# 1NC vs Lexington BF

## 1NC

#### Interpretation: “Appropriation of outer space” by private entities refers to the exercise of exclusive control of space.

TIMOTHY JUSTIN TRAPP, JD Candidate @ UIUC Law, ’13, TAKING UP SPACE BY ANY OTHER MEANS: COMING TO TERMS WITH THE NONAPPROPRIATION ARTICLE OF THE OUTER SPACE TREATY UNIVERSITY OF ILLINOIS LAW REVIEW [Vol. 2013 No. 4]

The issues presented in relation to the nonappropriation article of the Outer Space Treaty should be clear.214 The ITU has, quite blatantly, created something akin to “property interests in outer space.”215 It allows nations to exclude others from their orbital slots, even when the nation is not currently using that slot.216 This is directly in line with at least one definition of outer-space appropriation.217 [\*\*Start Footnote 217\*\*Id. at 236 (“Appropriation of outer space, therefore, is ‘the exercise of exclusive control or exclusive use’ with a sense of permanence, which limits other nations’ access to it.”) (quoting Milton L. Smith, The Role of the ITU in the Development of Space Law, 17 ANNALS AIR & SPACE L. 157, 165 (1992)). \*\*End Footnote 217\*\*]The ITU even allows nations with unused slots to devise them to other entities, creating a market for the property rights set up by this regulation.218 In some aspects, this seems to effect exactly what those signatory nations of the Bogotá Declaration were trying to accomplish, albeit through different means.219

#### Violation: they ban commercial exploration and mining

Gorove 84 [(Stephen, University of Mississippi Law Center) “Major Legal Issues Arising from the Use of the Geostationary Orbit,” Michigan journal of international law, 1984. <https://repository.law.umich.edu/cgi/viewcontent.cgi?article=1823&context=mjil#:~:text=This%20article%20has%20identified%20three,national%20appropriation%2C%20and%20equitable%20access>] RR

The question then becomes whether the continued exclusive occupation by a geostationary satellite of the same physical area is a violation of the ban on national appropriation. While a state may certainly exercise exclusive control over a traditional object, such as a ship, or an aircraft, or a part of airspace, it is not clear that a satellite in geostationary orbit would be able to maintain its exact position and occupy the same area over a period of time. 13 Even if a position could be accurately maintained, and thus possibly constitute an "appropriation" within the meaning of article II, the satellite would have to be kept in that orbit with a "sense of permanence" and not on a temporary basis.

#### Standards:

#### Limits – their interpretation means that affs about any outer space activity would be topical: mining, photography, sending rovers, collecting ice cores, launching satellites, deflecting debris, can’t sell rocks on EBAY, etc. This explodes neg prep burdens since outer space activity is so vague – no generics exist to answer both the photography and the rovers aff, so affs would just win with a tiny impact every round

#### Ground – allowing debates about extracting any space resource denies the neg links to core generics like space democracy bad, space colonization good, the moon pic, the property rights NC, etc. – that kills clash by forcing negatives to the fringes of argumentation that disagree with everything and kills fairness by giving the aff a major prep advantage since they only need to frontline the few negative arguments that link to their aff.

#### Fairness and education are voters – debate’s a game, and fairness is necessary to determine the winner of the game, and education is the reason why schools fund debate.

#### Drop the debater – dropping the argument doesn’t rectify abuse since winning T proves why we don’t have the burden of rejoinder against their aff.

#### Use competing interps – reasonability invites arbitrary judge intervention since there’s no consensus as to what’s reasonable.

#### No RVIs – fairness and education are logical litmus tests and they incentivize baiting theory and prepping it out which turns substance crowdout

## Case

#### Non inherant— your ev is from 2020 about private companies means it would have already happened

#### Can’t solve for other countries develping, your ev is just about private sector broadly not necessariliy specifc to the US.

#### No space exploration— ev not contextual to the US means that you can’t solve for it

#### No public sector drain— just says that its not successful not that it won’t happen

#### Space exploration causes global war— miscalc, AI, ecological damage

Morton 18 [(Adam, a retired philosopher attached to the University of British Columbia. He is a philosophical generalist with a particular interest in issues about knowledge and about how people understand one another.) “Colonizing Other Planets Could Trigger War on Earth,” Newsweek, 11/22/21. <https://www.newsweek.com/colonizing-other-planets-could-trigger-war-earth-and-ecological-disaster-1226630>] RR

Plans for the exploration and even colonization of other planets are very much in the air, and getting to Mars in particular has become a billionaire's hobby lately. Elon Musk would like to establish a human colony on Mars in a matter of decades. (For the foreseeable future—a century, I would venture—Mars will be the only real possibility.) But planetary colonies may be a bad idea, even a disastrous idea. So, it is important to see the arguments against them, as well as their appeal. I begin with a reason that is sometimes made central to proposals for colonies—the idea that we should achieve them as soon as it is feasible.

It is a call for escape from imminent danger. The idea is that nuclear war, ecological catastrophe, or the rise of artificially intelligent robots, will wipe out humans on Earth. But a colony far away might survive, so that the species continues. Stephen Hawking is among those who have argued, or usually just pronounced, for versions of this (and if you want scientific authority, it is hard to do better). But the idea has serious flaws. It is hard to think of even a post-apocalyptic Earth that is less hospitable to any terrestrial life than Mars, let alone elsewhere in the solar system, so the challenges are enormous. But let us ignore that. Suppose that a colony had a reasonable chance of surviving, would the argument from danger justify founding it soon? I think not.

One danger is nuclear and biological war: One nation or ethnic group fears or hates another enough to unleash bombs or viruses. In a bad scenario they succeed. Millions die, and their territory becomes uninhabitable. In the worst scenario, the other side retaliates or the affliction spreads and eventually everyone is dead. But people survive on Mars. Which people? They will include members of one group or their opponents, so if the aim really is to wipe out this group it will be directed at the colonists as well. They are hated, and they are capable of retaliation. Bomb-bearing rockets are much simpler to make than people-bearing rockets. And someone crazy enough to push the button would be crazy enough to direct them at the hated enemy wherever they are found. So, the colony would not be safe. At any rate, it will not be not safe enough that founding it is a better bet than making war less likely on Earth. Worse, any nation party to founding a colony will arouse suspicion in its enemies that it is scheming to start and survive a war. And this makes war more rather than less likely.

Another danger is the rise of smart robots. But again, there is no escape in space. Space travel and running a colony use as much computation as they can get. This was true of the moon landings and it is even truer now. Human beings have an essential role in plans and design, but on the trip itself they are mostly just going along for the ride. So, imagine, just for the sake of argument, that hyper-calculating artificial intelligences are in a position to threaten human civilization. The extension of that civilization on another planet relies even more on those very powers, which will have to be networked to earthly computation. If mere humans can hack into machinery in targeted countries to disrupt them, then these super-capable but malevolent AIs will have no problem. Whatever their "motives," these will be the same elsewhere as on earth, and space is less of an obstacle to the flow of (mis)information and commands than to the flow of people and physical objects. No safety there.

The third danger is ecological. We are ruining the climate and polluting the oceans. We could develop technology that mitigated or even reversed the dangers. It would be easier than developing technology for surviving on Mars, where we must grow food and create oxygen in a very cold and dark environment without much protection from radiation and a limited supply of water. Moreover, getting enough people to Mars to make a colony that could survive without help from home, self-sufficient technologically and with enough genetic diversity that our already rather uniform species would have a future, would involve a lot of rockets. Musk talks in terms of 10,000 flights, although some plans require more. And this would be just to get things started. We just do not know what the impact on the earth and its atmosphere of the launches and the prior manufacturing would be. It would not be positive, at any rate. And industrial power and scientific brains would be diverted away from the needs of earth to the well-being of the colony. It is not what we need; you would only think that we could afford it if you were blind to how desperate things really are. So again, the colony solution is likely to make the earthly situation even more dire.

#### Space colonization causes species diversification – extinction – forecloses governance, kills deterrence, and incentivizes powerful super-weapons that we can’t currently imagine

Torres 18 [(Phil, the director of the Project for Human Flourishing and the author of Morality, Foresight, and Human Flourishing: An Introduction to Existential Risks.) “Why We Should Think Twice About Colonizing Space” Nautilus, 7/18/2018. https://nautil.us/why-we-should-think-twice-about-colonizing-space-7525/] BC

To be sure, humanity will eventually need to escape Earth to survive, since the sun will make the planet uninhabitable in about 1 billion years. But for many “space expansionists,” escaping Earth is about much more than dodging the bullet of extinction: it’s about realizing astronomical amounts of value by exploiting the universe’s vast resources to create something resembling utopia. For example, the astrobiologist Milan Cirkovic calculates that some 1046 people per century could come into existence if we were to colonize our Local Supercluster, Virgo. This leads Nick Bostrom to argue that failing to colonize space would be tragic because it would mean that these potential “worthwhile lives” would never exist, and this would be morally bad.

But would these trillions of lives actually be worthwhile? Or would colonization of space lead to a dystopia?

In a recent article in Futures, which was inspired by political scientist Daniel Deudney’s forthcoming book Dark Skies, I decided to take a closer look at this question. My conclusion is that in a colonized universe the probability of the annihilation of the human race could actually rise rather than fall.

The argument is based on ideas from evolutionary biology and international relations theory, and it assumes that there aren’t any other technologically advanced lifeforms capable of colonizing the universe (as a recent study suggests is the case).

Consider what is likely to happen as humanity hops from Earth to Mars, and from Mars to relatively nearby, potentially habitable exoplanets like Epsilon Eridani b, Gliese 674 b, and Gliese 581 d. Each of these planets has its own unique environments that will drive Darwinian evolution, resulting in the emergence of novel species over time, just as species that migrate to a new island will evolve different traits than their parent species. The same applies to the artificial environments of spacecraft like “O’Neill Cylinders,” which are large cylindrical structures that rotate to produce artificial gravity. Insofar as future beings satisfy the basic conditions of evolution by natural selection—such as differential reproduction, heritability, and variation of traits across the population—then evolutionary pressures will yield new forms of life.

But the process of “cyborgization”—that is, of using technology to modify and enhance our bodies and brains—is much more likely to influence the evolutionary trajectories of future populations living on exoplanets or in spacecraft. The result could be beings with completely novel cognitive architectures (or mental abilities), emotional repertoires, physical capabilities, lifespans, and so on.

In other words, natural selection and cyborgization as humanity spreads throughout the cosmos will result in species diversification. At the same time, expanding across space will also result in ideological diversification. Space-hopping populations will create their own cultures, languages, governments, political institutions, religions, technologies, rituals, norms, worldviews, and so on. As a result, different species will find it increasingly difficult over time to understand each other’s motivations, intentions, behaviors, decisions, and so on. It could even make communication between species with alien languages almost impossible. Furthermore, some species might begin to wonder whether the proverbial “Other” is conscious. This matters because if a species Y cannot consciously experience pain, then another species X might not feel morally obligated to care about Y. After all, we don’t worry about kicking stones down the street because we don’t believe that rocks can feel pain. Thus, as I write in the paper, phylogenetic and ideological diversification will engender a situation in which many species will be “not merely aliens to each other but, more significantly, alienated from each other.”

But this yields some problems. First, extreme differences like those just listed will undercut trust between species. If you don’t trust that your neighbor isn’t going to steal from, harm, or kill you, then you’re going to be suspicious of your neighbor. And if you’re suspicious of your neighbor, you might want an effective defense strategy to stop an attack—just in case one were to happen. But your neighbor might reason the same way: she’s not entirely sure that you won’t kill her, so she establishes a defense as well. The problem is that, since you don’t fully trust her, you wonder whether her defense is actually part of an attack plan. So you start carrying a knife around with you, which she interprets as a threat to her, thus leading her to buy a gun, and so on. Within the field of international relations, this is called the “security dilemma,” and it results in a spiral of militarization that can significantly increase the probability of conflict, even in cases where all actors have genuinely peaceful intentions.

So, how can actors extricate themselves from the security dilemma if they can’t fully trust each other? On the level of individuals, one solution has involved what Thomas Hobbes’ calls the “Leviathan.” The key idea is that people get together and say, “Look, since we can’t fully trust each other, let’s establish an independent governing system—a referee of sorts—that has a monopoly on the legitimate use of force. By replacing anarchy with hierarchy, we can also replace the constant threat of harm with law and order.” Hobbes didn’t believe that this happened historically, only that this predicament is what justifies the existence of the state. According to Steven Pinker, the Leviathan is a major reason that violence has declined in recent centuries.

The point is that if individuals—you and I—can overcome the constant threat of harm posed by our neighbors by establishing a governing system, then maybe future species could get together and create some sort of cosmic governing system that could similarly guarantee peace by replacing anarchy with hierarchy. Unfortunately, this looks unpromising within the “cosmopolitical” realm. One reason is that for states to maintain law and order among their citizens, their various appendages—e.g., law enforcement, courts—need to be properly coordinated. If you call the police about a robbery and they don’t show up for three weeks, then what’s the point of living in that society? You’d be just as well off on your own! The question is, then, whether the appendages of a cosmic governing system could be sufficiently well-coordinated to respond to conflicts and make top-down decisions about how to respond to particular situations. To put it differently: If conflict were to break out in some region of the universe, could the relevant governing authorities respond soon enough for it to matter, for it to make a difference?

Probably not, because of the immense vastness of space. For example, consider again Epsilon Eridani b, Gliese 674 b, and Gliese 581 d. These are, respectively, 10.5, 14.8, and 20.4 light-years from Earth. This means that a signal sent as of this writing, in 2018, wouldn’t reach Gliese 581 d until 2038. A spaceship traveling at one-quarter the cosmic speed limit wouldn’t arrive until 2098, and a message to simply affirm that it had arrived safely wouldn’t return to Earth until 2118. And Gliese 581 is relatively close as far as exoplanets go. Just consider that he Andromeda Galaxy is some 2.5 million light-years from Earth and the Triangulum Galaxy about 3 million light-years away. What’s more, there are some 54 galaxies in our Local Group, which is about 10 million light-years wide, within a universe that stretches some 93 billion light-years across.

These facts make it look hopeless for a governing system to effectively coordinate law enforcement activities, judicial decisions, and so on, across cosmic distances. The universe is simply too big

#### Debris is key to prevent sustained economic growth

Tam 15 [(Walter, Director of Business Development at Orbital ATK, PhD from Walden University and BS from the University of Southern California) “The Space Debris Environment and Satellite Manufacturing,” Walden Dissertations and Doctoral Studies Collection, 10/2015] JL

Space-based systems are prevalent in modern society and critical to the global economy. The capabilities they provide are indispensable to the global community (Buckerfield de la Roche, 2013). The space debris problem is a global problem (Chen, 2011) with the potential to affect billions of consumers subscribing to space services (Meek, 2012). The knowledge base on space debris includes politics, behavior and ethics, space economy, and the space environment. There is also knowledge on the economic benefits of space use. However, no researchers have focused on the implications of the space debris problem on satellite manufacturers. The topic addressed was the space debris problem from the perspective of satellite manufacturers and provided business leaders additional information upon which they can make future business decisions. By providing business leaders at satellite manufacturing organizations insights into an SRM for effective space debris risk mitigation, business leaders seeking strategic solutions to update their business models might find the research findings helpful. The research findings could lead to improved business operations that promote lower operational risk, higher profitability, enhanced competitiveness, and organizational sustainability. By promoting the long-term sustainability of the space environment, business leaders at satellite manufacturing organizations could contribute to technology advancement, economic development, and positive social change. 14

The benefits of space technology are far reaching. The use of the space environment contributes to economic growth, higher standards of living, increased knowledge base, and technology advancement (Williamson, 2012). Social benefits of space activities include employment-associated hardware manufacture, technology research, and technology spin-offs (Abiodun, 2012; Jarritt, Peeters, & Schrogl, 2011; Machay, 2012). Investments into space technology serve as a source for the technology overflow that contributes to the economic development of nations and benefits many terrestrial industries (Venturini, Verbano, & Matsumoto, 2013). Such technology development could lead to new products, processes, applications, materials, or services to benefit societies (Petroni, Verbano, Bigliardi, & Galati, 2013). Earth observation using satellites in space facilitates the monitoring of the planetary health (Lele, 2012). For example, Earth observation satellites capable of oil spill detection could provide early warnings that reduce clean-up costs and prevent further damage to the environment (Jarritt et al., 2011).

New entrepreneurial ventures in space tourism are becoming a source of job creation and economic growth (Beery, 2012; Reddy, Nica, & Wilkes, 2012). Many developing economies are implementing knowledge-based economies through research in space exploration and the development of advanced products and services to promote human welfare (Acevedo, Becerra, Orihuela, & Varela, 2011; Manikowski, 2013). Economically depressed Africa is adopting space technology to meet continent-wide development needs (Abiodun, 2012). The sustainability of the space environment would 15 specifically benefit the African economy by providing application opportunities inherent in space efforts and preventing brain drain from Africa (Abiodun, 2012). Examples of application opportunities include research and development to develop future industries and applications in medical research.

#### Econ decline doesn’t cause war –

Clary ’15 (Christopher; 4/25/15; Ph.D. in political science from the Massachusetts Institute of Technology, M.A. in National Security Affairs, Postdoctoral fellow, Watson Institute for International Studies, Brown University; MIT Political Science Department Research Paper, “Economic Stress and International Cooperation: Evidence from International Rivalries,” https://papers.ssrn.com/sol3/papers.cfm?abstract\_id=2597712)

Do economic downturns generate pressure for diversionary conflict? Or might downturns **encourage austerity and economizing behavior** in foreign policy? This paper provides new evidence that economic stress is associated with conciliatory policies between strategic rivals. For states that view each other as military threats, the biggest step possible toward bilateral cooperation is to terminate the rivalry by taking political steps to manage the competition. Drawing on **data** from 109 **distinct rival** dyads **since 1950**, 67 of which terminated, the evidence suggests rivalries were approximately twice as likely to terminate during economic downturns than they were during periods of economic normalcy. This is true controlling for all of the main alternative explanations for peaceful relations between foes (democratic status, nuclear weapons possession, capability imbalance, common enemies, and international systemic changes), as well as many other possible confounding variables. This research questions existing theories claiming that economic downturns are associated with diversionary war, and instead argues that in certain circumstances peace may **result from economic troubles**. I define a rivalry as the perception by national elites of two states that the other state possesses conflicting interests and presents a military threat of sufficient severity that future military conflict is likely. Rivalry termination is the transition from a state of rivalry to one where conflicts of interest are not viewed as being so severe as to provoke interstate conflict and/or where a mutual recognition of the imbalance in military capabilities makes conflict-causing bargaining failures unlikely. In other words, rivalries terminate when the elites assess that the risks of military conflict between rivals has been reduced dramatically. This definition draws on a growing quantitative literature most closely associated with the research programs of William Thompson, J. Joseph Hewitt, and James P. Klein, Gary Goertz, and Paul F. Diehl.1 My definition conforms to that of William Thompson. In work with Karen Rasler, they define rivalries as situations in which “[b]oth actors view each other as a significant politicalmilitary threat and, therefore, an enemy.”2 In other work, Thompson writing with Michael Colaresi, explains further: The presumption is that decisionmakers explicitly identify who they think are their foreign enemies. They orient their military preparations and foreign policies toward meeting their threats. They assure their constituents that they will not let their adversaries take advantage. Usually, these activities are done in public. Hence, we should be able to follow the explicit cues in decisionmaker utterances and writings, as well as in the descriptive political histories written about the foreign policies of specific countries.3 Drawing from available records and histories, Thompson and David Dreyer have generated a universe of strategic rivalries from 1494 to 2010 that serves as the basis for this project’s empirical analysis.4 This project measures rivalry termination as occurring on the last year that Thompson and Dreyer record the existence of a rivalry. Economic crises lead to conciliatory behavior through five primary channels. (1) Economic crises lead to austerity pressures, which in turn incent leaders to search for ways to cut defense expenditures. (2) Economic crises also encourage strategic reassessment, so that leaders can argue to their peers and their publics that defense spending can be arrested without endangering the state. This can lead to threat deflation, where elites attempt to **downplay** **the seriousness** of the threat posed by a former rival. (3) If a state faces multiple threats, economic crises provoke elites to **consider** threat prioritization, a process that is postponed during periods of economic normalcy. (4) Economic crises increase the political and economic benefit from international **economic** cooperation. Leaders **seek foreign aid**, **enhanced trade**, and **increased investment** from abroad during periods of economic trouble. This search is made easier if tensions are reduced with historic rivals. (5) Finally, during crises, elites are more prone to select leaders who are perceived as **capable of** resolving **economic** difficulties, permitting the emergence of leaders who hold heterodox foreign policy views. Collectively, these mechanisms make it **much more likely** that a leader will prefer conciliatory policies compared to during periods of economic normalcy. This section reviews this **causal logic** in greater detail, while also providing **historical examples** that these mechanisms recur in practice. Economic Crisis Leads to **Austerity** Economic crises generate pressure for austerity. Government revenues are a function of national economic production, so that when production diminishes through recession, revenues available for expenditure also diminish. Planning almost **invariably assumes growth** rather than contraction, so the deviation in available revenues compared to the planned expenditure can be sizable. When growth slowdowns are prolonged, the cumulative departure from planning targets can grow even further, even if no single quarter meets the technical definition of recession. Pressures for austerity are **felt** most **acutely** in governments that face difficulty borrowing to finance deficit expenditures. This is **especially the case** when this borrowing relies on international sources of credit. Even for states that can borrow, however, intellectual attachment to balanced budgets as a means to restore confidence—a belief in what is sometimes called “expansionary austerity”—generates incentives to curtail expenditure. These incentives to cut occur precisely when populations are experiencing economic hardship, making reductions especially painful that target poverty alleviation, welfare programs, or economic subsidies. As a result, mass and elite constituents strongly resist such cuts. Welfare programs and other forms of public spending may be especially susceptible to a policy “ratchet effect,” where people are **very reluctant** to forego benefits once they have become accustomed to their availability.6 As Paul Pierson has argued, “The politics [of welfare state] retrenchment is typically treacherous, because it imposes **tangible losses** on concentrated groups of voters in return for diffuse and uncertain gains.”7

#### Only degrowth solves– infinite growth relies on burning fossil fuels, depleting natural resources, mining REMS, and pollution – COVID means a transition is possible

Herbert and Mastini 6/8 [(Joe Herbert, a doctoral researcher in Human Geography at Newcastle University) (Riccardo Mastini, a doctoral researcher in Political Ecology in the Institute of Environmental Science and Technology at the Autonomous University of Barcelona) “Economic Growth Can't Go Back to Normal If We Are to Solve the Ecological Crisis” Common Dreams, 6/8/2020] BC

The COVID-19 pandemic has delivered a sharp and sudden shock to the global economy’s usual diet of ever-expanding economic growth. Measures to tackle the virus have seen industries grind to a halt, and high streets become ghost towns. Experts are predicting the worst global recession since the 1930s, and the UK’s Gross Domestic Product (GDP) is forecast to fall by 14% in 2020.

For the beneficiaries of our existing economic system, this hit to growth is a waking nightmare.

Growth is heralded as a rising tide that lifts all boats, creating larger incomes and more jobs, as well as funding essential public services like healthcare and education. Strong and uninterrupted growth is considered an unquestionable good that benefits all of society.

The problems with growth

But what drives economic growth? Our economy relies on burning fossil fuels and depleting natural resources to expand production and consumption, while polluting the environment with the waste. Most of us are forced to work for wages in order to survive, creating the goods and services which generate growth, while a minority siphon off the profits. In 2018, 82% of new wealth created went to the world’s richest 1%, while the poorest half of the global population got nothing.

Most scientists agree that an unprecedented economic transformation is now needed to limit global temperature rise to 1.5°C and avert climate breakdown. Meanwhile, the destruction of ecosystems to claim land and resources in service of more economic growth is contributing to the sixth mass extinction of life on Earth.

“Green growth” has been touted as a solution to these problems. But recent research suggests that growth cannot be decoupled from environmental pressures at a scale or speed sufficient to halt ecological breakdown.

Transitioning to renewable energy can reduce carbon emissions, but it increases pressures on rare Earth minerals and land to build wind and solar farms. Reducing emissions in one country often involves exporting dirty production processes to another. When goods are made more efficient, they become cheaper to produce, and their lower ecological impact is often offset by increased consumption. Think of someone switching to a fuel efficient car but driving more often. Put simply, attempts at “greening” growth often shift, rather than eliminate, environmental impact.

Governments have taken action to reduce the spread of COVID-19 at the expense of economic growth. But as the post-pandemic recession kicks in, rebooting growth will be the priority. This would set us right back on the path of ecological catastrophe.

Yet, polling suggests a public appetite to prioritise wellbeing over growth in the post-COVID economy. To achieve this while tackling ecological crisis would require turning the current short-term disruption to growth into a long-term managed downscaling of the economy. As researchers, we work with a concept which can guide this task: degrowth.

Well-being without growth

Degrowth calls for a fundamental restructuring of the economy to reduce its ecological impact and improve well-being by abolishing economic growth as a social objective.

The pandemic will shrink the global economy, but not in a targeted way that downscales carbon-intensive sectors. For this reason, a degrowth transition would look very different to a crisis-driven recession such as the present one. Still, there are useful lessons to be drawn from COVID-19. Firstly, when confronted with a major crisis, we must stop activities that threaten well-being, regardless of the impact on growth.

Once we have established the necessary boundaries to protect well-being – whether it’s closing non-essential industries to prevent the spread of a virus, or curtailing those which threaten to push global warming beyond 1.5°C – our task as a society is to build an economy which helps everyone live well within those limits. For instance, the appeal during the pandemic to “stay home” could afterwards become “stay grounded”, as we scale down the enormously carbon-intensive aviation industry while expanding green public transport.

Secondly, COVID-19 has also prompted society to reconsider how we value different forms of labour. The heroes of the pandemic are those undervalued by our current economic system, often working for low wages or in poor conditions. They are, among others, the cleaners, shop workers, farmers, nurses, rubbish collectors, teachers, postal workers and food couriers. Feminist economists describe this work - disproportionately done by women - as the “reproductive economy”, so called because it provides the essential services on which the rest of society depends for its day to day functioning.

Lots of vital reproductive work also occurs outside of the waged labour market, such as care of relatives in family homes. If all this unwaged labour were paid, it’s estimated that its global value would total $10.8 trillion per year. A care income could support all those doing unpaid work caring for other people and their local environments.

Reproductive work is central to sustaining well-being, but it also tends to have a lower ecological impact than much of the industrial economy. For these reasons, a degrowth transition could reduce ecological degradation by shrinking the sectors that pollute the most, like the fossil fuel industry and aviation, while expanding reproductive sectors such as health care, education and ecosystems restoration.

The COVID-19 pandemic has undeniably created an upsurge of political imagination. Now, as the restructuring of the post-pandemic economy begins, we must resist the return to infinite growth. The future of life on Earth depends upon it.

**Warming causes extinction – any reduction should be prioritized above other impacts**

**Ramanathan et al. 17** [Veerabhadran Ramanathan is Victor Alderson Professor of Applied Ocean Sciences and director of the Center for Atmospheric Sciences at the Scripps Institution of Oceanography, University of California, San Diego, Dr. William Collins is an internationally recognized expert in climate modeling and climate change science. He is the Director of the Climate and Ecosystem Sciences Division (CESD) for the Earth and Environmental Sciences Area (EESA) at the Lawrence Berkeley National Laboratory (LBNL), Prof. Dr Mark Lawrence, Ph.D. is scientific director at the Institute for Advanced Sustainability Studies (IASS) in Potsdam, Örjan Gustafsson is a Professor in the Department of Environmental Science and Analytic Chemistry at Stockholm University, Shichang Kang is Professor, Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences (CAS); CAS Center for Excellence in Tibetan Plateau Earth Sciences, and Molina, M.J., Zaelke, D., Borgford-Parnell, N., Xu, Y., Alex, K., Auffhammer, M., Bledsoe, P., Croes, B., Forman, F., Haines, A., Harnish, R., Jacobson, M.Z., Lawrence, M., Leloup, D., Lenton, T., Morehouse, T., Munk, W., Picolotti, R., Prather, K., Raga, G., Rignot, E., Shindell, D., Singh, A.K., Steiner, A., Thiemens, M., Titley, D.W., Tucker, M.E., Tripathi, S., & Victor, D., authors come from the following 9 countries - US, Switzerland, Sweden, UK, China, Germany, Australia, Mexico, India, “Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from Extreme Climate Change,” Report of the Committee to Prevent Extreme Climate Change, September 2017, http://www.igsd.org/wp-content/uploads/2017/09/Well-Under-2-Degrees-Celsius-Report-2017.pdf] TDI

Climate change is becoming an existential threat with warming in excess of 2°C within the next three decades and 4°C to 6°C within the next several decades. Warming of such magnitudes will expose as many as 75% of the world’s population to deadly heat stress in addition to disrupting the climate and weather worldwide. Climate change is an urgent problem requiring urgent solutions. This paper lays out urgent and practical solutions that are ready for implementation now, will deliver benefits in the next few critical decades, and places the world on a path to achieving the longterm targets of the Paris Agreement and near-term sustainable development goals. The approach consists of four building blocks and 3 levers to implement ten scalable solutions described in this report by a team of climate scientists, policy makers, social and behavioral scientists, political scientists, legal experts, diplomats, and military experts from around the world. These solutions will enable society to decarbonize the global energy system by 2050 through efficiency and renewables, drastically reduce short-lived climate pollutants, and stabilize the climate well below 2°C both in the near term (before 2050) and in the long term (post 2050). It will also reduce premature mortalities by tens of millions by 2050. As an insurance against policy lapses, mitigation delays and faster than projected climate changes, the solutions include an Atmospheric Carbon Extraction lever to remove CO2 from the air. The amount of CO2 that must be removed ranges from negligible, if the emissions of CO2 from the energy system and SLCPs start to decrease by 2020 and carbon neutrality is achieved by 2050, to a staggering one trillion tons if the carbon lever is not pulled and emissions of climate pollutants continue to increase until 2030.

There are numerous living laboratories including 53 cities, many universities around the world, the state of California, and the nation of Sweden, who have embarked on a carbon neutral pathway. These laboratories have already created 8 million jobs in the clean energy industry; they have also shown that emissions of greenhouse gases and air pollutants can be decoupled from economic growth. Another favorable sign is that growth rates of worldwide carbon emissions have reduced from 2.9% per year during the first decade of this century to 1.3% from 2011 to 2014 and near zero growth rates during the last few years. The carbon emission curve is bending, but we have a long way to go and very little time for achieving carbon neutrality. We need institutions and enterprises that can accelerate this bending by scaling-up the solutions that are being proven in the living laboratories. We have less than a decade to put these solutions in place around the world to preserve nature and our quality of life for generations to come. The time is now.

The Paris Agreement is an historic achievement. For the first time, effectively all nations have committed to limiting their greenhouse gas emissions and taking other actions to limit global temperature change. Specifically, 197 nations agreed to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels,” and achieve carbon neutrality in the second half of this century.

The climate has already warmed by 1°C. The problem is running ahead of us, and under current trends we will likely reach 1.5°C in the next fifteen years and surpass the 2°C guardrail by mid-century with a 50% probability of reaching 4°C by end of century. Warming in excess of 3°C is likely to be a global catastrophe for three major reasons:

• Warming in the range of 3°C to 5°C is suggested as the threshold for several tipping points in the physical and geochemical systems; a warming of about 3°C has a probability of over 40% to cross over multiple tipping points, while a warming close to 5°C increases it to nearly 90%, compared with a baseline warming of less than 1.5°C, which has only just over a 10% probability of exceeding any tipping point.

**•** Health effects of such warming are emerging as a major if not dominant source of concern. Warming of 4°C or more will expose more than 70% of the population, i.e. about 7 billion by the end of the century, to deadly heat stress and expose about 2.4 billion to vector borne diseases such as Dengue, Chikengunya, and Zika virus among others. Ecologists and paleontologists have proposed that warming in excess of 3°C, accompanied by increased acidity of the oceans by the buildup of CO2 , can become a major causal factor for exposing more than 50% of all species to extinction. 20% of species are in danger of extinction now due to population, habitat destruction, and climate change.

The good news is that there may still be time to avert such catastrophic changes. The Paris Agreement and supporting climate policies must be strengthened substantially within the next five years to bend the emissions curve down faster, stabilize climate, and prevent catastrophic warmin**g**. To the extent those efforts fall short, societies and ecosystems will be forced to contend with substantial needs for adaptation—a burden that will fall disproportionately on the poorest three billion who are least responsible for causing the climate change problem**.**

Here we propose a policy roadmap with a realistic and reasonable chance of limiting global temperature to safe levels and preventing unmanageable climate change—an outline of specific science-based policy pathways that serve as the building blocks for a three-lever strategy that could limit warming to well under 2°C. The projections and the emission pathways proposed in this summary are based on a combination of published recommendations and new model simulations conducted by the authors of this study (see Figure 2). We have framed the plan in terms of four building blocks and three levers, which are implemented through 10 solutions. The first building block would be fully implementing the nationally determined mitigation pledges under the Paris Agreement of the UN Framework Convention on Climate Change (UNFCCC). In addition, several sister agreements that provide targeted and efficient mitigation must be strengthened. Sister agreements include the Kigali Amendment to the Montreal Protocol to phase down HFCs, efforts to address aviation emissions through the International Civil Aviation Organization (ICAO), maritime black carbon emissions through the International Maritime Organization (IMO), and the commitment by the eight countries of the Arctic Council to reduce black carbon emissions by up to 33%. There are many other complementary processes that have drawn attention to specific actions on climate change, such as the Group of 20 (G20), which has emphasized reform of fossil fuel subsidies, and the Climate and Clean Air Coalition (CCAC). HFC measures, for example, can avoid as much as 0.5°C of warming by 2100 through the mandatory global phasedown of HFC refrigerants within the next few decades, and substantially more through parallel efforts to improve energy efficiency of air conditioners and other cooling equipment potentially doubling this climate benefit.

For the second building block, numerous subnational and city scale climate action plans have to be scaled up. One prominent example is California’s Under 2 Coalition signed by over 177 jurisdictions from 37 countries in six continents covering a third of world economy. The goal of this Memorandum of Understanding is to catalyze efforts in many jurisdictions that are comparable with California’s target of 40% reductions in CO2 emissions by 2030 and 80% reductions by 2050—emission cuts that, if achieved globally, would be consistent with stopping warming at about 2°C above pre-industrial levels. Another prominent example is the climate action plans by over 52 cities and 65 businesses around the world aiming to cut emissions by 30% by 2030 and 80% to 100% by 2050. There are concerns that the carbon neutral goal will hinder economic progress; however, real world examples from California and Sweden since 2005 offer evidence that economic growth can be decoupled from carbon emissions and the data for CO2 emissions and GDP reveal that growth in fact prospers with a green economy.

The third building block consists of two levers that we need to pull as hard as we can: one for drastically reducing emissions of short-lived climate pollutants (SLCPs) beginning now and completing by 2030, and the other for decarbonizing the global energy system by 2050 through efficiency and renewables. Pulling both levers simultaneously can keep global temperature rise below 2°C through the end of the century. If we bend the CO2 emissions curve through decarbonization of the energy system such that global emissions peak in 2020 and decrease steadily thereafter until reaching zero in 2050, there is less than a 20% probability of exceeding 2°C. This call for bending the CO2 curve by 2020 is one key way in which this report’s proposal differs from the Paris Agreement and it is perhaps the most difficult task of all those envisioned here. Many cities and jurisdictions are already on this pathway, thus demonstrating its scalability. Achieving carbon neutrality and reducing emissions of SLCPs would also drastically reduce air pollution globally, including all major cities, thus saving millions of lives and over 100 million tons of crops lost to air pollution each year. In addition, these steps would provide clean energy access to the world’s poorest three billion who are still forced to resort to 18th century technologies to meet basic needs such as cooking. For the fourth and the final building block, we are adding a third lever, ACE (Atmospheric Carbon Extraction, also known as Carbon Dioxide Removal, or “CDR”). This lever is added as an insurance against surprises (due to policy lapses, mitigation delays, or non-linear climate changes) and would require development of scalable measures for removing the CO2 already in the atmosphere. The amount of CO2 that must be removed will range from negligible, if the emissions of CO2 from the energy system and SLCPs start to decrease by 2020 and carbon neutrality is achieved by 2050, to a staggering one trillion tons, if CO2 emissions continue to increase until 2030, and the carbon lever is not pulled until after 2030. This issue is raised because the NDCs (Nationally Determined Contributions) accompanying the Paris Agreement would allow CO2 emissions to increase until 2030. We call on economists and experts in political and administrative systems to assess the feasibility and cost-effectiveness of reducing carbon and SLCPs emissions beginning in 2020 compared with delaying it by ten years and then being forced to pull the third lever to extract one trillion tons of CO2

The fast mitigation plan of requiring emissions reductions to begin by 2020, which means that many countries need to cut now, is urgently needed to limit the warming to well under 2°C. Climate change is not a linear problem. Instead, we are facing non-linear climate tipping points that can lead to self-reinforcing and cascading climate change impacts. Tipping points and selfreinforcing feedbacks are wild cards that are more likely with increased temperatures, and many of the potential abrupt climate shifts could happen as warming goes from 1.5°C in 15 years to 2°C by 2050, with the potential to push us well beyond the Paris Agreement goals.

Where Do We Go from Here?

A massive effort will be needed to stop warming at 2°C, and time is of the essence. With unchecked business-as-usual emissions, global warming has a 50% likelihood of exceeding 4ºC and a 5% probability of exceeding 6ºC in this century, raising existential questions for most, but especially the poorest three billion people. A 4ºC warming is likely to expose as many as 75% of the global population to deadly heat**.** Dangerous to catastrophic impacts on the health of people including generations yet to be born, on the health of ecosystems, and on species extinction have emerged as major justifications for mitigating climate change well below 2ºC, although we must recognize that the uncertainties intrinsic in climate and social systems make it hard to pin down exactly the level of warming that will trigger possibly catastrophic impacts. To avoid these consequences, we must act now, and we must act fast and effectively. This report sets out a specific plan for reducing climate change in both the near- and long-term. With aggressive urgent actions, we can protect ourselves. Acting quickly to prevent catastrophic climate change by decarbonization will save millions of lives, trillions of dollars in economic costs, and massive suffering and dislocation to people around the world. This is a global security imperative, as it can avoid the migration and destabilization of entire societies and countries and reduce the likelihood of environmentally driven civil wars and other conflicts.

Staying well under 2°C will require a concerted global effort. We must address everything from our energy systems to our personal choices to reduce emissions to the greatest extent possible. We must redouble our efforts to invent, test, and perfect systems of governance so that the large measure of international cooperation needed to achieve these goals can be realized in practice. The health of people for generations to come and the health of ecosystems crucially depend on an energy revolution beginning now that will take us away from fossil fuels and toward the clean renewable energy sources of the future. It will be nearly impossible to obtain other critical social goals, including for example the UN agenda 2030 with the Sustainable Development Goals, if we do not make immediate and profound progress stabilizing climate, as we are outlining here.

1. The Building Blocks Approach The 2015 Paris Agreement, which went into effect November 2016, is a remarkable, historic achievement. For the frst time, essentially all nations have committed to limit their greenhouse gas emissions and take other actions to limit global temperature and adapt to unavoidable climate change. Nations agreed to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels” and “achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century” (UNFCCC, 2015). Nevertheless, the initial Paris Agreement has to be strengthened substantially within fve years if we are to prevent catastrophic warming; current pledges place the world on track for up to 3.4°C by 2100 (UNEP, 2016b). Until now, no specifc policy roadmap exists that provides a realistic and reasonable chance of limiting global temperatures to safe levels and preventing unmanageable climate change. This report is our attempt to provide such a plan— an outline of specifc solutions that serve as the building blocks for a comprehensive strategy for limiting the warming to well under 2°C and avoiding dangerous climate change (Figure 1). The frst building block is the full implementation of the nationally determined mitigation pledges under the Paris Agreement of the UN Framework Convention on Climate Change (UNFCCC) and strengthening global sister agreements, such as the Kigali Amendment to the Montreal Protocol to phase down HFCs, which can provide additional targeted, fast action mitigation at scale. For the second building block, numerous sub-national and city scale climate action plans have to be scaled up such as California’s Under 2 Coalition signed by 177 jurisdictions from 37 countries on six continents. The third building block is targeted measures to reduce emissions of shortlived climate pollutants (SLCPs), beginning now and fully implemented by 2030, along with major measures to fully decarbonize the global economy, causing the overall emissions growth rate to stop in 2020-2030 and reach carbon neutrality by 2050. Such a deep decarbonization would require an energy revolution similar to the Industrial Revolution that was based on fossil fuels. The fnal building block includes scalable and reversible carbon dioxide (CO2 ) removal measures, which can begin removing CO2 already emitted into the atmosphere. Such a plan is urgently needed. Climate change is not a linear problem. Instead, climate tipping points can lead to self-reinforcing, cascading climate change impacts (Lenton et al., 2008). Tipping points are more likely with increased temperatures, and many of the potential abrupt climate shifts could happen as warming goes from 1.5°C to 2°C, with the potential to push us well beyond the Paris Agreement goals (Drijfhout et al., 2015). In order to avoid dangerous climate change, we must address these concerns. We must act now, and we must act fast. Reduction of SLCPs will result in fast, near-term reductions in warming, while present-day reductions of CO2 will result in long-term climate benefts. This two-lever approach—aggressively cutting both SLCPs and CO2 –-will slow warming in the coming decades when it is most crucial to avoid impacts from climate change as well as maintain a safe climate many decades from now. To achieve the nearterm goals, we have outlined solutions to be implemented immediately. These solutions to bend down the rising emissions curve and thus bend the warming trajectory curve follow a 2015 assessment by the University of California under its Carbon Neutrality Initiative (Ramanathan et al., 2016). The solutions are clustered into categories of social transformation, governance improvement, market- and regulation-based solutions, technological innovation and transformation, and natural and ecosystem management. Additionally, we need to intensely investigate and pursue a third lever—ACE (Atmospheric Carbon Extraction). While many potential technologies exist, we do not know the extent to which they could be scaled up to remove the requisite amount of carbon from the atmosphere in order to achieve the Paris Agreement goals, and any delay in mitigation will demand increasing reliance on these technologies. Yet, there is still hope. Humanity can come together, as we have done in the past, to collaborate towards a common goal. We have no choice but to tackle the challenge of climate change. We only have the choice of when and how: either now, through the ambitious plan outlined here, or later, through radical adaptation and societal transformations in response to an ever-deteriorating climate system that will unleash devastating impacts—some of which may be beyond our capacity to fully adapt to or reverse for thousands of years.

2. Major Climate Disruptions: How Soon and How Fast? “Without adequate mitigation and adaptation, climate change poses unacceptable risks to global public health.” (WHO, 2016)

The planet has already witnessed nearly 1°C of warming, and another 0.6°C of additional warming is currently stored in the ocean to be released over the next two to four decades, if climate warming emissions are not radically reduced during that time (IPCC, 2013). The impacts of this warming on extreme weather, droughts, and foods are being felt by society worldwide to the extent that many think of this no longer as climate change but as climate disruption. Consider the business as usual scenario:

15 years from now: In 15 years, planetary warming will reach 1.5°C above pre-industrial global mean temperature (Ramanathan and Xu, 2010; Shindell et al., 2012). This exceeds the 0.5°C to 1°C of warming during the Eemian period, 115,000– 130,000 years ago, when sea-levels reached 6-9 meters (20-30 feet) higher than today (Hansen et al., 2016b). The impacts of this warming will affect us all yet will disproportionately affect the Earth’s poorest three billion people, who are primarily subsistence farmers that still rely on 18th century technologies and have the least capacity to adapt (IPCC, 2014a; Dasgupta et al., 2015). They thus may be forced to resort to mass migration into city slums and push across international borders (U.S. DOD, 2015). The existential fate of lowlying small islands and coastal communities will also need to be addressed, as they are primarily vulnerable to sea-level rise, diminishing freshwater resources, and more intense storms. In addition, many depend on fsheries for protein, and these are likely to be affected by ocean acidifcation and climate change. Climate injustice could start causing visible regional and international conficts. All of this will be exacerbated as the risk of passing tipping points increases (Lenton et al., 2008).

30 years from now: By mid-century, warming is expected to exceed 2°C, which would be unprecedented with respect to historical records of at least the last one million years (IPCC, 2014c). Such a warming through this century could result in sea-level rise of as much as 2 meters by 2100, with greater sea-level rise to follow. A group of tipping points are clustered between 1.5°C and 2°C (Figure 2) (Drijfhout et al., 2015). The melting of most mountain glaciers, including those in the Tibetan-Himalayas, combined with mega-droughts, heat waves, storms, and foods, would adversely affect nearly everyone on the planet.

80 years from now: In 80 years, warming is expected to exceed 4°C, increasing the likelihood of irreversible and catastrophic change (World Bank, 2013b). 4ºC warming is likely to expose as much as 75% of the global population to deadly heat (Mora et al., 2017). The 2°C and 4°C values quoted above and in other reports, however, are merely the central values with a 50% probability of occurrence (Ramanathan and Feng, 2008). There is a 5% probability the warming could be as high as 6°C due to uncertainties in the magnitude of amplifying feedbacks (see Section 4). This in turn could lead to major disruptions to natural and social systems, threatening food security, water security, and national security and fundamentally affecting the great majority of the projected 11.2 billion inhabitants of the planet in 2100 (UN DESA, 2015).

3. What Are the Wild Cards for Climate Disruption? Increasing the concentrations of greenhouse gases in the atmosphere increases radiative forcing (the difference between the amount of energy entering the atmosphere and leaving) and thus increases the global temperature (IPCC, 2013). However, climate wild cards exist that can alter the linear connection with warming and anthropogenic emissions by triggering abrupt changes in the climate (Lenton et al., 2008). Some of these wild cards have not been thoroughly captured by the models that policymakers rely on the most. These abrupt shifts are irreversible on a human time scale (<100 years) and will create a notable disruption to the climate system, condemning the world to warming beyond that which we have previously projected. These climate disruptions would divert resources from needed mitigation and upset mitigation strategies that we have already put in place.

1. Unmasking Aerosol Cooling: The frst such wild card is the unmasking of an estimated 0.7°C (with an uncertainty range of 0.3°C to 1.2°C) of the warming in addition to mitigating other aerosol effects such as disrupting rainfall patterns, by reducing emissions of aerosols such as sulfates and nitrates as part of air pollution regulations (Wigley, 1991; Ramanathan and Feng, 2008). Aerosol air pollution is a major health hazard with massive costs to public health and society, including contributing to about 7 million deaths (from household and ambient exposure) each year (WHO, 2014). While some aerosols, such as black carbon and brown carbon, strongly absorb sunlight and warm the climate, others refect sunlight back into space, which cools the climate (Ramanathan and Carmichael, 2008). The net impact of all manmade aerosols is negative, meaning that about 30% of the warming from greenhouse gases is being masked by co-emitted air pollution particles (Ramanathan and Carmichael, 2008). As we reduce greenhouse gas emissions and implement policies to eliminate air pollution, we are also reducing the concentration of aerosols in the air. Aerosols last in the atmosphere for about a week, so if we eliminate air pollution without reducing emissions of the greenhouse gases, the unmasking alone would lead to an estimated 0.7°C of warming within a matter of decades (Ramanathan and Feng, 2008). We must eliminate all aerosol emissions due to their health effects, but we must simultaneously mitigate emissions of CO2 , other greenhouse gases, and black carbon and co-pollutants to avoid an abrupt and very large jump in the near-term warming beyond 2°C (Brasseur and Roeckner, 2005).

2. Tipping Points**:** It is likely that as we cross the 1.5°C to 2°C thresholds we will trigger so called “tipping points” for abrupt and nonlinear changes in the climate system with catastrophic consequences for humanity and the environment (Lenton, 2008; Drijfhout et al., 2015). Once the tipping points are passed, the resulting impacts will range in timescales from: disruption of monsoon systems (transition in a year), loss of sea ice (approximately a decade for transition), dieback of major forests (nearly half a century for transition), reorganization of ocean circulation (approximately a century for transition), to loss of ice sheets and subsequent sea-level rise (transition over hundreds of years) (Lenton et al., 2008). Regardless of timescale, once underway many of these changes would be irreversible (Lontzek et al., 2015). There is also a likelihood of crossing over multiple tipping points simultaneously. Warming of close to 3°C would subject the system to a 46% probability of crossing multiple tipping points, while warming of close to 5°C would increase the risk to 87% (Cai et al., 2016). Recent modeling work shows a “cluster” of these tipping points could be triggered between 1.5°C and 2°C warming (Figure 2), including melting of land and sea ice and changes in highlatitude ocean circulation (deep convection) (Drijfhout et al., 2015). This is consistent with existing observations and understanding that the polar regions are particularly sensitive to global warming and have several potentially imminent tipping points. The Arctic is warming nearly twice as quickly as the global average, which makes the abrupt changes in the Arctic more likely at a lower level of global warming (IPCC, 2013). Similarly, the Himalayas are warming at roughly the same rate as the Arctic and are thus also more susceptible to incremental changes in temperature (UNEP-WMO, 2011). This gives further justifcation for limiting warming to no more than 1.5°C.

While all climate tipping points have the potential to rapidly destabilize climate, social, and economic systems, some are also self-amplifying feedbacks that once set in motion increase warming in such a way that they perpetuate yet even more warming. Declining Arctic sea ice, thawing permafrost, and the poleward migration of cloud systems are all examples of self-amplifying feedback mechanisms, where initial warming feeds upon itself to cause still more warming acting as a force multiplier (Schuur et al., 2015).

#### The US would first strike Russia – they could eliminate their nuclear arsenal with a conventional strike

Plesch 18 [(Dan, Director of the Centre for International Studies and Diplomacy, SOAS, University of London) “Could the US win World War III without using nuclear weapons?” The Conversation, 4/19/2018] BC

As the US, Russia and China test each other’s patience and strategic focus, speculation about the chances of a world war has hit a new high. But many of the people seriously engaged in this weighty discussion often get it wrong.

When it comes to estimating military capability, the Western media is principally concerned with the weapons capabilities of weaker states – and it rarely pays much attention to the colossal capability of the US, which still accounts for most of the world’s defence spending.

Any sensible discussion of what a hypothetical World War III might look like needs to begin with the sheer size and force of America’s military assets. For all that China and Russia are arming up on various measures, US commanders have the power to dominate escalating crises and counter opposing forces before they can be used.

Take missile warfare alone. The US Navy already has 4,000 Tomahawk cruise missiles, and the Navy and Air Force are currently taking delivery of 5,000 JASSM conventional cruise missiles with ranges from 200-600 miles. Barely visible to radar, these are designed to destroy “hardened” targets such as nuclear missile silos. Russia and China, by contrast, have nothing of equivalent quantity or quality with which to threaten the US mainland.

The same holds true when it comes to maritime forces. While much is made of Russia’s two frigates and smaller vessels stationed off the Syrian coast, France alone has 20 warships and an aircraft carrier in the Mediterranean – and US standing forces in the area include six destroyers equipped with scores of cruise missiles and anti-missile systems. At the other end of Europe, the Russian military is threatening the small Baltic states, but it is rarely noted that the Russian Baltic fleet is the same size as Denmark’s and half the size of Germany’s.

Meanwhile, China’s aggressively expansionist behaviour in the South China Sea is reported alongside stories of its first aircraft carrier and long-range ballistic missiles. But for all that the Chinese navy is large and growing, according to the International Institute for Strategic Studies, it’s still only numerically equivalent to the combined fleets of Japan and Taiwan, while the US boasts 19 aircraft carriers worldwide if its marine assault ships are included.

But overhanging all this, of course, is the nuclear factor.

Out of the sky

The US, Russia and China are all nuclear-armed; Vladimir Putin recently unveiled a new fleet of nuclear-capable missiles which he described as “invincible in the face of all existing and future systems”, and some have suggested that China may be moving away from its no-first-use policy. This is all undeniably disturbing. While it has long been assumed that the threat of nuclear weapons acts as a deterrent to any war between the major powers, it’s also possible that the world may simply have been riding its luck. But once again, the US’s non-nuclear capabilities are all too often overlooked.

US leaders may in fact believe they can remove Russia’s nuclear deterrent with an overwhelming conventional attack backed up by missile defences. This ability was cultivated under the Prompt Global Strike programme, which was initiated before 9/11 and continued during the Obama years. Organised through the US Air Force’s Global Strike Command, it is to use conventional weapons to attack anywhere on Earth in under 60 minutes.

This is not to say the task would be small. In order to destroy Russia’s nuclear missiles before they can be launched, the US military would need to first blind Russian radar and command and communications to incoming attack, probably using both physical and cyber attacks. It would then have to destroy some 200 fixed and 200 mobile missiles on land, a dozen Russian missile submarines, and Russian bombers. It would then need to shoot down any missiles that could still be fired.

Russia is not well positioned to survive such an attack. Its early warning radars, both satellite and land-based, are decaying and will be hard to replace. At the same time, the US has and is developing a range of technologies to carry out anti-satellite and radar missions, and it has been using them for years. (All the way back in 1985, it shot down a satellite with an F15 jet fighter.) That said, the West is very dependent on satellites too, and Russia and China continue to develop their own anti-satellite systems.

The air war

Russia’s bomber aircraft date back to the Soviet era, so despite the alarm they provoke when they nudge at Western countries’ airspace, they pose no major threat in themselves. Were the Russian and US planes to face each other, the Russians would find themselves under attack from planes they couldn’t see and that are any way out of their range.

US and British submarine crews claim a perfect record in constantly shadowing Soviet submarines as they left their bases throughout the Cold War. Since then, Russian forces have declined and US anti-submarine warfare has been revived, raising the prospect that Russian submarines could be taken out before they could even launch their missiles.

The core of the Russia’s nuclear forces consists of land-based missiles, some fixed in silos, others mobile on rail and road. The silo-based missiles can now be targeted by several types of missiles, carried by US planes almost invisible to radar; all are designed to destroy targets protected by deep concrete and steel bunkers. But a problem for US war planners is that it might take hours too long for their missile-carrying planes to reach these targets – hence the need to act in minutes.

One apparently simple solution to attacking targets very quickly is to fit quick nuclear ballistic missiles with non-nuclear warheads. In 2010, Robert Gates, then serving as secretary of defence under Barack Obama, said that the US had this capability. Intercontinental ballistic missiles take just 30 minutes to fly between the continental US’s Midwest and Siberia; if launched from well-positioned submarines, the Navy’s Tridents can be even quicker, with a launch-to-target time of under ten minutes.

From 2001, the US Navy prepared to fit its Trident missiles with either inert solid warheads – accurate to within ten metres – or vast splinter/shrapnel weapons. Critics have argued that this would leave a potential enemy unable to tell whether they were under nuclear or conventional attack, meaning they would have to assume the worst. According to US Congressional researchers, the development work came close to completion, but apparently ceased in 2013.

Nonetheless, the US has continued to develop other technologies across its armed services to attack targets around the world in under an hour – foremost among them hypersonic missiles, which could return to Earth at up to ten times the speed of sound, with China and Russia trying to keep up.

Missile envy

The remainder of Russia’s nuclear force consists of missiles transported by rail. An article on Kremlin-sponsored news outlet Sputnik described how these missile rail cars would be so hard to find that Prompt Global Strike might not be as effective as the US would like – but taken at face value, the article implies that the rest of the Russian nuclear arsenal is in fact relatively vulnerable.

Starting with the “Scud hunt” of the First Gulf War, the US military has spent years improving its proficiency at targeting mobile ground-based missiles. Those skills now use remote sensors to attack small ground targets at short notice in the myriad counter-insurgency operations it’s pursued since 2001.

If the “sword” of Prompt Global Strike doesn’t stop the launch of all Russian missiles, then the US could use the “shield” of its own missile defences. These it deployed after it walked out of a treaty with Russia banning such weapons in 2002.

While some of these post-2002 missile defence systems have been called ineffective, the US Navy has a more effective system called Aegis, which one former head of the Pentagon’s missile defence programs claims can shoot down intercontinental ballistic missiles. Some 300 Aegis anti-ballistic missiles now equip 40 US warships; in 2008, one destroyed a satellite as it fell out of orbit.

War mentality

In advance of the Iraq war, various governments and onlookers cautioned the US and UK about the potential for unforeseen consequences, but the two governments were driven by a mindset impervious to criticism and misgivings. And despite all the lessons that can be learned from the Iraq disaster, there’s an ample risk today that a similarly gung-ho attitude could take hold.

Foreign casualties generally have little impact on domestic US politics. The hundreds of thousands of Iraqi civilians who died under first sanctions and then war did not negatively impact presidents Clinton or George W. Bush. Neither might the prospect of similar casualties in Iran or North Korea or other states, especially if “humanitarian” precision weapons are used.

But more than that, an opinion poll run by Stanford University’s Scott Sagan found that the US public would not oppose the preemptive use of even nuclear weapons provided that the US itself was not affected. And nuclear Trident offers that temptation.

The control of major conventional weapons as well as WMD needs urgent attention from international civil society, media and political parties. There is still time to galvanise behind the Nobel-winning International Campaign to Abolish Nuclear Weapons and the nuclear ban treaty, and to revive and globalise the decaying arms control agenda of the Organisation for Security and Co-operation in Europe, which played a vital part in bringing the Cold War to a largely peaceful end.

Like the Kaiser in 1914, perhaps Trump or one of his successors will express dismay when faced with the reality a major US offensive unleashes. But unlike the Kaiser, who saw his empire first defeated and then dismembered, perhaps a 21st-century US president might get away with it.

**Successful preemptive strike forces a surrender – solves further escalation**

Sarah **Johnson 17**, "U.S. Nuclear First Strike Policy; Be Afraid", Bill Track 50, https://www.billtrack50.com/blog/in-the-news/u-s-nuclear-first-strike-policy-be-afraid/

The second situation is a [preemptive strike](http://www.dictionary.com/browse/preemptive-strike) — a first-strike attack with nuclear weapons carried out to destroy an enemy’s capacity to respond. Preemptive strikes can be based on the assumption that the enemy is planning an **imminent attack**, but don’t have to be. The methodology behind a preemptive nuclear strike is to attack the enemy’s **strategic nuclear weapon facilities** (missile silos, submarine bases, bomber airfields), command and control sites and storage depots first. By hitting these targets first the enemy will be **so wounded** with **so little of their resources left** that they will be **forced to surrender** with minimal damage to the attacking party.

**Otherwise, Russia will broadly scale up military AI – extinction**

Mike **Rogers 17**, former US Representative from Michigan, chairman of the House Permanent Select Committee on Intelligence, "Artificial intelligence — the arms race we may not be able to control", TheHill, https://thehill.com/opinion/technology/351725-artificial-intelligence-is-the-new-arms-race-we-may-not-be-able-to-control

“Whoever becomes the leader in this sphere will **become ruler of the world**,” [said](https://www.theverge.com/2017/9/4/16251226/russia-ai-putin-rule-the-world) Vladimir Putin. The sphere the President of Russia is referring to is **artificial intelligence** (AI) and his comments should give you a moment of pause. Addressing students at the beginning of our Labor Day weekend, Putin remarked “Artificial intelligence is the future, not only for Russia, but for all humankind,” adding, “It comes with colossal opportunities, but also threats that are difficult to predict.” For once, I find myself in agreement with the President of Russia, but just this once. Artificial Intelligence offers **incredible** promise and **peril**. **Nowhere is this clearer than in the realm of national security**. Today un-crewed systems are a fact of modern warfare. Nearly every country is adopting systems where personnel are far removed from the conflict and wage war by remote control. AI [stands](https://www.nytimes.com/2016/10/26/us/pentagon-artificial-intelligence-terminator.html) to sever that ground connection. Imagine a **fully autonomous Predator or Reaper drone**. Managed by an AI system, the drone could **identify targets**, **determine their legitimacy**, and **conduct a strike** all **without human intervention.** Indeed, the Ministry of Defence of the United Kingdom issued a press [statement](https://www.theverge.com/2017/9/12/16286580/uk-government-killer-robots-drones-weapons) in September that the country “does not possess fully autonomous weapon systems and has no intention of developing them,” and that its weapons systems “will always be under control as an absolute guarantee of human oversight and authority and accountability.” Let’s think smaller. Imagine a tiny insect-sized drone loaded with explosive. Guided by a [pre-programmed AI](https://www.amazon.com/Life-3-0-Being-Artificial-Intelligence/dp/1101946598), it could hunt down a specific target — a politician, a general, or an opposition figure — determine when to strike, how to strike, and if to strike based on its own learning. Howard Hughes Medical Center [recently](https://qz.com/1000011/scientists-attached-an-electronic-backpack-to-a-genetically-modified-dragonfly-and-turned-it-into-a-drone/) attached a backpack to a genetically modified dragonfly and flew it remotely. These examples are, however, where humans are involved and largely control the left and right limits of AI. **Yet, there are examples of AI purposely and independently going beyond programed parameters.** Rogue algorithms led to a [flash crash](http://gizmodo.com/rogue-algorithm-blamed-for-historic-crash-of-the-britis-1787523587) of the British Pound. In 2016, in-game AIs **created super AIs weapons** and [**hunted down**](http://www.kotaku.co.uk/2016/06/03/elites-ai-created-super-weapons-and-started-hunting-players-skynet-is-here) **human players**, and AIs have [**created**](https://www.forbes.com/sites/tonybradley/2017/07/31/facebook-ai-creates-its-own-language-in-creepy-preview-of-our-potential-future/#1cf69787292c) **their own languages** that were **indecipherable to humans**. AIs proved more effective than their human counterparts in producing and catching users in **spear phishing programs**. Not only did the AIs create more content, they successfully [captured](https://www.blackhat.com/docs/us-16/materials/us-16-Seymour-Tully-Weaponizing-Data-Science-For-Social-Engineering-Automated-E2E-Spear-Phishing-On-Twitter.pdf) more users with their deception. While seemingly simple and low stakes in nature, **extrapolate these scenarios into more significant and risky areas and the consequences become much greater.** Cybersecurity is no different. Today we are focused on the hackers, trolls, and cyber criminals (officially sanctioned and otherwise) who seek to penetrate our networks, steal our intellectual property, and leave behind malicious code for activation in the event of a conflict. Replace the individual with an AI and imagine how fast hacking takes place; networks against networks, at machine speed all without a human in the loop. Sound far-fetched? **It’s not**. In 2016, the Defense Advanced Research Projects Agency held an AI on AI capture the flag contest called the [Cyber Grand Challenge](https://www.youtube.com/watch?v=qSgYu3w3DMM) at the DEF CON event. AI networks against AI networks. In August of this year the founders of 116 AI and robotics companies signed a letter petitioning the United Nations [to ban](https://www.theverge.com/2017/8/21/16177828/killer-robots-ban-elon-musk-un-petition) lethal autonomous systems. Signatories to this letter included Google DeepMind’s co-founder Mustafa Suleyman and Elon Musk who, in response to Putin’s quote [tweeted](https://twitter.com/elonmusk/status/904638455761612800), “Competition for AI superiority at national level most likely cause of WW3 imo (sic)”. AI is not some far off future challenge. It is a challenge today and one with which we must grapple. I am in favor of fielding any system that enhances our national security, but we must have an open and honest conversation about the implications of AI, the consequences of which **we do not**, **and may not**, **fully understand**. This is not a new type of bullet or missile. This is a potentially **fully autonomous system** that even with human oversight and guidance will make its own decisions on the battlefield and in cyberspace. How can we ensure that the system does not **escape our control?** How can we prevent such systems from falling into the hands of terrorists or insurgents? Who controls the source code? How and can we build in so-called impenetrable kill switches? AI and AI-like systems are slowly being introduced into our arsenal. Our adversaries, China, Russia, and others are also introducing AI systems into their arsenals as well. Implementation is happening faster than our ability to fully **comprehend the consequences.** Putin’s new call spells out a new arms race. **Rushing to AI weapon systems without guiding principles is a dangerous**. It risks an **escalation** that we do not fully understand and may not be able to control. The cost of limiting AI intelligence being weaponized [**could vastly exceed**](https://www.belfercenter.org/sites/default/files/files/publication/AI%20NatSec%20-%20final.pdf) **all of our nuclear proliferation efforts to date**. More troubling, the **consequences of failure are equally existential.**

#### \*Capitalism is the root cause of disease – it encourages industrial ag, loss of ecological diversity, and increased interaction with pathogens

Duzgun 4/5 [(Eren, teaches Historical Sociology and International Relations at Leiden University, Netherlands.) “Capitalism, Coronavirus and the Road to Extinction” The Bullet, 4/5/2020] BC

Contradictions on a Global Scale

Critical biologists and epidemiologists have put the blame on industrial agriculture as the root cause of the emergence of new pathogens since the 1990s. According to Rob Wallace, giant agribusiness and resource extraction firms have now reached the last virgin forests and smallholder-held farmlands in the world, subordinating them to the logic of capitalist markets.

The loss of the ecological diversity and complexity of these huge tracts of land has increasingly forced wild food operators to hunt in previously untouched parts of the jungle, which, in turn, has increased “the interaction with, and spillover of, previously boxed-in pathogens, including Covid-19.” Likewise, global warming has forced or allowed pathogens to escape their natural habitat. As a result, new viruses against which we have no immunity “are being sprung free, threatening the whole world.” In short, as John Vidal writes, “we disrupt ecosystems, and we shake viruses loose from their natural hosts. When that happens, they need a new host. Often, we are it.”

That some agribusiness firms have been blatantly risking lives for profit would not come as a surprise to the critical reader. Even Bill Gates has been sounding the alarm about the potentially deadly consequences of irresponsible business practices and new viruses. Yet, what tends to remain underemphasized in these debates is that the blame belongs neither solely to ‘greedy’ firms that have driven viruses out of their natural habitat, nor to ‘short-sighted’ politicians who have not invested enough in vaccine technology or national health systems. Instead, the problem is rooted in the very structure and rationality of the system as a whole. That is, we may go extinct as a result of the ‘successes’ of the very system ‘we’ created in the first place, i.e., capitalism.

How did we end up losing control of an ‘economic’ system of our own making? This is indeed an anomaly in human history. The conception of the ‘economy’ as an autonomous sphere dictating its own rules over society did not exist in non-capitalist societies. As the economic anthropologist Karl Polanyi put it, “neither under tribal, nor feudal, nor mercantile conditions was there… a separate economic system in society.” The economy either “remained nameless” or had “no obvious meaning,” for the economic process and prices were instituted through non-market means, such as kinship, marriage, age-groups, status, political patronage, etc. Even “where markets were most highly developed, as under the mercantile system,” the economic system, as a rule, “was absorbed in the social system” and showed “no tendency to expand at the expense of the rest.”

In this sense, the market with a distinctive logic, autonomy, and dynamic of its own was completely unknown to our ancestors, and indeed, the emergence of the idea of ‘self-regulating’ markets represented a complete reversal of the way in which past economies functioned.

In order for ‘self-regulating’ markets to ‘self-regulate’, a variety of political and institutional arrangements had to be initiated to progressively eliminate the non-market survival strategies that humans previously relied upon. Most notably, the age-old communal systems of social and moral regulation needed to be eradicated, a process that systematically subordinated the ‘natural and human substance of society’, i.e., land and labour, to market relations for the first time in history.

Rise of Capitalism

At the heart of the rise of capitalism, therefore, rested a ‘political’, legal, and violent process that led to the historically unprecedented characterization of land and labour as commodities. Without commodifying land and labour, i.e., without treating the planet’s living substance as commodities, it would have been impossible to view the ‘economy’ as an institutionally and motivationally self-regulating sphere of life, an almost robotic creature functioning at the expense of human lives and livelihoods.

Capitalism presupposed from the very beginning a radical transformation in the human use of nature as well as in the provision of life’s essential requirements. In this sense, the danger of global extinction which we have been going through is not a temporary hiccup in an otherwise smoothly operating capitalist ecosystem but has always been a possibility built into the very structure of market society.

On the one hand, by treating land and labour as commodities, by subjecting people’s utilization of land and enjoyment of life to their ability to continuously increase market competitiveness and productivity, capitalism has enabled massive technological advancements in all spheres of life. This, in turn, has generated, above all, an unprecedented potential to feed, clothe, and accommodate an ever-increasing world population.

On the other hand, however, as Ellen Wood argues, by subordinating all other considerations to the imperatives of market competition, capitalism has also created poverty, homelessness, environmental destruction and pandemics. Billions of people who could be fed and housed are subjected to immense doses of insecurity, living their lives under the constant threat of joblessness, homelessness, loss of status and starvation. In a similar fashion, the environment that could be protected is systematically destroyed for profit, and killer viruses that could be contained are unleashed.

Undoubtedly, Covid-19 has become the archetypal example that lays bare “the destructive impulses of a system in which the very fundamentals of existence are subjected to the requirements of profit.”

Can the ‘positive’ and ‘negative’ outcomes of capitalism be somewhat reconciled? Indeed, for a brief period in the Global North, it seemed they could be. During the so-called Golden Age of Capitalism (1945-70), massive productivity increases (alongside working-class struggles) allowed for steady increases in wages, job security, expansion of welfare state, improvements in the living conditions of the majority of the labouring masses as well as the expansion of civil and political liberties.

Yet, this brief period of generalized prosperity and stability also facilitated the incorporation of the western working classes into the dominant capitalist ideology, causing them to turn a blind eye to the economically destabilizing, environmentally destructive, and socially degrading impact of global capitalism in the Global South.

The main ‘problem’ with the Global South has been, by and large, a question of ‘timing’. Once capitalism was established and consolidated in the Global North, it has not only led to the birth of new and more effective forms of imperialist control and neocolonial expansion but has also irrevocably undermined the potentially positive outcomes of capitalist development elsewhere.

For example, the MIT political economist Alice Amsden, a large chunk of whose work in the 1970s and 1980s sought to explain the success of the ‘Asian Tigers’, more recently concluded that the massive technological and infrastructural gap between the North and the South has literally made impossible capitalist ‘development’ of any sort in the vast majority of southern economies since the 1990s. The economic situation in the Global North has gotten progressively worse too. Under the conditions of increased global economic competition wages have been stagnating or declining since the 1970s, while decades of fiscal austerity wiping out most of the economic and social gains of the earlier period. The new reality of high unemployment, stagnant wages, long work hours and precarious jobs has been masked for a while by a debt-driven growth, the unsustainability of which has been bitterly testified by millions of people since the 2008 financial crisis.

All in all, market imperatives have been regulating social reproduction almost worldwide for a long time but with no prospect of capitalist ‘development’ for an overwhelming majority of the world’s population in the South and the North alike. Furthermore, the ecologically disastrous and socially inhumane consequences of capitalism have long outweighed the prospects of material gain in the Global South. In this respect, what is being painfully realized in the current conjuncture is that the North is no longer able to externalize the worst consequences of such an unsustainable mode of life. The North isn’t and won’t be spared the existential threats posed by global capitalism.

The implication is that any meaningful attempt at solving the present, and future crises needs to take the bull by the horn. There is literally no choice to be made between ‘capitalism’ and ‘capitalism with a human face’. As long as the underlying dynamics of our lives remain the same, as long as we keep treating nature and human beings as commodities, no cosmetic surgery will do.

To the contrary, historical experience suggests that such minimal interventions will sooner or later backfire, re-legitimizing capitalism pure and simple. The only way to ‘re-embed’ our economies and save our lives from ecological collapse is by intervening in the very heart of the beast: land and human beings need to be taken out of the market. The beast is not tameable; it needs to be killed. •

#### \*Diseases cause extinction – they’ll start in the U.S., which avoids burnout

Bar-Yam, 16 - SB and PhD in physics from MIT, president of the New England Complex Systems Institute (Yaneer Bar-Yam, "Transition to extinction: Pandemics in a connected world," *Medium*, 7-3-2016, https://medium.com/complex-systems-channel/transition-to-extinction-pandemics-in-a-connected-world-153867fe98f4#.2bxv2alfc)

When we introduce long range transportation into the model, the success of more aggressive strains changes. They can use the long range transportation to find new hosts and escape local extinction. Figure 3 shows that the more transportation routes introduced into the model, the more higher aggressive pathogens are able to survive and spread.

As we add more long range transportation, there is a critical point at which pathogens become so aggressive that the entire host population dies. The pathogens die at the same time, but that is not exactly a consolation to the hosts. We call this the phase transition to extinction (Figure 4). With increasing levels of global transportation, human civilization may be approaching such a critical threshold.

In the paper we wrote in 2006 about the dangers of global transportation for pathogen evolution and pandemics [8], we mentioned the risk from Ebola. Ebola is a horrendous disease that was present only in isolated villages in Africa. It was far away from the rest of the world only because of that isolation. Since Africa was developing, it was only a matter of time before it reached population centers and airports. While the model is about evolution, it is really about which pathogens will be found in a system that is highly connected, and Ebola can spread in a highly connected world.

The traditional approach to public health uses historical evidence analyzed statistically to assess the potential impacts of a disease. As a result, many were surprised by the spread of Ebola through West Africa in 2014. As the connectivity of the world increases, past experience is not a good guide to future events.

A key point about the phase transition to extinction is its suddenness. Even a system that seems stable, can be destabilized by a few more long-range connections, and connectivity is continuing to increase.

So how close are we to the tipping point? We don’t know but it would be good to find out before it happens.

While Ebola ravaged three countries in West Africa, it only resulted in a handful of cases outside that region. One possible reason is that many of the airlines that fly to west Africa stopped or reduced flights during the epidemic [9]. In the absence of a clear connection, public health authorities who downplayed the dangers of the epidemic spreading to the West might seem to be vindicated.

As with the choice of airlines to stop flying to west Africa, our analysis didn’t take into consideration how people respond to epidemics. It does tell us what the outcome will be unless we respond fast enough and well enough to stop the spread of future diseases, which may not be the same as the ones we saw in the past. As the world becomes more connected, the dangers increase.

Are people in western countries safe because of higher quality health systems? Countries like the U.S. have highly skewed networks of social interactions with some very highly connected individuals that can be “superspreaders.” The chances of such an individual becoming infected may be low but events like a mass outbreak pose a much greater risk if they do happen. If a sick food service worker in an airport infects 100 passengers, or a contagion event happens in mass transportation, an outbreak could very well prove unstoppable.

Watch this mock video of a pathogen spreading globally through land and air transportation. Long range transportation will continue to pose a threat of pandemic if its impacts cannot be contained.