining tool that carries potentially serious threats. Single incidences might become a major ordeal and if multiple incidences were to occur simultaneously, a catastrophic tipping point could be highly likely. Hypothetically, if several different groups acquired the ability to use nanotech blackmail as a bargaining tool and an uncompromising overlap of interests were present, it seems likely that **a dire ‘lose-lose’ scenario might occur.** That is, many future forms of this type of technology appear to have the potential of cataclysmic consequences if applied in a negative manner. I**t’s not only environment consuming self replicating nanomites or Grey Goo that are immediate threats.** “So-called Grey Goo could only be the product of a deliberate and difficult engineering process, not an accident. **Far more [threatening] is the possibility that a large-scale and convenient manufacturing capacity could be used to make incredibly powerful non-replicating weapons in unprecedented quantity**” (Nanotechnology: Experts put 'grey goo' in perspective, 2004). Accordingly, the construction of anything resembling a dangerous self-replicating nanomachine can and should be prohibited. Although advanced nanotechnologies could (with great difficulty and little incentive) be used to build such devices, other concerns present greater problems. Since **weapon systems will be both easier to build and more likely to draw investment because of their large payback**, the potential for dangerous systems is best considered in the context of military competition and arms control (Phoenix & Drexler, 2004). Consequently, there are many unknown aspects to explore and resolve before these technologies can be safe and secure. How to control, share and monitor them has not yet been fully addressed or even understood well by the public. This is an area that requires public discussion and participation. The future of technology may have profoundly disruptive and extinctive impacts on our planet’s ecology. We can only fathom at this point how potentially dangerous future technology can be, but either way, we must begin preparing for it now. This is precisely where the horrific aspect of warfare comes into the equation and has the potential to decimate civilizations worldwide. Consequences of war in the future can potentially threaten and stress ecological thresholds and systems. Therefore, a major question that remains unanswered is ‘are we capable of turning these future technologies into results that are beneficial rather than harmful to our planet?’

### 1AC – Extra

Similarly, refuse their appeal to space colonization: It fails to support the human race – too many people and it’ll be gatekept by elites (not in the girlboss way but in the musty musk way).

– Corporate space colonization efforts are only for the rich 🡪 reproduces the problems of cap in space

– Scope – a staff of thousands of people are necessary to move tens of people to Mars – there’s so much that needs to be done because it’s new technology that it’s infeasible to move sm people there, and unethical to leave the working class to dust

– Elitism – empirics prove that only the rich can access the good things such as private transport, cool cars, etc. – it’ll be the same way for space col

Paris Marx, ‘20, Paris Marx has previously written for NBC news and CBC news; they are well read and have experience writing and discussing tech and capitalism, Leave the Billionaires in Space, Jacobin Magazine, 7-13-2021, https://www.jacobinmag.com/2021/07/billionaires-space-richard-branson-jeff-bezos-elon-musk, Accessed: 12-13-2021, Hari \*edited for ableist language, struck through & modified in brackets

Billionaires Aren’t Going Anywhere

For years, there have been concerns that billionaires’ space investments are about escaping the climate chaos their class continues to fuel here on Earth. It’s the story of Neill Blomkamp’s Elysium: the rich live on a space colony, and the rest of us suffer on a climate-ravaged Earth while being pushed around by robot police as we perform the labor that makes the abundance of the colony possible. But that’s not actually the future we’re headed toward.

As Sim Kern explains, keeping just a few people alive on the International Space Station takes a staff of thousands — and it gets harder the farther away people are from the one world we can truly call home. Mars colonies or massive space stations are not happening anytime soon; they won’t be a backup plan, nor an escape hatch. As billionaires chase profit in space and boost their egos in the process, they’re also planning for climate apocalypse down here on Earth — but they’re only planning for themselves.

Just as Musk uses misleading narratives about space to fuel public excitement, he does the same with climate solutions. His portfolio of electric cars, suburban solar installations, and other transport projects are promoted to the public, but they are designed to work best — if not exclusively — for the elite. Billionaires are not leaving the planet, they’re insulating themselves from the general public with bulletproof vehicles, battery-powered gated communities, and possibly even exclusive transport tunnels. They have the resources to maintain multiple homes and to have private jets on standby if they need to flee a natural disaster or public outrage.

We desperately need the public to ~~see through~~ [not be deceived by] the spectacle of the billionaire space race and recognize that they’re not laying the groundwork for a fantastic future, or even advancing scientific knowledge about the universe. They’re trying to extend our ailing capitalist system, while diverting resources and attention from the most pressing challenge the overwhelming majority of the planet faces. Instead of letting the billionaires keep playing in space, we need to seize the wealth they’ve extracted from us and redeploy it to address the climate crisis — before it’s too late.

#### Recurring capitalist crises are inevitable, shifting away now causes escalating existential crises in the short and long run.

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If there’s one thing the coronavirus has made clear it is that, if we are to have any hope of resolving the dire problems that plague humanity, from ecological collapse, to war, poverty, inequality and disease, we have to collectively confront across borders the powers that be in the world capitalist system and their control over the means of our existence. From U.S. President Donald Trump’s criminal ineptitude in addressing the pandemic, to the multi-trillion-dollar bailouts for capital, the threat to survival that billions of precarious workers face as the global economy has plunged, and the overwhelming of woefully underfunded and collapsing public health systems, the pandemic has laid bare how it cannot be left to our rulers to resolve the crisis of humanity.

The pandemic has brought home the extent to which the fate of any one community on the planet is now bound up inextricably with that of humanity as a whole. What appeared as a localised virus in Wuhan has quickly spread to just about every country and community in the world, leading to the lockdown of several billion people and prompting what some have called the greatest crisis since World War II. The economic meltdown triggered by the virus has underscored how dependent we all are now on the globally integrated production, financial, and service system, controlled as it is by the transnational capitalist class (TCC) and its political agents in capitalist states around the world.

These agents were quick to blame the meltdown on the virus as stock markets and global commerce have gone into free fall starting in March 2020. But the economic calamity the pandemic has unleashed is a chronicle foretold. The underlying structural causes of the 2008 Global Financial Crisis (GFC), far from being resolved, have become steadily aggravated. Frenzied financial speculation, unsustainable debt, the plunder of public finance, an overinflated tech sector, and state-organised militarised accumulation have kept the global economy sputtering along in recent years in the face of chronic stagnation and concealed its underlying instability. The pandemic will pass but the crisis of global capitalism is here to stay and will become more acute in the wake of COVID-19.

The TCC has wasted no time in endeavouring to shift the burden of the crisis and the sacrifice that the pandemic imposes onto the working and popular classes. For this purpose, it has relied on the backing of capitalist state power. Many governments have turned to massive new bailouts of capital with only very modest relief, if any at all, for the working classes. The United States government have injected an initial $1.5 trillion into Wall Street banks, with the White House promising that its response to the pandemic is ‘centered fully on unleashing the power of the private sector’, meaning that capitalist profit comes first, shaping the response to the emergency. The US have since passed a $2 trillion stimulus package, the single biggest component of which was a giveaway to corporations, along with smaller amounts for relief to the unemployed and poor families. In Europe, the EU and member governments have approved similar stimulus packages, as did the Chinese government. Most governments around the world have approved packages that involved the same combination of fiscal stimulus, corporate bailout, and modest public relief, if it was provided at all.

The International Labor Organization has predicted, in early April, that some 200 million people worldwide would lose their jobs as a result of the virus. Some one billion children worldwide have been affected by school closures. Hundreds of millions of transnational migrants and refugees face the virus with no access to health infrastructure. Prisoners in overcrowded jails the world over, the homeless, and those in war zones are sitting ducks for the virus. The capitalist crisis unleashed by the coronavirus, it would seem, may be even more deadly for impoverished workers than the virus itself.

Global Capitalism’s Structural Crisis

All the tell-tale signs of what political economists refer to as an overaccumulation crisis have been present for some time. Capitalist globalisation and neoliberal austerity since the late 1970s has pushed the global working and popular classes onto the defensive and shifted the global balance of class forces in favour of transnational capital, following the period of mass struggles in the 1960s and 1970s. But globalisation also aggravated capitalism’s most fundamental contradiction, overaccumulation. This refers to a situation in which enormous amounts of capital are built up but without productive outlets for reinvestment. This capital then becomes stagnant. By liberating emergent transnational capital from national constraints, globalisation has undermined redistributive programs that once attenuated capitalism’s inherent tendency towards social polarisation. The result has been an unprecedented sharpening of inequality that has fuelled overaccumulation.

The level of global social polarisation and inequality now experienced is unprecedented. In 2018, the richest one per cent of humanity controlled more than half of the world’s wealth while the bottom 80 per cent had to make do with just 4.5 per cent. Such inequalities end up undermining the stability of the system as the gap grows between what is (or could be) produced and what the market can absorb. The extreme concentration of the planet’s wealth in the hands of the few and the accelerated impoverishment and dispossession of the majority means that transnational capital has increasing difficulty in finding productive outlets to unload enormous amounts of surplus capital. If left unchecked, the expanding social polarisation results in crisis—in stagnation, recessions, depressions, social upheavals and war.

Overaccumulation originates in the circuit of capitalist production, yet it becomes manifest in the sphere of circulation, that is, in the market, as a crisis of overproduction or underconsumption. Over the past few years there has been a rise in underutilised capacity and a slowdown in industrial production around the world. As the productive economy stagnates, capitalists have turned to financial speculation. This surplus of accumulated capital with nowhere to go is without precedent. Transnational corporations recorded record profits during the 2010s; in the same period corporate investment declined. Worldwide corporate cash reserves topped $12 trillion in 2017, more than the foreign exchange reserves of the world’s central governments.

In the wake of the Great Recession of 2008, the US Federal Reserve injected a whopping $16 trillion in secret bailouts to banks and corporations from around the world. But then the banks and institutional investors simply recycled the trillions of dollars it received into new speculative activities in various derivatives and global commodities markets, in cryptocurrencies, and in land around the world, fuelling a new global land grab. As opportunities have dried up for speculative investment in one sector the TCC simply turns to another sector to unload its surplus. As a result, the gap between the productive economy and fictitious capital grew into an enormous chasm. In 2018, for example, the gross world product (or the total value of goods and services) stood at some $75 trillion, whereas the global derivatives market was estimated at a mind-boggling $1.2 quadrillion. This accumulation of fictitious capital gave the appearance of recovery. But it only offset the crisis temporally, while in the long run exacerbating the underlying problem.

In addition to speculation, growth has been driven by mounting government, corporate, and consumer debt. Consumer credit has served the dual purpose of class pacification and of generating demand even as real incomes have dropped for the immiserated majority, who have been subjected to austerity and ever more precarious forms of employment. In countries around the world, consumer debt was higher on the eve of the pandemic that it has been for all of post-war history. State and corporate debt is also at a breaking point. The global bond market—an indicator of total government debt worldwide—surpassed $100 trillion in 2017, while total global debt reached a staggering $215 trillion in 2016. Worldwide corporate debt has soared to $75 trillion, up from $32 trillion in 2005, while corporations have issued $13 trillion in bonds, more than twice the bond debt on the eve of the 2008 collapse. As depression sets in, a default on consumer, state, or corporate debt will set off a further chain reaction in the downward plunge of the global economy. In sum, financial speculation, pillaging the state, and debt-driven growth were ‘fixes’ that could not address the underlying structural conditions that triggered the 2008 financial collapse. The global economy was a ticking time bomb. All that was needed was something to light the fuse. That has arrived in the form of the coronavirus.

#### Specifically, global capitalism’s next stage is the fourth industrial revolution which democratizes violence as a means of efficiency – extintion!

Michael J. Albert 20, doctoral candidate in Political Science at Johns Hopkins University, “The Dangers of Decoupling: Earth System Crisis and the ‘Fourth Industrial Revolution,’” Global Policy, vol. 11, no. 2, 2020, pp. 245–254

Infinite growth on a finite planet: the decoupling challenge

As both its critics and defenders agree, global capitalism as a system relies on continuous compound growth (about 3 per cent per year) for its stability and survival (Lynas, 2011; Smith, 2016). Without growth (and by extension the expectation of future profit), investment dwindles, interest on debt cannot be repaid, unemployment rises, and consumer spending falls, thereby catalyzing a reinforcing spiral of economic contraction. The problem for global capitalism in a context of earth system crisis, then, is how to make this compound growth compatible with climate stabilization and ecological regeneration. This has clearly been a challenge thus far. As Roger Pielke explains: ‘If there is an iron law of climate policy, it is that when policies focused on economic growth confront policies focused on emission reductions, it is economic growth that will win out every time’; therefore, any successful policy ‘must be designed so that economic growth and environmental progress go hand in hand’ (quoted in Lynas, 2011, p. 68). The philosophy known as ‘ecomodernism’, which can be considered the dominant approach to climate policy in the World Bank, OECD, and UNEP, believes these goals can be simultaneously attained by ‘decoupling’ economic growth from resource use and environmental impact. In the words of the Ecomodernist Manifesto:

Intensifying many human activities – particularly farming, energy extraction, forestry, and settlement – so that they use less land and interfere less with the natural world is the key to decoupling human development from environmental impacts … Together they allow people to mitigate climate change, to spare nature, and to alleviate global poverty (Asafu-Adjaye et al., 2015, p. 7).

The ecomodernists distinguish between relative and absolute decoupling: relative decoupling means that ‘human environmental impacts rise at a slower rate than overall economic growth’, whereas absolute decoupling would occur when ‘total environmental impacts … peak and begin to decline, even as the economy continues to grow’ (Asafu-Adjaye et al., 2015, p. 11). Modern technology and urbanization are considered the keys to achieving decoupling, which they claim enable humanity to ‘[use] natural ecosystem flows and services more efficiently’ (Asafu-Adjaye et al., 2015, p. 17). In this way, the ecomodernists not only believe that it is possible to decouple economic growth from CO2 emissions, but that all environmental impacts – including deforestation, biodiversity, soil depletion, air and water pollution, etc. – can decline even as the global economy continues to grow.

There are a number of indicators that ecomodernists and other proponents of decoupling draw upon as evidence for their theoretical claims. First, the ‘domestic material consumption’ indicator, which measures the total material and energy consumption in a given nation-state, shows that GDP has grown faster than total material consumption in rich countries like the United States, with some European countries going further towards absolute decoupling (Pearce, 2012). In particular, ecomodernists highlight trends in wealthier countries toward reforestation, reduced air pollution, plateauing meat consumption, and saturating demand for material-energy intensive goods (e.g. cars) (Asafu-Adjaye et al., 2015). This shift is often attributed to the transition from manufacturing to service-based economies in these countries, which are thought to promote ‘dematerialization’ by relying on less material and energy intensive services to create economic value (Asafu-Adjaye et al., 2015). Ecomodernists also point to steady improvements in the carbon intensity of the global economy (roughly 1.4 per cent per year, though the rate of improvement has slowed in the past 2 years), which has enabled global growth to relatively decouple from CO2 emissions (IEA, 2016). Ecomodernists therefore conclude: ‘taken together, these trends mean that the total human impact on the environment, including land-use change, overexploitation, and pollution, can peak and decline this century’ (Asafu-Adjaye et al., 2015, p. 15).

Unfortunately for the ecomodernists, degrowth scholars and ecological economists have begun to poke holes in their optimistic assessments. Their response can be summarized according to three key counter-arguments: (1) the evidence that ecomodernists provide for relative decoupling is flawed and limited at best; (2) their evidence for the possibility of absolute decoupling is even weaker; and (3) even if absolute decoupling was possible in principle, there is even weaker evidence that this could occur with the necessary speed to stabilize the earth system before reaching irreversible tipping points.

First, claims that rich countries have seen relative or even absolute decoupling of economic growth from domestic material consumption have been shown to focus solely on correlations between national GDP and material throughput while ignoring the material-energetic costs embodied in imported consumer goods. For example, Thomas Wiedmann and colleagues show that while the EU, the US, and Japan have grown economically while stabilizing or even reducing domestic material consumption, a broader analysis of their material footprint embedded in their imports shows that it has kept pace with GDP growth. They conclude that ‘no decoupling has taken place over the past two decades for this group of developed countries’ (Wiedmann et al., 2015, p. 6273). Focusing on the global economy as a whole, Krausmann et al. show that its resource intensity improved over the course of the 20th century, though the early 21st century has seen a faster rate of growing resource consumption than global economic growth (cited in Hickel and Kallis, 2019). Thus, as Kallis and Hickel (Kallis and Hickel, 2019, p. 4; italics added) explain: ‘Global historical trends show relative decoupling but no evidence of absolute decoupling, and twenty-first century trends show not greater efficiency but rather worse efficiency, with re-coupling occurring’.

Second, given the limited evidence for even relative decoupling, it is little surprise that the evidential basis on which claims for the possibility of absolute decoupling rest is even flimsier. In the most comprehensive summary of the modeling evidence to date, Hickel and Kallis (2019) show that even the most optimistic scenarios fail to prove the possibility of absolute decoupling. For example, a modeling study by Schandl et al. (2016) shows that in a ‘high efficiency’ scenario, one that combines a high and rising carbon price plus a doubling in the rate of material efficiency improvement, global resource use grows more slowly (about a quarter the rate of GDP growth) but steadily to reach 95 billion tons in 2050, while global energy use grows from 14,253 million tons of oil equivalent in 2010 to 26, 932 million in 2050. The authors therefore conclude: ‘While some relative decoupling can be achieved in some scenarios, none would lead to an absolute reduction in … materials footprint’ (Schandl et al., 2016, p. 8). A high efficiency scenario modeled by the UNEP comes to even less optimistic conclusions (with global resource use rising to 132 billion tons in 2050), since it incorporates the ‘rebound effect’ in which efficiency improvements lead to increased consumption due to resulting price reductions (Hickel and Kallis, 2019). In short, as they conclude, these ‘models suggest that absolute decoupling is not feasible on a global scale in the context of continued economic growth’ (Hickel and Kallis, 2019, p. 6).

Third, the critics show that even if absolute decoupling (from both emissions and total environmental impact) were possible in principle, this would need to occur fast enough to prevent transgression of ecological tipping points. Just focusing on the climate problem, the 2018 IPCC report claims that emissions must be reduced 7 per cent annually to reach net zero by 2050 in order to achieve the 1.5 C target, whereas they must reduce 4 per cent annually to reach net zero by 2075 for a shot at the 2 degree target (IPCC, 2018, p. 15). However, even under optimistic assumptions (e.g. a near-term implementation of a high and rising carbon price, alongside heroic carbon intensity improvements), studies suggest that annual declines of 3–4 per cent might be the fastest rate possible assuming continued economic growth (Hickel, 2019). Thus, it would most likely be impossible to meet the 1.5 C target in a context of continuous compound growth. While the 2 degree target might be feasible in this context (assuming implementation of a globally coordinated program starting in 2020), many argue that the IPCC’s estimates downplay the existence of positive feedbacks in the earth system (e.g. Steffen et al., 2018), and thus more rapid emissions cuts might be needed even for 2 degrees. On top of this, economic growth must also be decoupled from impacts on other ‘planetary boundaries’ that may have already been overshot, especially land-use change and biodiversity loss (Raworth, 2017). A number of ecologists believe that to bring humanity back into a ‘safe operating space’, total resource consumption should be reduced from roughly 70 to 50 gigatons per year (Hoekstra and Wiedmann, 2014), while a ‘half earth strategy’ should be implemented that protects 50 per cent of the planet’s surface from direct human interference (up from roughly 18 per cent today) (Wilson, 2017), possibly by 2050 to prevent tipping points in biodiversity loss and land-use change (Hickel and Kallis, 2019). Even if these claims are exaggerated, the magnitude of the overall decoupling challenge remains clear. It would mean that total resource consumption and land use needs to shrink, remain stable, or only increase moderately (depending on our assumptions regarding the further stress (if any) that planetary boundaries can handle) even as the total output of the global economy triples by 2060. It is thus not hyperbole to say, as Boris Frankel puts it, that this goal of absolute decoupling is ‘overwhelmingly staggering in its ambition and historical novelty’ (Frankel, 2018, p. 127).

Given the magnitude of the decoupling challenge and limited evidence for even relative decoupling so far, what arguments could believers in the possibility of absolute decoupling in the future possibly turn to? Some would claim that we simply need to ramp up government regulations and planning to accelerate efficiency improvements. However, the Schandl et al. (2016) study cited above shows that even under highly optimistic scenarios in which such policies are globally implemented, absolute decoupling still fails to occur. Others point to the potential of the ‘circular economy’ in which wastes are converted into inputs for other industrial processes across the global economy (e.g. Rockstrom and Klum, 2015). However, only a fraction of total throughput (roughly 29 per cent) can be converted to a circular economy, since agricultural and energy inputs (44 per cent of the total) are irreversibly degraded, while buildings and infrastructure (27 per cent) involve net additions that cannot be recycled until the end of their lifespan (Hickel and Kallis, 2019). Even for the 29 per cent of the economy that is convertible to the circular economy, the reality of entropy means that total recycling is likely to be physically impossible, while additional constraints on re-using other materials (particularly the rare earth minerals in electronic goods) may lower this potential even further (Frankel, 2018).

The best hope for advocates of absolute decoupling, therefore, appears to be a technological revolution that would render projections of potential material-energy efficiency improvement rates obsolete. Indeed, the Schandl et al. (2016, p. 4) study makes ‘very conservative assumptions regarding the development of new technologies’, and thus significantly faster rates of efficiency improvement are possible (at least in principle) via technological breakthroughs. And as Kallis and Hickel acknowledge, ‘we cannot rule out substitutions or technological breakthroughs that will push such limits [to efficiency improvements] so far into the future as to render them irrelevant’ (Hickel and Kallis, 2019, p. 13). The belief that future innovations will in fact enable such breakthroughs is likely responsible for the fact that ecomodernists and other advocates of decoupling remain undeterred by limited evidence to date. Is there any basis for their optimism?

The fourth industrial revolution

While it remains to some extent speculative, there is a wildcard in the pocket of ecomodernists that lends at least a degree of plausibility to their confidence in future decoupling. This is the Fourth Industrial Revolution (FIR): the convergence of technological developments in the fields of nanotechnology, biotechnology, information technology, AI, and 3D printing among others. As noted earlier, it is the convergent and reinforcing nature of these technological trends that lead many to believe that they will deliver exponential breakthroughs in all fields of science and engineering, even catalyzing a transformation that will be ‘unlike anything humankind has experienced before’ (Schwab, 2017, p. 1). Klaus Schwab, the founder and executive chairman of the World Economic Forum, effectively captures the hope that many place in these converging technologies:

We have yet to grasp fully the speed and breadth of this new revolution … think about the staggering confluence of emerging technology breakthroughs, covering wide-ranging fields such as artificial intelligence (AI), robotics, the Internet of things (IoT), autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing. Many of these innovations are in their infancy, but they are already reaching an inflection point in their development as they build on and amplify each other in a fusion of technologies across the physical, digital, and biological worlds (Schwab, 2017, p. 1).

Given the immensity of the decoupling challenge, it seems likely that to sustain economic growth in the coming decades while stabilizing the earth system would require such a technological revolution. And indeed, this is what many ecomodernists anticipate. Stewart Brand (2012, p. 19), for example, affirms the need for environmentalists to embrace these ‘self-accelerating’ technologies, which he claims can be ‘deployed against the self-accelerating problems of world industrialization and against the positive feedbacks in climate itself’. In particular, both Brand (2012) and Lynas (2011) envision an important role for biotechnology and synthetic biology, which they claim will enable the production of more resilient crops with higher yields, clean and renewable biofuels, and microbes engineered to cleanse polluted environments and sequester carbon. Recent breakthroughs in gene editing and DNA synthesis have enabled new techniques for restoring damaged ecosystems, conserving endangered species, improving biological fixation of carbon, developing bio-based materials, and boosting crop yields by enhancing the efficiency of photosynthesis (Maxmen, 2015; Wintle et al., 2017), thereby raising hopes among environmentalists and governments that the emerging ‘bioeconomy’ can help solve sustainability challenges (Synthetic Biology Leadership Council, 2016).

Others focus on the promise of emerging developments in information technology, particularly AI, big data, and IOT – the global network of online devices, sensors, and databases forming a ‘world-spanning information fabric’ (Goodman, 2016, p. 284). For example, a recent report commissioned for the 2018 Global Climate Action Summit highlights the importance of these ‘exponential technologies’ for accelerating the transition to a low-carbon economy. It places particular emphasis on the power of the IOT and machine learning to ‘enable next generation mobility and electric vehicle breakthroughs, improvements in energy and space efficiency for buildings, and electricity generation and storage’, while making cities orders of magnitude more efficient through traffic, energy, and infrastructural optimization (Falk et al., 2018, p. 80). It also highlights the potential of 3D printing to ‘democratize production’ by enabling local communities to print their material and infrastructural needs, thereby making them ‘far less dependent on global supply chains’ (Falk et al., 2018, p. 33). Overall, the authors believe these technologies can fuel a rapid decarbonization and dematerialization of the economy, with IOT and AI-driven efficiency gains alone enabling 15 per cent emissions reductions by 2030, without sacrificing economic growth or rising material standards of living (Falk et al., 2018).

While its technological flowering may not occur for at least another decade or two, nanotechnology may further revolutionize the above fields. For example, inventor and futurist Eric Drexler claims that nanotech:

will increase energy efficiency across a wide range of applications and sometimes by large factors…In ground and air transportation, the accessible improvements include ten-fold reductions in vehicle mass and a doubling of typical engine efficiencies…reductions in the costs of physical capital will lower the cost of new installations of all kinds, facilitating replacement of capital stock at rates that could surpass any in historical experience. (Drexler, 2013, p. 229)

Combined with 3D printing, nanotechnologists claim that ‘personal nanofactories’ will enable any product to be assembled locally, atom by atom, which would bypass energy-intensive supply chains, reduce energy consumption by an ‘order of magnitude’ (Ramsden, 2016, p. 288), ‘essentially eliminate waste’ and overcome scarcity by disassembling and reassembling any atomic assemblage into novel material compounds (Ramsden, 2016, p. 296), and may even enable the rapid creation of a carbon sequestration and storage infrastructure that would ‘return the Earth’s atmosphere to its pre-industrial composition in a decade, and at an affordable cost’ (Drexler, 2013, p. 234).

Whatever the actual potential of these technologies, it is clear that a powerful technological imaginary exists among policy makers, technologists, and economists that contributes to an unshakeable faith in innovation and human ingenuity to solve the decoupling challenge. Degrowth proponents have so far mainly challenged this optimism by emphasizing the limited potential of renewable energy due to its intermittency and high land and raw material demands (e.g. Kallis, 2018). However, this may downplay the (at least theoretical) potential for convergent breakthroughs in nanotechnology, synthetic biology, and AI to vastly improve renewable energy efficiency and storage systems while designing new materials to substitute for depleting minerals (Diamandis and Kotler, 2014). More broadly, while degrowthers have to some extent considered individual FIR technologies (particularly AI and biotechnology) (e.g. Kallis, 2018; Kerschner et al., 2018), they have yet to address their convergent and mutually amplifying character, which leaves them vulnerable to the arguments of techno-optimists.

Of course, the revolutionary promise of these technologies may fail to materialize, and, given the magnitude of the decoupling challenge, degrowth advocates are right to be skeptical. However, due to irreducible uncertainty combined with the ‘exponential’ and ‘revolutionary’ potential of the FIR (Schwab, 2017), even more rigorous critical assessments would always be insufficient in the eyes of the techno-optimists. Therefore, an alternative line of response should also be pursued: what if the FIR does succeed in decoupling economic growth from total environmental impact? What unintended consequences then might this give rise to?3

Dual-use technologies and the democratization of violence

First, we must consider that all these are ‘dual-use technologies’, or technologies with potential both for economic productivity and violence. As Blum and Wittes (2015, p. 2) explain, these technologies are driving a trend referred to as the ‘democratization of violence’ in which the ‘destructive power once reserved to states is now the potential province of individuals’. Rather than simply a matter of creating new individual weapons, Blum and Wittes (2015, pp. 39, 7–8) emphasize that convergent FIR technologies are generating ‘whole technological fields – a series of breakthroughs in basic science and engineering’ that ‘generate creativity in their users to build and invent new things, new weapons, and new modes of attack’. And to compound the problem, while FIR technologies empower individuals to kill and provoke systemic chaos unlike any other time in history, they also empower states to monitor the minute details of private and public life and potentially constrict individual and collective freedoms, while the unprecedented threats enabled by these same technologies will likely reinforce governmental efforts to intensify securitization as deeply as is technologically feasible. Blum and Wittes summarize the emerging predicament as follows:

How should we think about the relationship between liberty and security when we both rely on governments to protect us from radically empowered fellow citizens around the globe and also fear the power those same technologies give to governments? (Blum and Wittes, 2015, p. 13)

Blum and Wittes do not consider how the earth system crisis will intersect with these threats, either as a positive or negative feedback. But it should be clear that, in a world of FIR-driven sustainability solutions, they would inevitably intensify, and it is thus necessary to consider what new problems and governmental responses they would engender.4

Without claiming to exhaustively describe the security risks created by the FIR, I will focus on three emerging areas of concern: biosecurity, cybersecurity, and state securitization, and will then discuss how they may collectively generate a spiral of insecurity and securitization.

Biotechnology and the emerging terrain of biosecurity

To begin with biosecurity, both the promise and peril of biotechnology – particularly the still nascent field of synthetic biology – is its immense creative potential. As a recent report from the National Academies of Sciences (NAS) describes:

synthetic biology is expected to (1) expand the range of what could be produced, including making bacteria and viruses more harmful; (2) decrease the amount of time required to engineer such organisms; and (3) expand the range of actors who could undertake such efforts. (NAS, 2018, p. 4)

For example, manipulating DNA structures in microorganisms can make certain agents more virulent, improve their resistance to antibiotics and vaccines, make them less detectable by already limited surveillance systems, transform harmless microorganisms into deadly ones, and make pathogens more resilient to diverse atmospheric conditions, thus increasing their lifespan (Charlet, 2018; NAS, 2018). At present these capabilities remain limited and dependent on highly advanced techniques and laboratory equipment, which is why most experts believe there have to date been no mass casualty bioterror attacks (NAS, 2018). However, the NAS notes that improvements in synthesis technology have followed a ‘Moore’s Law–like’ curve for both reductions in costs and increases in the length of constructs that are attainable’, and that ‘these trends are likely to continue’ (NAS, 2018, pp. 18–19). Moreover, automated DNA synthesis techniques remove much of the time-consuming and technically difficult aspects of manipulating DNA, further reducing barriers to access (Wintle et al., 2017). And in the future, experts warn that ‘convergent capabilities’ between synthetic biology, information technology, nanotechnology, and 3D printing may enable ‘sudden’ breakthroughs in bio-weaponization (e.g. by improving bio-agent stability and delivery, providing advances aerosolization capability, and accelerating the ‘Design-and-Build’ cycle) (NAS, 2018, p. 87).

The possibilities of bio-weaponization will expand as these techniques diffuse, which are already enabling the formation of a ‘DIYbio’ movement in which amateur scientists, inventors, and others are increasingly ‘capable of doing at home what just a few years ago was only possible in the most advanced university, government or industry laboratories’ (Bennett et al., 2009, p. 1109). The new CRIPSR/Cas9 gene editing technique further expands the range of genomic tinkering available to individuals, which has been widely embraced by the DIYbio community as a powerful tool that ‘makes it easy, cheap, and fast to move genes around – any genes, in any living thing’ (Maxmen, 2015). The capacities of DIY biohackers remain limited in important ways, though the trends described above suggests they will continue to increase as barriers to advanced bio-weaponization fall (NAS, 2018). And while the risks are evident, the democratization of these techniques may also facilitate the diffusion and customization of local solutions to environmental and health challenges while enhancing popular participation in the direction of biotechnological evolution away from transnational corporate dominance (Bennett et al., 2009).

We can therefore say that these emerging technologies pose a unique kind of ‘security dilemma’: while their development and diffusion may strengthen local and global capacities to solve environmental challenges, they may also imperil global security by unleashing uniquely powerful and complex violence capabilities. Synthetic biology is only in its early stages, and governments from the UK to China aim to ‘accelerate [its] industrialization and commercialization’ in order ‘to drive economic growth’ and ‘develop solutions to key challenges across the bioeconomy, spanning health, chemicals, advanced materials, energy, food, security and environmental protection’ (Synthetic Biology Leadership Council, 2016, pp. 13, 4). If calls for emergency action to exponentially expand the green economy indeed accelerate these trends (Falk et al., 2018), then by 2030 (and more so by 2040) we will live in a world where genetically engineered biofuels dramatically increase, genetic tinkering with crop varieties is normalized to enhance agricultural resilience, and gene drives are deployed to control old and new disease vectors intensified by climate change (among other potential applications), which would exponentially expand the number of individuals with biotech expertise and access to the needed equipment. Therefore, while we have yet to experience a catastrophic bioterror attack, rapid advances in synthetic biology are nonetheless creating a ‘black swan waiting to happen’ (Bennett et al., 2009, p. 1110), and the risk is that such black swans could become increasingly ‘normal’ if this technology becomes a key engine of economic growth and green technological innovation.

Cybersecurity in an age of ‘smart everything’

The second key problem with the FIR is that ‘exponential technologies’ deployed to decouple growth from environmental impact will also intensify ongoing cybersecurity threats. Cybercrime has increased to the point of costing the global economy an estimated $500–600 billion per year, while new vulnerabilities in civilian infrastructures continue to be discovered and exploited more quickly than they can be secured (Goodman, 2016). We are thus dealing with an already significant problem, though it remains important to consider how it will deepen in a world reliant on FIR-dependent solutions to the earth system crisis, especially once we take into account the cyber vulnerabilities posed by next generation information systems (Goodman, 2016).

In particular, we must consider the risks associated with the incipient IOT, which is a key component of the solution-set offered by techno-optimists for decoupling economic growth by dramatically improving efficiencies in energy, transportation, and agriculture (Falk et al., 2018; World Economic Forum, 2018). One of the prerequisites of a future renewable energy system capable of providing at least 80 per cent of growing electricity demand would be the creation of national or regional ‘smart grids’ in which energy surpluses in areas with lots of wind and sun at a given time can be transmitted to areas with energy deficits. While this system would itself increase cyber vulnerabilities relative to more modular systems, the efforts of Cisco and others to enhance the efficiency of smart grids via the IOT would intensify these vulnerabilities even more. In this vision, the smart grid would form ‘an intelligent network of power lines, switches, and sensors able to monitor and control energy down to the level of a single lightbulb’, which would be enabled by IOT connected sensors that ‘monitor energy use and manage demand, time shifting noncritical applications like delaying the start of your dishwasher to the middle of the night, when energy is cheaper’ (Diamandis and Kotler, 2014, pp. 169–171). In this way, every connected device – from iPhones and laptops to dishwashers and microwaves – would become a possible point of entry for hackers to the overall network (Goodman, 2016). The IOT is also envisioned as a possible solution to traffic congestion and fuel efficiency for the future fleet of self-driving electric vehicles that are set to (potentially) transform the market over the next decade. While advocates of ‘smart’ cars and ‘smart’ cities are enthusiastic regarding the possibilities for improved energetic and economic efficiency, it would also leave vehicles vulnerable to remote hijacking, as researchers Chris Valasek and Charlie Miller demonstrated in 2014 by taking control of a 2014 Jeep Cherokee (Markey, 2015). Adding further to the IOT-hype, a recent World Economic Forum report proposes deploying it to create ‘precision agriculture’ systems, which could link farms with global positioning systems and weather data collection to monitor water and soil conditions while enabling farms to automatically optimize inputs (World Economic Forum, 2018).

If these IOT powered energy, urban, and agricultural systems come into being, this would constitute an exponential expansion of attack vectors for would-be hackers, whether they come from states, criminal organizations, or non-state terrorist networks. Cybersecurity analyst Mark Goodman effectively captures the scale the problem:

The IoT will be a global network of unintended consequences and black swan events … we cannot even adequately protect the standard desktops and laptops we presently have online, let alone the hundreds of millions of mobile phones and tablets we are adding annually. In what vision of the future, then, is it conceivable that we will have any clue how to protect the next fifty billion things to go online? (Goodman, 2016, pp. 301–302).

In short, while the expansion of cyber vulnerabilities is already stressing if not overwhelming the defense capacities of governments, corporations, and public utilities, it is also practically assured that these vulnerabilities will expand significantly if the global economy relies on smart energy grids and the IOT to maximize energy efficiency and decouple growth from growing resource use.

State securitization and totalitarian dangers

The third key risk domain involves the securitization powers of states. FIR technologies may not qualitatively transform state power individually, though their convergent character could offer immense power to states that are able to systematically harness these capabilities for surveillance and militarization purposes. Unsurprisingly, such capacities are being intensively pursued by leading states. In particular, the US and China appear to be engaged in an AI arms race, with China aiming to create a $150 billion AI industry by 2030 and the Pentagon seeking to triple its AI warfare budget to match China’s ambition (Ashizuka, 2019). Military robotics is also a key field of competition, with worldwide spending tripling between 2000 and 2015 from $2.4 to $7.5 billion, and which some estimate will double again by 2025 (Allen and Chan, 2017). The US has also spent $29 billion on nanotechnology research since 2001, with about 20 per cent of its investments involving military applications (National Nanotechnology Initiative, 2019). A short list of potential military applications includes powerful and lightweight body armor, microscopic and networked nano-bots with capacities for ‘swarm intelligence’, and more compact and powerful chemical and nuclear weapons (Drexler, 2013; National Nanotechnology Initiative, 2019).

The full extent of the capabilities these technologies may unleash cannot be known in advance, though it seems possible that they could become an ‘axial’ capability of states. As Deudney (2007) describes, an axial capability is one that can dominate an entire system due to its unique character. While FIR technologies may not offer axial capabilities individually, their convergent character is such that they could collectively offer an axial advantage to states able to systematically harness their potential. This could take the form of a globally networked and nano-IOT-AI powered system harnessing vast capacities for force mobilization and information gathering and processing. By integrating nanotechnology, the IOT, big data, and robotics while harnessing the processing power and flexibility of advanced AI, states may in this way be in the midst of unleashing technological capabilities that will enable them to informationalize and monitor human populations while mobilizing destructive power with an unprecedented degree of precision and sophistication.

Of course, without speculating on the future, we can already see how states are taking advantage of the global information infrastructure to enhance control over the security environment. In particular, the metastasizing US security state is already in process of forging an incipient Techno-Leviathan – a ‘global-surveillance-state-in-the-making’ – whose drive for informational omniscience is pushing it beyond territorial boundaries in an effort to control the global infosphere and erode all pretense of legality and democratic oversight (Engelhardt, 2014, p. 107). And we are seeing comparable developments in China, where advances in AI, the IOT, and big data are being used to construct a ‘citizen score’ system that incentivizes ‘good’ (i.e. regime-friendly) behavior and punishes citizens for critical thinking (Mitchell and Diamond, 2018). Thus, while securitization trends in the US and China should already give us pause, they will only become more extensive and intensive by integrating increasingly advanced FIR technologies over time, which would likely be the case if the latter are relied upon to achieve decoupling.

The spiral of insecurity and securitization

Overall, due to the combination of democratized violence capacities and totalitarian state powers that it would create, the FIR would likely generate a reinforcing spiral of insecurity and securitization that produces a qualitatively new kind of techno-authoritarianism on a global scale. To understand how this may come about, it is first important to recognize that even if the FIR enables the global economy to grow while stabilizing the climate at 1.5 or 2 degrees C (a highly optimistic assumption), this would still (according to one study) leave 16 to 29 per cent of the world’s population (mostly in the Global South) vulnerable to lethal climate impacts (Byers et al., 2018). Technological advance could certainly improve adaptation capacities even amidst such environmental changes, but poverty and deprivation will remain difficult to reverse, and deep grievances felt towards the Global North – due to its primary responsibility in creating the problem whose consequences are primarily suffered in the Global South – will make militant and/or terrorist violence a likely response. Second, we can see that the increasing dependence of the global economy on FIR technologies would create an exponential expansion of possible bio and cyber attack vectors. In conjunction with steady advances in technologies of securitization and rising fear among policy makers and populations, it may only require a relatively ‘minimal’ attack (e.g. something comparable to 9/11, rather than the kind of million or even billion casualty attack feared by some bioterror experts) to catalyze a further threshold of intensified global securitization.

What might this threshold entail? Abstractly, it could be understood as a shift from a predominant ‘liberal’ security apparatus to an ‘authoritarian’ mode that establishes a permanent ‘state of emergency’ on a global scale (Opitz, 2011). While we can only speculate on what this might look like in practice, especially as technologies of securitization advance, it would likely involve a conjoined transformation in and integration of both technological-surveillance and institutional-legal assemblages, with the former being intensified and extended while the latter sheds all pretext of democratic oversight to become an increasingly absolutist form of sovereign authority on a global scale. Surveillance would reach from the planetary to the molecular scale through a network of satellites, distributed environmental sensors, and AI-facilitated data collection and processing techniques; military force mobilization capacities of nearly absolute speed and global reach could be created through a combination of space-based and networked AI-robotic weapons systems; and the right of the planetary sovereign to detain individuals, mobilize force without legal pretext, and constrict the mobility of people and goods to more tightly regulated territories, would be enshrined. While such an apparatus may seem far-fetched, philosopher and futurist Nick Bostrom envisions a similarly totalitarian global surveillance system as the necessary prerequisite of global security in an age of democratized weapons of mass destruction (Bostrom, 2018). And he notes that ‘thanks to the falling price of cameras, data transmission, storage, and computing, and the rapid advances in AI-enabled content analysis, [it] may soon become both technologically feasible and affordable’ (Bostrom, 2018, p. 25).

In sum, while techno-authoritarian trends are already evident in the US and China, FIR technologies would further enhance their capabilities while ‘democratizing’ WMD capacities among non-state actors (Blum and Wittes, 2015). This would incentivize states to extend and deepen surveillance as far as possible while making democratic populations more willing to accept intensified securitization, therefore making it difficult to avoid an authoritarian global security apparatus.

Conclusions

To return to the question that opened this essay: can global capitalism solve the earth system crisis? I have shown that the answer is an ambiguous maybe: the FIR may enable economic growth to decouple sufficiently rapidly from CO2 emissions and broader environmental impacts to stabilize the earth system, though these technological solutions would then intensify risks in the domains of biosecurity, cybersecurity, and state surveillance, thereby unleashing a spiral of insecurity and securitization that will push global capitalism towards a new kind of techno-authoritarianism. It is thus worth showing, in a way that differs from, yet complements the arguments of degrowth advocates, that even if global capitalism can succeed in stabilizing the earth system in a context of endless growth, then it would likely create security threats and totalitarian dangers that would undermine the desirability of such a system.

This conclusion reinforces the need for a set of global policies that break decisively from the growth-oriented status quo. On one hand, to dampen these technological trends and improve the prospects of earth system stabilization, the pursuit of GDP growth should be replaced by alternative goals based on new metrics (e.g. the Genuine Progress Indicator or Index of Sustainable Economic Welfare) that more accurately represent social welfare (Kallis, 2018). The European Commission’s Beyond GDP project shows that steps are being taken in this direction, though they should go further by explicitly ending reliance on growth by placing hard caps on material-energy throughput while restructuring economies so that livelihoods are not dependent on increasing GDP (Hickel, 2019; O’Neill et al., 2018). On the other hand, many FIR technologies (especially open source synthetic biology) offer great promise for improving human welfare through advances in sustainable energy, agriculture, and medicine. Thus, transitioning beyond growth should not necessarily entail abandoning these technologies, and strong global regimes for regulating and monitoring their use would therefore be necessary. However, rather than simply strengthening existing regimes like the Biological Weapons Convention (Charlet, 2018) or relying on private sector-led initiatives to regulate emerging risks ‘without impeding the capacity of research to deliver innovation and economic growth’ (Schwab, 2017, p. 90), more far-reaching changes are needed to enhance democratic control over the pace and direction of technological innovation, thereby counter-balancing the influence of multinational firms and militaries. In particular, ‘citizens assemblies’ should be empowered to debate the relative benefits and risks posed by FIR technologies (from synthetic biology to IoT, nanotechnology, and AI) and set mandates regarding investment levels and priorities, the direction of research, and the pace of deployment, while also having the right to ‘relinquish’ certain technological trajectories if their risks are perceived to outweigh the benefits.5

Overall, a ‘post-growth’ economy based on more democratized ownership of common wealth, reduced overall material-energetic throughput, decelerated and democratically controlled technological innovation, and prioritization of production for meeting essential human needs rather than profit (Hickel, 2019; Kallis, 2018; Raworth, 2017), has the potential to create a global political-economy that meets all human needs within planetary boundaries without shifting problems into the realms of biosecurity, cybersecurity, and state securitization. While the obstacles it confronts are of course formidable, the alternatives may be ecological collapse and civilizational breakdown (if the FIR fails to decouple economic growth from environmental impacts) or global techno-authoritarianism (if it succeeds).