**1AC**

**Mars**

**Plan: The appropriation of Mars by private entities is unjust.**

**Colonization**

**The pursuit of Mars colonization is actively harmful even though it won’t happen – legitimates and sanitizes the activity of the ultra rich**

**Kern 21**

(Sim, <https://www.independent.co.uk/voices/bezos-musk-branson-space-billionaires-b1886741.html>, 7-19)

Last weekend, Richard Branson described his bounce up to low-earth orbit as making space “more accessible to all.” **It’s laughably ironic for a billionaire to co-opt the language of inclusivity to describe the privatization of space flight.** However, mainstream media shared the speech far and wide, largely uncritically, with few journalists pointing out that this carnival ride for the uber-rich was funded with over $200 million dollars in taxpayer subsidies. None that I saw credited Chanda Prescod-Weinstein, the Black feminist astrophysicist whose line Branson reflected, and whose idea of making space accessible to all starts with social justice on earth. With this speech, Branson added to the chorus of billionaires using **science fiction fantasies to sell us on their vanity space programs**. Jeff Bezos will likely treat us to more high-minded speechifying in advance of his launch on Tuesday. He has described Blue Origin’s mission as necessary to avoid putting a limit on energy usage per capita on Earth. Basically, in order to avoid learning to live sustainably here, we must go up to space so we can keep exploiting the hell out of whatever we find up there. As SpaceX’s Elon Musk has said, “We don’t want to be one of those single planet species, we want to be a multi-planet species”. Never mind that we’ve found zero evidence of any kind of life on other planets, let alone intelligent life, let alone intelligent life spread across multiple planets; Musk’s rhetoric echoes a commonly-held belief that space colonization is an inevitability, that it’s our destiny. **We should be wary when rich people say that colonization is our destiny**. That rhetoric sounds awfully similar to Manifest Destiny, which provided greedy men a moral pretense to commit **a lot of atrocities.** I recently wrote a viral Twitter-thread-turned-essay about the enormous challenges of sustaining life in space, and why we’re not going to see lunar colonies anytime soon. But **just because these billionaires won’t succeed in establishing exoplanetary colonies in their lifetimes doesn’t mean their pursuit of them isn’t harmful.** Bezos, Branson, and Musk have sold the public on their space programs, and as a result, **we’re giving them a lot of our wealth** – billions of dollars of taxpayer money and billions in personal investments. What’s more, the global economic system is rigged so that a guy like Bezos can become a hundred-billionaire while profiting off the labor of over a million employees, some working for poverty wages, who piss in bottles to meet quotas and sometimes die at work. Meanwhile, the activities of the corporations that create these billionaires are **ravaging the only habitable** planet we’ve got. But because our neo-feudal lords have sold us on a **science-fiction fantasy**, many look up to them as heroes rather than decrying their **obscene and ill-gotten wealth.** Look, I love science fiction. I’m a sci-fi writer and a lifelong Trekkie. But I’m starting to realize that a public which consumes so much science fiction and so little science fact is dangerous. Just because you watched Matt Damon live on Mars for a year in a movie with convincing graphics doesn’t mean that Elon Musk is on the verge of building a colony there. But when he says he’s going to Mars in six years, there are legions of Musk stans on Twitter who believe him – and his stock soars. One reason we find the fantasy of outer space colonization so irresistible is the **prospect of starting afresh**. Our global society is enormously complicated, with baked-in bigotries and illogical ways of doing things that seem impossible to untangle here on earth. But on another planet, so we assume, we could start over and get it right this time. Realistically, though, there’s **no leaving our messiness behind**, no matter how many light-years away we travel. I can’t think of a better illustration for this than the fact that the moon is already a toilet. When people think of what astronauts left behind on the moon, they might picture Buzz Aldrin planting an American flag. But I picture all the literal shit we left up there. NASA, unlike any respectable hiker, didn’t value “packing out waste”. The pooping protocol for Apollo astronauts involved wearing adhesive bags stuck to their asses, which notoriously tore out pubic hairs when removed. They sealed the bag – hoping nothing escaped to float around the lunar module – and crushed an antibacterial capsule inside, mushing it around with their poop to prevent a future biohazard. Then they chucked the bag out the airlock. Over the course of the Apollo missions, we planted five flags on the moon and ninety-six bags of human excrement. We also left a plaque on the Lunar Lander reading, “We came in peace for all mankind” – never mind that at the time, the US was carpet-bombing Vietnam and hitting the kids who lived there with napalm. Anywhere we travel, we’ll be bringing all our shit – literal and figurative – with us. And as any Apollo astronaut can tell you, shit is much easier to deal with on Earth than in space. **If you care deeply, as I do, about the long-term goals of space science, it’s imperative to put a stop to the world-eating overconsumption that creates billionaires, rather than indulging their pet projects**. For now, the best thing we could do to ensure humanity’s long-term survival in space is to **figure out living sustainably here on earth.** If you’re a sci-fi lover like me, think of it this way: we are already living on a magnificent spaceship uniquely suited to our needs. It is enormous, big enough to bring all our friends and family along. It has excellent gravity and radiation shielding in the form of a breathable atmosphere. It comes with a nearly-unlimited renewable energy source – the Sun – which should last us another billion years before it gets too hot and burns us up.

**Ventures directly trade off with nationalized ones – private companies get billions in subsidies to waste on Mars**

**Pizzigati 18**

Sam Pizzigati, (Veteran labor journalist and Institute for Policy Studies associate), 3-21-2018, "Billionaires won’t save the world – just look at Elon Musk," https://www.commondreams.org/views/2018/03/21/billionaires-wont-save-world-just-look-elon-musk, // HW AW

Will Mars save humanity? Or will our savior be billionaire Elon Musk? Musk, the CEO of SpaceX and Tesla, humbly believes we don’t have to choose. Mars will save us, he promises, and Musk himself will engineer this Mars miracle. In 2019, Musk claims, SpaceX will [start making](https://www.cbsnews.com/news/elon-musk-revises-spacex-mars-plans-hopes-for-flights-2022/) short trips to Mars. By the early 2020s, his company will begin colonizing the Red Planet with a human population. Why this feverish haste to set foot on interplanetary terra firma? Musk [sees](https://www.cnet.com/news/elon-musk-wants-to-preserve-humanity-in-space/?ftag=CAD090e536&bhid=21042762719686224048097372147668) a new “dark age” descending on our precious Earth. Another world war — or some environmental collapse — appears likely to threaten us with extinction, he fears. Mars strikes Musk as our ideal refuge, the place where humankind will heroically regroup and eventually “bring human civilization back” to our mother planet. And we can even have some fun in the process. The Mars colony that Musk envisions will have everything from iron foundries to “pizza joints and nightclubs.” “Mars,” he [quips](https://www.cnet.com/news/elon-musk-wants-to-preserve-humanity-in-space/?ftag=CAD090e536&bhid=21042762719686224048097372147668), “should really have great bars.” Reporters have become accustomed to this sort of visionary whimsy from Musk. The billionaire, In These Times says, has [crafted](http://inthesetimes.com/working/entry/20899/elon-musk-spacex-tesla-falcon-heavy-launch) his image as “a quirky and slightly off-kilter playboy genius inventor capable of conquering everything from outer space to the climate crisis with the sheer force of his imagination.” This carefully cultivated image has proven extraordinarily lucrative. Investors now value Tesla, his 15-year-old car company, at around $60 billion — not bad, [note](http://wallstreetonparade.com/2018/03/this-is-not-normal-markets-elon-musk-and-donald-trump/) Wall Street watchdogs Pam and Russ Martens, for a firm that “lost almost $2 billion last year and has never delivered an annual profit to shareholders.” But Musk remains [supremely confident](https://www.cbsnews.com/news/elon-musk-mars-explorers-sxsw-south-by-southwest-austin-texas-today-2018-03-13/) that his enterprise on Mars will take root and prosper. He’s betting a good chunk of his fortune on that. Or rather, **he’s betting a good chunk of taxpayers’ fortune**. Musk owes his billions, as commentator Kate Aronoff [points out](https://www.salon.com/2018/02/12/the-case-for-nationalizing-elon-musk/), to the **billions in direct taxpayer subsidies his companies have received over the years — and the billions more in taxpayer-funded research into rocket technology and other high-tech fields of knowledge**. **So Musk is essentially investing our billions in his own pet projects, everything from the Mars gambit to establishing a** [**mass-market niche**](https://www.theverge.com/tldr/2018/2/1/16954950/elon-musk-flamethrowers-sold-out) **for high-tech flamethrowers.** None of this is going to rescue humanity anytime soon. Indeed, if Musk really wanted to ensure humankind a sustainable future, he wouldn’t be plotting escapes to Mars or marketing flamethrowers to the masses. He’d be challenging the global economic status quo that’s left him phenomenally rich and our world phenomenally unequal. This inequality **may well pose the greatest threat to our well-being as a species.** Stark economic divides invite armed confrontations. Inequality and conflict, Norwegian scholars observed last year in a [major report](https://www.prio.org/Publications/Publication/?x=10538) for the United Nations and the World Bank, remain “inextricably linked.” They found that “**inequality influences the outbreak and dynamics of violent conflict,”** going all the way back to the ancient Greeks. In more recent years, researchers have made great strides in understanding the actual pathways in unequal societies that turn conflict violent. But huge gaps in the research are still frustrating our understanding. What we do know: Hawking high-tech flamethrowers is never going to save humanity. Neither will bar-hopping on Mars.

**Private colonization ensures error replication and resources would be better deployed terrestrially**

**Bharmal 18**

(Zahaan works for Google and is a recipient of Nasa’s Exceptional Public Achievement Medal for YouTube Space Lab. [https://www.theguardian.com/science/blog/2018/aug/28/the-case-against-mars-colonisation 8-28](https://www.theguardian.com/science/blog/2018/aug/28/the-case-against-mars-colonisation%208-28))

The most polarising issue in the Mars debate is arguably the tension between those dreaming of a second home and those prioritising the one we have now. Before his death, Stephen Hawking made the bleak prediction that humanity only had 100 years left on Earth. Faced with a growing list of threats – climate change, overpopulation, nuclear war – Hawking believed that we had reached "the point of no return" and had no choice as a species but to become multi-planetary – starting with the colonisation of Mars. Elon Musk has also said on numerous occasions that we need a “backup planet” should something apocalyptic – like an asteroid collision – destroy Earth. **However, not everyone agrees**. In the Pew survey mentioned earlier, a majority of US adults believed that Nasa’s number one priority should be fixing problems on Earth. The billions – if not trillions – of dollars needed to colonise Mars could, for example, **be better spent investing in renewable forms of energy to address climate change or strengthening our planetary defences against asteroid collisions.** And of course, **if we have not figured out how to deal with problems of our own making here on Earth, there is no guarantee that the same fate would not befall Mars colonists.** Furthermore, if something truly horrible were to happen on Earth, it’s not clear Mars would actually be an **effective salvation.** Giant underground bunkers on Earth, for example, **could protect more people, more easily than a colony on Mars**. And in the event of apocalyptic scenario, it is possible that the conditions on Earth – **however horrific** – **may still be more hospitable than the Martian wasteland**. Let's not forget that Mars has next to no atmosphere, only one third gravity and is exposed to surface radiation approximately 100 times greater than on Earth.

**Mars colonization is disastrous – causes interplanetary war and environmental collapse on earth**

**Morton, PhD, 18**

(Adam Morton is a retired philosopher attached to the University of British Columbia <https://www.newsweek.com/colonizing-other-planets-could-trigger-war-earth-and-ecological-disaster-1226630>, 11-22)

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.**

**Warming causes extinction – a confluence of nonlinear and unpredictable effects will make human and natural systems inhospitable while increasing escalatory conflicts – even if the impacts are far off, only drastic action soon solves**

**Melton 19** [Michelle Melton is a 3L at Harvard Law School. Before law school, she was an associate fellow in the Energy and National Security Program at the Center for Strategic and International Studies, where she focused on climate policy. Climate Change and National Security, Part II: How Big a Threat is the Climate? January 7, 2019. https://www.lawfareblog.com/climate-change-and-national-security-part-ii-how-big-threat-climate]

At least until 2050, and possibly for decades after, climate change will remain a **creeping threat** that will **exacerbate and amplify** existing, **structural** global **inequalities**. While the developed world will be negatively affected by climate change through 2050, the consequences of climate change will be felt most acutely in the developing world. The national security threats posed by climate change to 2050 are likely to differ in degree, not kind, from the kinds of threats already posed by climate change. For the next few decades, climate change will **exacerbate humanitarian crises**—some of which will result in the deployment of **military personnel**, as well as material and financial assistance. It will also **aggravate** natural **resource constraints**, potentially contributing to political and economic **conflict** over **water**, **food** and **energy**. The question for the next 30 years is not “can humanity survive as a species with 1.5°C or 2°C of warming,” but, “how much will the existing disparities between the developed and developing world widen, and how long (and how successfully) can these widening political/economic disparities be sustained?” The urgency of the climate threat in the next few decades will depend, to a large degree, on whether and how much the U.S. government perceives a widening of these global inequities as a threat to U.S. national security. By contrast, if emissions continue to **creep upward** (or if they do not decline rapidly), by 2100 climate-related national security threats could be **existential**. The question for the next hundred years is not, “are disparities politically and economically manageable?” but, “can the **global order**, premised on the **nation-state system**, itself based on territorial sovereignty, **survive** in a world in which **substantial swathes of territory** are potentially **uninhabitable**?” National Security Consequences of Climate Change to 2050 Scientists can predict the consequences of climate change to 2050 with some measure of certainty. (Beyond that date, the pace and magnitude of climate change—and therefore, the national security threat posed by it—depend heavily on the level of emissions in the coming years, as I have explained.) There is relative agreement across modeled climate scenarios that the world will likely warm, on average, at least 1.5°C above pre-industrial levels by about 2050—but perhaps as soon as 2030. This level of warming is likely to occur even if the world succeeds in dramatically reducing greenhouse gas emissions, as even the recent Intergovernmental Panel on Climate Change (IPCC) report implicitly admits. In other words, a certain amount of additional warming—at least 1.5°C, and probably more than that—is presumptively unavoidable. Looking ahead to 2050, it can be said with relative confidence that the national security consequences of climate change will vary in degree, not in kind, from the national security threats already facing the United States. This is hardly good news. Even **small differences** in global average **temperatures** result in **significant environmental changes**, with attendant **social**, **economic** and **political consequences**. By 2050, climate change will **wreak increasing havoc** on **human** and **natural systems**—predominantly, but not exclusively, in the developing world—with attenuated but **profound consequences** for **national security**. In particular, changes in **temperature**, the **hydrological cycle** and the **ranges of insects** will impact **food availability** and food access in much of the world, increasing food insecurity. **Storms**, **flooding**, **changes in ocean pH** and other climate-linked changes will damage **infrastructure** and negatively impact **labor productivity** and economic **growth** in much of the world. Vector-borne **diseases** will also become **more prevalent**, as climate change will expand the geographic **range** and **intensity** of **transmission** of diseases like malaria, West Nile, Zika and dengue fever, and cholera. Rising **public health challenges**, **economic devastation** and **food insecurity** will translate into an increased **demand** for **humanitarian assistance** provided by the **military**, increased **migration**—especially from tropical and subtropical regions—and **geopolitical conflict**. Long-term trends such as declining food security, coupled with short-term events like hurricanes, could sustain unprecedented levels of migration. The 2015 refugee crisis in Europe portends the kinds of population movements that will only accelerate in the coming decades: people from Africa, Southwest and South Asia and elsewhere crossing land and water to reach Europe. For the United States, this likely means greater numbers of people seeking entry from both Central America and the Caribbean. Such influxes are not unprecedented, but they are unlikely to abate and could increase in volume over the next few decades, driven in part by climate change-related food insecurity, climate change-related storms and also by economic and political instability. Food insecurity, economic losses and loss of human life are also likely to exacerbate existing political tensions in the developing world, especially in regions with poor governance and/or where the climate is particularly vulnerable to warming (e.g., the Mediterranean basin). While the Arab Spring had many underlying causes, it also coincided with a period of high food prices, which arguably contributed to the protests. In some situations, **food insecurity**, **economic losses** and **public health crises**, combined with **weak** and ineffectual **governance**, could **precipitate future conflicts** of this kind—although it will be difficult to know where and when without more precise local studies of both underlying political dynamics and the regionally-specific impacts of climate change. 2100 and Beyond While the national security impacts of climate change to 2050 are likely to be costly and disruptive for the U.S. military—and devastating for many people around the world—at some point after 2050, if warming continues at its current pace, changes to the climate could **fundamentally reshape geopolitics** and possibly even the current nation-state basis of the current global order. To be clear, both the ultimate level of warming and its attendant political consequences is highly speculative, for the reasons I explained in my last post. Nonetheless, we do know that the planet is currently on track for at least 3-4°C of warming by 2100. The “known knowns” of higher levels of warming—say, 3°C—are frightening. At that 3°C of warming, for example, scientists project that there will be a nearly **70 percent decline** in **wheat** production in **Central America** and the Caribbean, **75 percent** of the **land area** in the **Mid**dle **East** and more than 50 percent in South Asia will be affected by highly unusual heat, and **sea level rise** could **displace** and imperil the lives **hundreds of millions** of people, among other consequences. But even higher levels of warming are physically possible within this century. At these levels of warming, some **regions of the world** would be **literally uninhabitable**, likely resulting in the depopulation of the tropics, to say nothing of the consequences of **sea-level rise** for **economically important cities** such as Amsterdam and New York. Even if newly warmed regions of the far north could **theoretically accommodate** the resulting **migrants**, this **presumes** that the **political response** to this unprecedented **global displacement** would be **orderly** and **conflict-free** **borders on fantasy**. The geopolitical consequences of significant levels of warming are severe, but if these changes occur in a linear way, at least there will be time for human systems to adjust. Perhaps more challenging for national security is the possibility that the until-now **linear changes give way** to **abrupt** and **irreversible ones**. Scientists forecast that, at higher levels of warming—precisely what level is speculative—humanity could trigger **catastrophic**, **abrupt** and **unavoidable consequences** to the **ecosystem**. The IPCC has considered **nine** such abrupt changes; one example is the potential **shutting down** of the **Indian summer monsoon**. Over a **billion** people are **dependent** upon the Indian monsoon, which provides parts of South Asia with about 80 percent of its annual rainfall; relatively minor changes in the monsoon in either direction can cause disasters. In 2010, a wetter monsoon led to the catastrophic flooding in Pakistan, which directly affected 20 million people; a drier monsoon in 2002 led to devastating drought. Studies suggest that the Indian summer monsoon has two stable states: wet (i.e., the current state) and dry (characterized by low precipitation over the subcontinent). At some point, if warming continues, the monsoon could abruptly shift into the second, “dry” state, with catastrophic consequences for over a billion people dependent on monsoon-fed agriculture. The IPCC suggests that such a state-shift is “unlikely”—that is, there is a 10 to 33 percent chance that a state-shift will happen in the 21st century—but scientists also have relatively low confidence in their understanding of the underlying mechanisms in this and other large-scale natural systems. The consequences of abrupt, severe warming for national security are obvious in general, if unclear in the specifics. In 2003, the Defense Department asked a contractor to explore such a scenario. The resulting report outlined the offensive and defensive national security strategies countries may adopt if faced with abrupt climate change, and highlighted the **increased risk** of inter- and intra-state **conflict** over natural **resources** and **immigration**. Although the report may be off in its imagined timeframe (positing abrupt climate change by 2020), the world it conjures is improbable but not outlandish. If the Indian monsoon were to switch to dry state, and a billion people were suddenly without reliable food sources, for example, it is not clear how the Indian government would react, assuming it would survive in its current form. Major wars or low-intensity proxy conflicts seem likely, if not inevitable, in such a scenario. This is not to say that a parade of climate horribles is certain—or even likely—to come to pass. Scientific understanding of the sensitivities in the climate system are far from perfect. It is also possible that emissions will decline more rapidly than anticipated, averting the worst consequences of climate change. But this outcome is far from guaranteed. And even if global emissions decline precipitously, humanity cannot be sure when or whether the planet has crossed a climate tipping point beyond which the incremental nature of the current changes shifts from the current linear, gradual progression to a non-linear and abrupt process. Within the next few decades, the most likely scenario involves manageable, but costly, consequences on infrastructure, food security and natural disasters, which will be borne primarily by the world’s most impoverished citizens and the members of the military who provide them with humanitarian assistance and disaster relief. But **while** the head-turning national security **impacts** of climate change are **probably** several **decades away**, the **nature of the threat** is such that **waiting until** these **changes manifest** is **not a viable option**. By the time the climate consequences are severe enough to compel action, there is likely to be little that can be done on human timescales to undo the changes to **environmental systems** and the **human societies dependent upon them**.

**Microbes**

**Private space activity guarantees Martian contamination- rush, no standards, profit motive**

**Rolfe, PhD, 19**

(Samantha, Lecturer in Astrobiology and Principal Technical Officer at Bayfordbury Observatory, University of Hertfordshire <https://theconversation.com/elon-musks-starship-may-be-more-moral-catastrophe-than-bold-step-in-space-exploration-124450> 10-2)

There are many reasons to believe SpaceX will succeed. The company has been extremely impressive in its contribution to space, filling a gap when government agencies such as NASA could not justify the spending. It’s not the rocket technology that I doubt, my concern is mainly **astrobiological.** If life exists elsewhere in our universe, the solar system is a good place to start looking – enabling us to touch, collect and analyse samples in a reasonably short time. Along with some of Jupiter’s and Saturn’s moons, Mars is one of the top contenders for hosting some sort of microbial life, or for having done so in the past. However, there is a risk that microbe-ridden humans walking on the red planet could contaminate it with bugs from Earth. And contamination may threaten alien organisms, if they exist. It may also make it impossible to figure out whether any microbes found on Mars later on are martian or terrestrial in origin. A mission to return samples from Mars to Earth is expected to be completed by the early 2030s, with all the collection work completed by sterilised robots. While such missions pose a certain risk of contamination too, there are rigorous protocols to help minimise the chance. These were initiated by the Outer Space Treaty in 1967 and must be followed by anyone in the space industry, governmental or non-governmental entities alike. Can we be confident that, while pushing the boundaries of human exploration in such a short time frame, **corners won’t be cut or standards won’t be allowed to slip**? It will be considerably harder to follow these protocols once humans are actually on the planet. If SpaceX was serious about planetary protection, I would expect to see a policy on its website, or easily found by searching “SpaceX planetary protection”. But that isn’t the case. So while it is possible that it has a rigorous planetary protection plan in place behind the scenes, its public-facing content seems to suggest that pushing the boundaries of human exploration is **more important than the consequences of that exploration**.

**Preserving Martial life outweighs any benefit of colonization**

**Bharmal 18**

(Zahaan works for Google and is a recipient of Nasa’s Exceptional Public Achievement Medal for YouTube Space Lab. [https://www.theguardian.com/science/blog/2018/aug/28/the-case-against-mars-colonisation 8-28](https://www.theguardian.com/science/blog/2018/aug/28/the-case-against-mars-colonisation%208-28))

It is hard to forget the images six months ago of Elon Musk's midnight cherry Tesla floating through space. Launched atop the Falcon Heavy, SpaceX hoped to shoot the Tesla into orbit with Mars. A stunt, for sure – but also a marvellous demonstration of technical competence. But not everyone was happy. Unlike every previous craft sent to Mars, this car – and the mannequin called Starman sitting behind the wheel – **had not been sterilised.** And for this reason, some scientists described it as the “largest load of earthly bacteria to ever enter space”. As it happens, the Tesla overshot its orbit. At the time of writing, it is 88 million miles from Mars, drifting through the darkness of space with Bowie on an infinite loop. But the episode illustrates the first argument against human travel to Mars: contamination. If humans do eventually land on Mars, they would not arrive alone. They would carry with them their earthly microbes. Trillions of them. There is a real risk that some of these microbes could find their way onto the surface of Mars and, in doing so, confuse – perhaps irreversibly so – the search for Martian life. This is because we wouldn't be able to distinguish indigenous life from the microbes we'd brought with us. Our presence on Mars could jeopardise one of our main reasons for being there – the **search for life.** Furthermore, there is no one way of knowing how our microbes may react with the vulnerable Martian ecosystem. In Cosmos, the late Carl Sagan wrote, “If there is life on Mars, I believe we should do nothing with Mars. Mars then belongs to the Martians, **even if the Martians are only microbes** … the preservation of that life must, I think, **supersede any other possible use of Mars**.”

**Organisms in space can surpass the immune systems of Earth creatures – colonization is a biosecurity risk**

**Smith et al. 20** [Adam Smith, Science and Technology reporter for The Independent. Harry Cockburn, newsdesk editor for The Independent. "Space germs could pose threat to mammals’ immune systems, scientists warn." Independent, 7-23-2020, accessed 2-17-2022, https://www.independent.co.uk/life-style/gadgets-and-tech/news/alien-germs-human-cells-immune-system-science-a9633811.html] HWIC

Just as the Martians in HG Wells’ novel The War of the Worlds are finally slain by “disease bacteria” on Earth, scientists now suggest humans and other mammals could struggle to fight germs from other planets.

Given the right conditions and mixture of elements, it is conceivable that microorganisms such as bacteria and viruses could exist beyond Earth, and there are plans to search for signs of them on Mars and some of Saturn and Jupiter’s moons.

Alien life forms could theoretically be composed of different amino acids to those familiar to us on Earth.

Amino acids are the fundamental organic compounds which form the basis for all life as we know it, and are made up of nitrogen, carbon, hydrogen and oxygen.

Scientists from the universities of Aberdeen and Exeter tested how mammal immune cells responded to peptides containing two amino acids that are rare on Earth but are commonly found on meteorites.

The amino acids “isovaline” and “α-aminoisobutyric acid” were introduced to mice, which have immune systems similar to humans.

They found that those mice’s immune systems responded to the “alien” peptides in a way that was “less efficient” than to germs from this planet.

The research team examined mammalian T cells, which normally work to kill pathogenic bodies, and can recruit other cells to fight off invading diseases.

But when the scientists introduced the amino acids found on the meteorites, the T cell response was less efficient, with activation levels of 15 per cent and 61 per cent – compared to 82 per cent and 91 per cent when exposed to peptides made entirely of amino acids that are common on Earth.

“Life on Earth relies on essential 22 amino acids,” said lead author Dr Katja Schaefer, of the University of Exeter, in a statement. “Our investigation showed that these exo-peptides were still processed, and T cells were still activated, but these responses were less efficient than for ‘ordinary’ Earth peptides.”

“We therefore speculate that contact with extra-terrestrial microorganisms might pose an immunological risk for space missions aiming to retrieve organisms from exoplanets and moons,” Dr Schaefer added.

“The world is now only too aware of the immune challenge posed by the emergence of brand new pathogens,” said Professor Neil Gow, a Deputy Vice-Chancellor at the University of Exeter.

The research will be published in in the journal Microorganisms, with the title, ‘A weakened immune response to synthetic exo-peptides predicts a potential biosecurity risk in the retrieval of exo-microorganisms’.

The discovery of liquid water at several locations in the solar system raises the possibility that microbial life could have [also] evolved outside Earth, and could therefore be accidentally introduced into the Earth’s ecosystem.

The issue of alien germs is a rising priority, as missions to other planets are becoming more common.

**Disease causes extinction.**

**Ord ‘20** (Toby Ord is a moral philosopher, Oxford University, Future of Life Institute. Ord has advised the World Health Organization, the World Bank, the World Economic Forum, the US National Intelligence Council, the UK Prime Minister’s Office, Cabinet Office, and Government Office for Science; “Why we need worst-case thinking to prevent pandemics”; The Guardian; D.A. April 18th 2020, [Published March 6th 2020]; <https://www.theguardian.com/science/2020/mar/06/worst-case-thinking-prevent-pandemics-coronavirus-existential-risk>) //LFS—JCM

[TITLE]: Why **we need worst-case thinking to prevent pandemics**

The world is in the early stages of what may be the most deadly pandemic of the past 100 years. In China, thousands of people have already died; large outbreaks have begun in South Korea, Iran and Italy; and the rest of the world is bracing for impact. We do not yet know whether the final toll will be measured in thousands or hundreds of thousands. **For all our advances** in medicine, **humanity remains** much more **vulnerable** **to pandemics** than we would like to believe.

To understand our vulnerability, and to determine what steps must be taken to end it, it is useful to ask about the very worst-case scenarios. Just how bad could a pandemic be? In science fiction, we sometimes encounter the idea of a **pandemic** so severe that it **could cause** the **end of** civilisation, or even of **humanity** itself. Such a risk to humanity’s entire future is known as **an existential risk**. We can say with certainty that the novel coronavirus, named Covid-19, does not pose such a risk. **But could the next pandemic?** To find out, and to put the current outbreak into greater context, let us turn to the past.

In 1347, death came to Europe. It entered through the Crimean town of Caffa, brought by the besieging Mongol army. Fleeing merchants unwittingly carried it back to Italy. From there, it spread to France, Spain and England. Then up as far as Norway and across the rest of Europe – all the way to Moscow. Within six years, the Black Death had taken the continent.

Tens of millions fell gravely ill, their bodies succumbing to the disease in different ways. Some bore swollen buboes on their necks, armpits and thighs; some had their flesh turn black from haemorrhaging beneath the skin; some coughed blood from the necrotic inflammation of their throats and lungs. All forms involved fever, exhaustion and an intolerable stench from the material that exuded from the body.

There were so many dead that mass graves needed to be dug and, even then, cemeteries ran out of room for the bodies. The **Black Death devastated Europe**. In those six years, between a quarter and half of all Europeans were killed. The Middle East was ravaged, too, with the plague killing about one in three Egyptians and Syrians. And it may have also laid waste to parts of central Asia, India and China. Due to the scant records of the 14th century, we will never know the true toll, but our best estimates are that somewhere between 5% and 14% of all the world’s people were killed, in what may have been the greatest catastrophe humanity has seen.

The Black Death was not the only biological disaster to scar human history. It was not even the only great bubonic plague. In AD541 the plague of Justinian struck the Byzantine empire. Over three years, it took the lives of roughly 3% of the world’s people.

When Europeans reached the Americas in 1492, the two populations exposed each other to completely novel diseases. Over thousands of years, each population had built up resistance to their own set of diseases, but were extremely susceptible to the others. The American peoples got by far the worse end of the exchange, through diseases such as **measles**, **influenza** and, especially, **smallpox**.

During the next 100 years, a combination of invasion and disease took an immense toll – one whose scale may never be known, due to great uncertainty about the size of the pre-existing population. We can’t rule out the **loss** of more than **90% of the population** of the Americas during that century, though the number could also be much lower. And it is very difficult to tease out how much of this should be attributed to war and occupation, rather than disease. At a rough estimate, as many as 10% of the world’s people may have been killed.

Centuries later, **the world had become** so **interconnected** that a truly global pandemic was possible. Towards the end of the first world war, a devastating strain of influenza, known as the 1918 flu or [**Spanish flu**](https://www.theguardian.com/world/2018/sep/09/spanish-flu-pandemic-centenary-first-world-war), spread to six continents, and **even remote Pacific islands**. About a third of the world’s population were infected and between 3% and 6% were killed. This death toll **outstripped that of the first world war**.

Yet even events like these fall short of being a threat to humanity’s long-term potential. In the great bubonic plagues we saw civilisation in the affected areas falter, but recover. The regional 25%-50% death rate was not enough to precipitate a continent-wide collapse. It changed the relative fortunes of empires, and may have substantially altered the course of history, but if anything, it gives us reason to believe that human civilisation is likely to make it through future events with similar death rates, even if they were global in scale.

The Spanish flu pandemic was remarkable in having very little apparent effect on the world’s development, despite its global reach. It looks as if it was lost in the wake of the first world war, which, despite a smaller death toll, seems to have had a much larger effect on the course of history. The full history of humanity covers at least 200,000 years. While we have scarce records for most of these 2,000 centuries, there is a key lesson we can draw from the sheer length of our past. **The chance of human extinction** from natural catastrophes of any kind **must have been very low** for most of this time – or we would not have made it so far. But **could these risks have changed?** Might the past provide false comfort?

Our **population** now is a **thousand times greater** than it was for most of human history, so there are vastly **more opportunities** for new human **diseases to originate**. And our **farming practices** have created vast numbers of animals living in unhealthy conditions within **close proximity to humans**. This increases the risk, as many major diseases originate in animals before crossing over to humans. Examples include **HIV** (chimpanzees), **Ebola** (bats), **Sars** (probably civets or bats) and **influenza** (usually pigs or birds). We do not yet know where Covid-19 came from, though it is very similar to coronaviruses found in bats and pangolins. Evidence suggests that diseases are crossing over into human populations from animals **at an increasing rate**.

Modern civilisation may also **make it** much **easier for a pandemic to spread**. The higher **density of people** living together in cities increases the number of people each of us may infect. Rapid **long-distance transport** greatly increases the distance pathogens can spread, **reducing** the **degrees of separation** between any two people. Moreover, we are no longer divided into isolated populations as we were for most of the past 10,000 years.

Together these effects suggest that we might expect more new pandemics, for them to spread more quickly, and to reach a higher percentage of the world’s people.

But we have also changed the world in ways that offer protection. We have a healthier population; improved sanitation and hygiene; preventative and curative medicine; and a scientific understanding of disease. Perhaps most importantly, we have public health bodies to facilitate global communication and coordination in the face of new outbreaks. We have seen the benefits of this protection through the dramatic decline of endemic infectious disease over the past century (though we can’t be sure pandemics will obey the same trend). Finally, we have spread to a range of locations and environments unprecedented for any mammalian species. This offers special protection from extinction events, because it requires the pathogen to be able to flourish in a vast range of environments and to reach exceptionally isolated populations such as uncontacted tribes, Antarctic researchers and nuclear submarine crews.

It is hard to know whether these combined effects have increased or decreased the existential risk from pandemics. This uncertainty is ultimately bad news: we were previously sitting on a powerful argument that the risk was tiny; now we are not.

We have seen the indirect ways that our actions aid and abet the origination and spread of pandemics. But **what about cases where we** have a much more direct hand in the process – where we **deliberately use**, **improve or create the pathogens?**

Our understanding and control of pathogens is very recent. Just 200 years ago, we didn’t even understand the basic cause of pandemics – a leading theory in the west claimed that disease was produced by a kind of gas. In just two centuries, we discovered it was caused by a diverse variety of microscopic agents and **we worked** out **how to grow them** in the lab, to **breed** them for **different traits**, to sequence their genomes, to **implant new genes** and to create entire functional viruses from their written code.

**This progress is continuing at a rapid pace**. The past 10 years have seen major qualitative breakthroughs, such as the **use of the gene editing tool Crispr** to efficiently insert new genetic sequences into a genome, and the use of gene drives to efficiently replace populations of natural organisms in the wild with genetically modified versions.

This progress in **biotechnology seems unlikely to fizzle out** anytime soon: there are no insurmountable challenges looming; no fundamental laws blocking further developments. But **it would be optimistic to assume that this uncharted new terrain holds only familiar dangers.**

To start with, let’s set aside the risks from malicious intent, and consider only the risks that can arise from well-intentioned research. Most scientific and medical research poses a negligible risk of harms at the scale we are considering. But there is a small fraction that uses live pathogens of kinds that are known to threaten global harm. These include the agents that cause the Spanish flu, smallpox, Sars and H5N1 or avian flu. And a small part of this research involves making strains of these pathogens that pose even more danger than the natural types, **increasing their transmissibility, lethality or resistance to vaccination or treatment**.

In 2012, a Dutch virologist, Ron Fouchier, published details of an experiment on the recent H5N1 strain of bird flu. This strain was extremely deadly, killing an estimated 60% of humans it infected – far beyond even the Spanish flu. Yet its inability to pass from human to human had so far prevented a pandemic. Fouchier wanted to find out whether (and how) H5N1 could naturally develop this ability. He passed the disease through a series of 10 ferrets, which are commonly used as a model for how influenza affects humans. By the time it passed to the final ferret, his strain of H5N1 had become directly transmissible between mammals.

The work caused fierce controversy. Much of this was focused on the information contained in his work. The US National Science Advisory Board for Biosecurity ruled that his paper had to be stripped of some of its technical details before publication, to limit the ability of bad actors to cause a pandemic. And the Dutch government claimed that the research broke EU law on exporting information useful for bioweapons. But it is not the possibility of misuse that concerns me here. Fouchier’s research provides a clear example of well-intentioned scientists enhancing the destructive capabilities of pathogens known to **threaten global catastrophe**.

Of course, such experiments are done in secure labs, with stringent safety standards. It is highly unlikely that in any particular case the enhanced pathogens would escape into the wild. But just how unlikely? Unfortunately, we don’t have good data, due to a lack of transparency about incident and escape rates. This prevents society from making well-informed decisions balancing the risks and benefits of this research, and it limits the ability of labs to learn from each other’s incidents.

**Security for highly dangerous pathogens has been deeply flawed, and remains insufficient**. In 2001, Britain was struck by a devastating outbreak of foot-and-mouth disease in livestock. Six million animals were killed in an attempt to halt its spread, and the economic damages totalled £8bn. Then, in 2007, there was another outbreak, which was traced to a lab working on the disease. Foot-and-mouth was considered a highest-category pathogen, and required the highest level of biosecurity. Yet the **virus escaped** from a badly maintained pipe, leaking into the groundwater at the facility. After an investigation, the **lab’s** licence was renewed – only for another leak to occur two weeks later.

In my view, this track record of escapes shows that even the highest biosafety level (BSL-4) is insufficient for working on pathogens that **pose a risk of global pandemics** on the scale of the Spanish flu or worse. Thirteen years since the last publicly acknowledged outbreak from a BSL-4 facility is not good enough. It doesn’t matter whether this is from insufficient standards, inspections, operations or penalties. **What matters is the poor track record in the field, made worse by a lack of transparency and accountability**. With current BSL-4 labs, an escape of a pandemic pathogen is only a matter of time.

One of the most exciting trends in biotechnology is its rapid democratisation – the speed at which cutting-edge techniques can be adopted by students and amateurs. When a new breakthrough is achieved, the pool of people with the talent, training, resources and patience to reproduce it rapidly expands: from a handful of the world’s top biologists, to people with PhDs in the field, to millions of people with undergraduate-level biology.

The Human Genome Project was the largest ever scientific collaboration in biology. It took 13 years and $500m to produce the full DNA sequence of the human genome. Just 15 years later, a genome can be sequenced for under $1,000, and within a single hour. The reverse process has become much easier, too: online DNA synthesis services allow anyone to upload a DNA sequence of their choice then have it constructed and shipped to their address. While still expensive, the price of synthesis has fallen by a factor of 1,000 in the past two decades, and continues to drop. The first ever uses of Crispr and gene drives were the biotechnology achievements of the decade. But within just two years, each of these technologies were used successfully by bright students participating in science competitions.

Such democratisation promises to fuel a boom of entrepreneurial biotechnology. But since biotechnology can be misused to lethal effect, democratisation also means proliferation. As the pool of people with access to a technique grows, so does the chance it contains someone with malign intent.

People with the motivation to wreak global destruction are mercifully rare. But they exist. Perhaps the best example is the **Aum Shinrikyo** cult in Japan, active between 1984 and 1995, which sought to bring about the destruction of humanity. It attracted several thousand members, including people with advanced skills in chemistry and biology. And it demonstrated that it was not mere misanthropic ideation. It launched multiple lethal attacks using VX gas and sarin gas, killing more than 20 people and injuring thousands. It **attempted to weaponise anthrax**, but did not succeed. What happens when the circle of people able to create a global pandemic becomes wide enough to include members of such a group? Or members of a **terrorist organisation or rogue state** that could try to build an omnicidal weapon for the purposes of extortion or deterrence?

The main candidate for biological **existential risk** in the coming decades thus stems from technology – particularly the risk of misuse by states or small groups. But this is not a case in which the world is blissfully unaware of the risks. Bertrand Russell wrote of the danger of extinction from biowarfare to Einstein in 1955. And, in 1969, the possibility was raised by the American Nobel laureate for medicine, Joshua Lederberg: “As a scientist I am profoundly concerned about the continued involvement of the United States and other nations in the development of biological warfare. **This process puts the very future of human life on earth in serious peril**.”

In response to such warnings, we have already begun national and international efforts to protect humanity. There is action through public health and international conventions, and self-regulation by biotechnology companies and the scientific community. **Are they adequate?** National and international work in public health offers some protection from engineered pandemics, and its existing infrastructure could be adapted to better address them. Yet even for existing dangers this protection is uneven and under-provided.

Despite its importance, **public health is underfunded worldwide**, and **poorer countries** remain **vulnerable** to being overwhelmed by outbreaks. Biotechnology companies are working to limit the dark side of the democratisation of their field. For example, unrestricted DNA synthesis would help bad actors overcome a major hurdle in creating extremely deadly pathogens. It would allow them to get access to the DNA of controlled pathogens such as smallpox (whose genome is readily available online) and to create DNA with modifications to make the pathogen more dangerous. Therefore, many synthesis companies make voluntary efforts to manage this risk, screening their orders for dangerous sequences. But the **screening methods are imperfect**, and they only cover about 80% of orders. There is significant room for improving this process, and a strong case for making screening mandatory.

We might also look to the scientific community for careful management of biological risks. Many of the dangerous advances usable by states and small groups have come from open science. And we’ve seen that science produces **substantial accident risk**. The scientific community has tried to regulate its dangerous research, but with limited success. There are a variety of reasons why this is extremely hard, including difficulty in knowing where to draw the line, lack of central authorities to unify practice, a culture of openness and freedom to pursue whatever is of interest, and the rapid pace of science outpacing that of governance. It may be possible for the scientific community to overcome these challenges and provide strong management of global risks, but it would require a willingness to accept serious changes to its culture and governance – such as treating the security around biotechnology more like that around nuclear power. And the scientific community would need to find this willingness before catastrophe strikes.

**Threats to humanity**, **and how we address them, define our time**. The advent of nuclear weapons posed a real risk of human extinction in the 20th century. There is strong reason to believe the risk will be higher this century, and increasing with each century that technological progress continues. Because these anthropogenic risks outstrip all natural risks combined, they set the clock on how long humanity has left to pull back from the brink.

I am not claiming that extinction is the inevitable conclusion of scientific progress, or even the most likely outcome. What I am claiming is that there has been a robust trend towards increases in the power of humanity, which has reached a point where **we pose a serious risk to our own existence**. How we react to this risk is up to us. Nor am I arguing against technology. Technology has proved itself immensely valuable in improving the human condition.

The problem is not so much an excess of technology as a lack of wisdom. Carl Sagan put this especially well: “Many of the dangers we face indeed arise from science and technology – but, more fundamentally, because we have become powerful without becoming commensurately wise. The world-altering powers that technology has delivered into our hands now require a degree of consideration and foresight that has never before been asked of us.”

Because we cannot come back from extinction, we cannot wait until a threat strikes before acting – we must be proactive. And because gaining wisdom takes time, **we need to start now.**

I think that we are likely to make it through this period. Not because the challenges are small, but because we will rise to them. The very fact that these risks stem from human action shows us that human action can address them. **Defeatism would be both unwarranted and counterproductive – a self-fulfilling prophecy**. Instead, we must address these challenges head-on with clear and rigorous thinking, guided by a positive vision of the longterm future we are trying to protect.

**OST**

**Elon’s mars col attempts kill OST legitimacy –trying to establish self governing paradigms and an extra-legal regime, plus it violates article 8**

**Salmeri 20**

Antonino Salmeri, (attorney and doctoral researcher in space law at the University of Luxembourg, where he is pursuing a Ph.D. on space mining enforcement), 12-5-2020, "No, Mars is not a free planet, no matter what SpaceX says," SpaceNews, https://spacenews.com/op-ed-no-mars-is-not-a-free-planet-no-matter-what-spacex-says/, // HW AW

\*\*bracketed for roman numerals

SpaceX makes no secret of its driving goal to make humans a multiplanetary species. Given SpaceX founder Elon Musk’s fixation on Mars and fondness for Tesla ‘Easter eggs’ and other gags, it’s hardly surprising to see Mars mentioned in the terms of service (ToS) agreement for beta users of its Starlink satellite broadband service. However, as a space lawyer, I certainly didn’t expect Starlink’s beta ToS to include the following provision: “For services provided on Mars, or in transit to Mars via Starship or other colonization spacecraft, the parties recognize Mars as a free planet and that no Earth-based government has authority or sovereignty over Martian activities. Accordingly, Disputes will be settled through self-governing principles, established in good faith at the time of the Martian settlement.” To be sure, SpaceX might have inserted Clause 9 as another one of Musk’s jokes that aren’t really jokes, like the time he invoked South Park’s infamous underwear gnomes in explaining how he intended to fund his ambitious Mars colonization plans. After all, there are no Starlink satellites orbiting Mars, and no prospective customers there yet, either. But international law is no laughing matter. Taken literally, Starlink users must agree with SpaceX that Mars is a “free planet” and that disputes concerning Starlink services provided on Mars or while en route to the red planet via a SpaceX Starship — will be settled through self-regulation. But is this clause valid? What are the political implications of a transportation company proclaiming the legal status of a celestial body? Does such an attempt make strategic sense? LEGAL ASPECTS From a legal viewpoint, Clause 9 of Starlink’s terms of service should be regarded as void. Simply put, declaring Mars as a “free planet” and refusing any Earth-based authority over Martian activities conflicts with the international obligations of the United States under the Outer Space Treaty, which naturally take precedence over contractual terms of services. First, under Articles I and III of the treaty, international law applies in outer space, including the moon and other celestial bodies, and influences all activities conducted thereby. Accordingly, Mars cannot be considered a “free planet” left to “self-governing principles” of dubious nature and origin, because it is rather fully subjected to the rule of law. A passenger-laden Starship enters Mars’ atmosphere in this artist’s concept. Credit: SpaceX illustration Further, Starlink’s **refusal of Earth-based governmental authority on Mars is in clear violation of Article [8]** VIII **of the treaty.** According to this provision, states “retain jurisdiction and control”over any registered space objects and “any personnel thereof, while in outer space or on a celestial body.” This principle is known as “quasi-territorial” jurisdiction and serves the purpose of ensuring the applicability of relevant national laws, **preventing space from being abandoned to the rule of the strongest**. As an American company, SpaceX is obliged under U.S. law to respect these rules in order to get licenses from the U.S. government to conduct commercial launches and provide satellite services. This is mandated by Article VI of the treaty, according to which nongovernmental activities in space require the “authorization and continuing supervision of the appropriate State,” which is internationally responsible for assuring that these activities “are carried out in conformity with the provisions set forth in the present Treaty.” As such, any attempt to declare “Mars as a free planet” and reject the authority of “Earth-based government” over Martian activities is in violation of international space law and would consequently bear no legal effect on third parties. POLITICAL IMPLICATIONS **SpaceX’s declaration on the legal status of Mars is not without political implications**. Interestingly enough, a thorough look at the first part of Starlink’s terms of service Clause 9 shows that SpaceX doesn’t seem to have problems with “Earth-based authority” regulating lunar activities: “For Services provided to, on or in orbit around the planet Earth or the Moon, these Terms and any disputes […] will be governed by and construed in accordance with the laws of the State of California in the United States.” Nevertheless, under international space law there are no grounds to distinguish between the moon and Mars; the same rules apply to “the Moon and other celestial bodies.” Assuming SpaceX knows this, it appears that **the company is sending a political message to subvert the status quo and establish a separate regime for Mars**. Now, if SpaceX was merely an internet service provider, the issue would be purely theoretical with no reason for any further concern. However, SpaceX fully intends to send the first humans to Mars. As such, the company’s refusal to respect international law once its en route could put SpaceX’s passengers in real peril. These early passengers would fully depend on SpaceX for their survival en route to Mars and while on the surface, not to mention their prospects for returning to Earth. One the one hand, you have a company that controls the means to survival; on the other hand, you have a group of fragile individuals potentially stranded in an incredibly hostile environment a long, long way from home. How could SpaceX seriously refer to principles established in “good faith” given such a massive imbalance of power? Politically speaking, declaring Mars a “free planet” would condemn its first inhabitants to the indisputable will of a private corporation — a dangerous situation threatening the fundamental rights of any human traveling with SpaceX. STRATEGIC CONSIDERATIONS Truth to be told, **any attempt to escape international law on Mars may actually turn out to be strategically counterproductive**. First, as any international lawyer knows, the only support for declaring Mars a “free planet” can only come from the applicability of international law, not its denial. Under Article I (2) of the UN Charter, any independent community of humans enjoys the right to self-determination. If and when SpaceX’s vision of a million people living on Mars becomes a reality, there is no doubt that this community would be entitled to political independence and self-regulation. However, this outcome can neither be imposed in advance nor accomplished against international law. Rather, it can only develop from the natural evolution of the circumstances, under the safeguards of the rule of law. In the early stages, any Martian settlement will have to rely on Earth’s supplies, technologies, personnel and overall logistical support. Conversely, this dependence will also **imply the legitimate exercise of Earth-based authority in order to protect the settlement from degenerating into violence and Wild West types of behaviors**. Later, when the settlement has developed an autonomous structure and a balanced division of powers, then independence and self-regulation would naturally follow — but not a minute before the conditions for protecting fundamental rights are established. Finally, another reason why SpaceX’s declaration may become counterproductive can be identified by looking at the company’s core business: launching spacecraft for a government-heavy customer base. Openly refusing governmental authority while still depending on governmental contracts is not exactly a smart move; it undermines the credibility of SpaceX as a reliable partner and advantages its competitors. If a government had to choose between an expensive service from a company pledging allegiance to the rule of law and a cheap one from an enterprise trying to impose “self-governing principles established in good faith,” there is little doubt which one will be awarded a contract. Actually, with such terms of service, SpaceX would not even be authorized to launch its Starships toward Mars in the first place. There can be no doubts that **applying international law on other celestial bodies is the best way to preserve the exploration and use of outer space as the province of all humankind**. Space activities, no matter where in the solar system, shall always be conducted under the safeguards of the rule of law. No company should be allowed to question this essential principle in the attempt to turn outer space into a modern Wild West. SpaceX’s defiance of international law should be taken very seriously and stopped now, before the company is able to push it to the point of establishing its private domain on Mars. **The future of space as a peaceful, fair and inclusive domain may very well depend on this.**

**OST collapse kills multilat in space – decks cooperation and diplomacy**

**Cheney, PhD, 20** (Thomas has a PhD in space law from Northumbria University, where his research focused on space resources and the associated issues of the relationship between property rights and sovereignty, Space Resource the Need for Multilateralism in Outer Space, Space Resource the Need for Multilateralism in Outer Space, <https://www.open.ac.uk/research-groups/astrobiology/blog/space-resource-need-multilateralism-outer-space>) // HW ML

24 April 2020 is the International Day of Multilateralism and Diplomacy for Peace. This post will argue that a multilateralism is vital for the effective maintenance of order in outer space. It will use space resources as a case study to make this argument. **The Outer Space Treaty**, the foundational legal instrument for the space law regime, **is an outstanding example of a multilateral instrument.** While often perceived as a Cold War bargain between the Untied States and the Soviet Union, the Outer Space Treaty was negotiated by the (then) 28 member states of the UN Committee on the Peaceful Uses of Outer Space.[1] The negotiating record is full of interjections by delegates from a relatively diverse range of countries, and important contributions were made by delegations from countries like Brazil and Japan. Furthermore, the treaty is open to all States and in Article I declares that the use and exploration of outer space is a freedom enjoyed by all States. COPUOS remains an important forum for the continuing discussion of space governance and has grown to approximately 95 members with the Outer Space Treaty now has over 109 parties.[2] Outer space, particularly Earth orbit naturally lends itself to a multilateral governance structure, however, just as with terrestrial governance, **multilateralism in outer space is under threat**. Space resources represent one strain of that ‘threat’. Several States responded to the promulgation, by the United States in 2015, of national legislation on space resources with claims of ‘unilateralism’. Subsequent discussions at UNCOPUOS and further developments since have highlighted the risk of diverging approaches to space resources and **the potential danger of ‘fragmentation’ of ´space law regime. This could have disastrous consequences and is a perfect example of why we need to retrench a multilateral approach to space governance.** The space resource industry and its advocates constantly proclaim the need for property rights and/or legal certainty in order to acquire the necessary funding in order to conduct space resource activities. This makes sense, at the most basic level in order to secure investment you need to be able to convince investors that if you go to the trouble (and expense) of locating viable ‘ore’ deposits and then extracting them you will be able to make a profit from the exercise. However, property rights, as they are generally understood, rely on the backing of a State to protect and enforce those rights. Traditionally, this would be done by annexation of the territory concerned (as with the ‘Guano islands’ in the late 19th century)[3] or other territorial measures. However, this is prohibited by Article II of the Outer Space Treaty. Beyond such a remedy raw force would be necessary to protect ‘property rights’, however this is a recipe for anarchy and only provides security insofar as you are able to actually protect your ‘property’ (although technically annexation only provides security to the extent that the State is actually able to protect that territory, as English colonies in North America and elsewhere demonstrated Spanish declarations of sovereignty over territory didn’t amount to much in the areas beyond their actual control.) However, **a multilateral approach would enable a mutually beneficial solution**. Further, there are multiple reasons this is so. While, it is possible to grant ‘property rights’ over resources once they have been extracted from a celestial body without violating Article II of the Outer Space Treaty, the space resources industry needs more than that. They need to be sure they don’t have to worry about ‘claim jumping’ and a host of other issues, some of which were explored during the drafting of The Hague International Space Resources Governance Working Group’s Building Blocks for the Development of an International Framework on Space Resource Activities.[4] While **individual countries** can provide assurances of these things against claims or actions between their own citizens they are **unable to provide assurances, beyond the vague protections** offered by Article IX of the Outer Space Treaty and its injunction against ‘harmful interference’, against actions taken by citizens of other countries (at least without violating Article II of the Outer Space Treaty. However, **some sort of multilateral framework**, such as that proposed by The Hague Working Group, **would be able to provide such protections**. Similar multilateral frameworks already exist. The International Telecommunications Union provides such a framework for regulation of radio frequency which avoids harmful interference with satellite and radio communication by coordinating spectrum use. So it is possible, it just needs to be developed. Further, now is perhaps the best time to negotiate such a framework, or at least the basic principles of one. We still benefit from a relative ‘veil of ignorance’, sure we can be reasonably certain who the ‘major players’ will be in any ‘race’ for space resources but no one, as yet, has any entrenched interests. And while it is easy to be cynical, the evidence from UNCOPUOS and indeed President Trump’s recent executive order is encouraging. There is broad agreement and a desire to maintain the multilateral nature of space governance. Multilateralism isn’t about a utopian vision for international relations, it is about balancing interests and compromising, in short it is the essence of diplomacy. 75 years ago, in the final days of calamity that was the Second World War the nations of this planet committed to embracing multilateralism embodied by the United Nations in order to ensure the peace and build a better future. And they reaffirmed that in the Outer Space Treaty, the foundation for the governance of humanity’s journey into the cosmos. We shouldn’t abandon it now.

**Space militarization causes collapse of R&D, commercial ops, economy, and deterrence – global war is inevitable.**

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Consequences of Armament and Aggression in Space

The consequences of weapons testing and aggression in space could span generations, and current technological advances only increase the urgency for policymakers to pursue a limitations treaty. As it stands, there are three major ramifications of a potential arms race in space:

The destruction of satellites

As both financial and technological barriers to the space services industry have decreased, the number of governmental and private investors with assets in space has inevitably increased. There is now an abundance of satellites in space owned by multiple states and corporations. These satellites are used to not only coordinate military actions, but to perform more mundane tasks, like obtaining weather reports, or managing on-ground communications, and navigation.

Should states begin weapons testing in space, debris could cloud the orbit and make positioning new satellites impossible, disrupting our current way of life. More pressing, however, is that if a country’s satellites are successfully destroyed by an enemy state, military capabilities can be severely hindered or destroyed, leaving the country vulnerable to attack and unable to coordinate its military forces on the ground.

Diminished future use of near space

Whether caused by weapons testing or actual aggression, the subsequent proliferation of debris around the planet would damage our future ability to access space. Not only would debris act as shrapnel to preexisting assets in space, but it would also become much more difficult to launch satellites or rockets, hindering scientific research, space exploration, and commercial operations.

From the past fifty-odd years of activity in space alone, the debris left behind in Earth’s orbital field has already become hazardous to spacecraft — a main reason why the U.S. and the Soviet Union did not continue with ASAT testing during the Cold War. If greater pollution were to occur, space itself could be become unusable, resulting in the collapse of the global economic system, air travel, and various communications.

Power imbalances and proliferation on the ground

Only so many states currently have access to space—which means any militarization be by the few, while other states would be left to fend for themselves. This would establish a clear power imbalance that could breed distrust among nations, resulting in a more insecure world and a veritable power keg primed for war. Additionally, deterrence measures taken by states with access to space would escalate, attempting to build up weapons caches not dissimilar to the nuclear weapons stockpiling activities of the Cold War.

In any arms race, it is inevitable that more advanced weaponry is created. Yet, this does not only pose a risk to assets in space. Should a terrestrial war break out, this weaponry may eventually be deployed on the ground, and space-faring states would be able to capitalize on the power imbalance by using these new developments against states that have not yet broken into the space industry or developed equally-advanced weaponry.

**Framing**

**The standard is maximizing expected well-being. To clarify, hedonistic act util. Prefer –**

**1] Pleasure and pain *are* intrinsic value and disvalue – everything else *regresses* – robust neuroscience.**

**Blum et al. 18**

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**Pleasure** is not only one of the three primary reward functions but it also **defines reward.** As homeostasis explains the functions of only a limited number of rewards, the principal reason why particular stimuli, objects, events, situations, and activities are rewarding may be due to pleasure. This applies first of all to sex and to the primary homeostatic rewards of food and liquid and extends to money, taste, beauty, social encounters and nonmaterial, internally set, and intrinsic rewards. Pleasure, as the primary effect of rewards, drives the prime reward functions of learning, approach behavior, and decision making and provides the **basis for hedonic theories** of reward function. We are attracted by most rewards and exert intense efforts to obtain them, just because they are enjoyable [10].

Pleasure is a passive reaction that derives from the experience or prediction of reward and may lead to a long-lasting state of happiness. The word happiness is difficult to define. In fact, just obtaining physical pleasure may not be enough. One key to happiness involves a network of good friends. However, it is not obvious how the higher forms of satisfaction and pleasure are related to an ice cream cone, or to your team winning a sporting event. Recent multidisciplinary research, using both humans and detailed invasive brain analysis of animals has discovered some critical ways that the brain processes pleasure [14].

Pleasure as a hallmark of reward is sufficient for defining a reward, but it may not be necessary. A reward may generate positive learning and approach behavior simply because it contains substances that are essential for body function. When we are hungry, we may eat bad and unpleasant meals. A monkey who receives hundreds of small drops of water every morning in the laboratory is unlikely to feel a rush of pleasure every time it gets the 0.1 ml. Nevertheless, with these precautions in mind, we may define any stimulus, object, event, activity, or situation that has the potential to produce pleasure as a reward. In the context of reward deficiency or for disorders of addiction, homeostasis pursues pharmacological treatments: drugs to treat drug addiction, obesity, and other compulsive behaviors. The theory of allostasis suggests broader approaches - such as re-expanding the range of possible pleasures and providing opportunities to expend effort in their pursuit. [15]. It is noteworthy, the first animal studies eliciting approach behavior by electrical brain stimulation interpreted their findings as a discovery of the brain’s pleasure centers [16] which were later partly associated with midbrain dopamine neurons [17–19] despite the notorious difficulties of identifying emotions in animals.

Evolutionary theories of pleasure: The love connection BO:D

Charles Darwin and other biological scientists that have examined the biological evolution and its basic principles found various mechanisms that steer behavior and biological development. Besides their theory on natural selection, it was particularly the sexual selection process that gained significance in the latter context over the last century, especially when it comes to the question of what makes us “what we are,” i.e., human. However, the capacity to sexually select and evolve is not at all a human accomplishment alone or a sign of our uniqueness; yet, we humans, as it seems, are ingenious in fooling ourselves and others–when we are in love or desperately search for it.

It is well established that modern biological theory conjectures that **organisms are** the **result of evolutionary competition.** In fact, Richard Dawkins stresses gene survival and propagation as the basic mechanism of life [20]. Only genes that lead to the fittest phenotype will make it. It is noteworthy that the phenotype is selected based on behavior that maximizes gene propagation. To do so, the phenotype must survive and generate offspring, and be better at it than its competitors. Thus, the ultimate, distal function of rewards is to increase evolutionary fitness by ensuring the survival of the organism and reproduction. It is agreed that learning, approach, economic decisions, and positive emotions are the proximal functions through which phenotypes obtain other necessary nutrients for survival, mating, and care for offspring.

Behavioral reward functions have evolved to help individuals to survive and propagate their genes. Apparently, people need to live well and long enough to reproduce. Most would agree that homo-sapiens do so by ingesting the substances that make their bodies function properly. For this reason, foods and drinks are rewards. Additional rewards, including those used for economic exchanges, ensure sufficient palatable food and drink supply. Mating and gene propagation is supported by powerful sexual attraction. Additional properties, like body form, augment the chance to mate and nourish and defend offspring and are therefore also rewards. Care for offspring until they can reproduce themselves helps gene propagation and is rewarding; otherwise, many believe mating is useless. According to David E Comings, as any small edge will ultimately result in evolutionary advantage [21], additional reward mechanisms like novelty seeking and exploration widen the spectrum of available rewards and thus enhance the chance for survival, reproduction, and ultimate gene propagation. These functions may help us to obtain the benefits of distant rewards that are determined by our own interests and not immediately available in the environment. Thus the distal reward function in gene propagation and evolutionary fitness defines the proximal reward functions that we see in everyday behavior. That is why foods, drinks, mates, and offspring are rewarding.

There have been theories linking pleasure as a required component of health benefits salutogenesis, (salugenesis). In essence, under these terms, pleasure is described as a state or feeling of happiness and satisfaction resulting from an experience that one enjoys. Regarding pleasure, it is a double-edged sword, on the one hand, it promotes positive feelings (like mindfulness) and even better cognition, possibly through the release of dopamine [22]. But on the other hand, pleasure simultaneously encourages addiction and other negative behaviors, i.e., motivational toxicity. It is a complex neurobiological phenomenon, relying on reward circuitry or limbic activity. It is important to realize that through the “Brain Reward Cascade” (BRC) endorphin and endogenous morphinergic mechanisms may play a role [23]. While natural rewards are essential for survival and appetitive motivation leading to beneficial biological behaviors like eating, sex, and reproduction, crucial social interactions seem to further facilitate the positive effects exerted by pleasurable experiences. Indeed, experimentation with addictive drugs is capable of directly acting on reward pathways and causing deterioration of these systems promoting hypodopaminergia [24]. Most would agree that pleasurable activities can stimulate personal growth and may help to induce healthy behavioral changes, including stress management [25]. The work of Esch and Stefano [26] concerning the link between compassion and love implicate the brain reward system, and pleasure induction suggests that social contact in general, i.e., love, attachment, and compassion, can be highly effective in stress reduction, survival, and overall health.

Understanding the role of neurotransmission and pleasurable states both positive and negative have been adequately studied over many decades [26–37], but comparative anatomical and neurobiological function between animals and homo sapiens appear to be required and seem to be in an infancy stage.

Finding happiness is different between apes and humans

As stated earlier in this expert opinion one key to happiness involves a network of good friends [38]. However, it is not entirely clear exactly how the higher forms of satisfaction and pleasure are related to a sugar rush, winning a sports event or even sky diving, all of which augment dopamine release at the reward brain site. Recent multidisciplinary research, using both humans and detailed invasive brain analysis of animals has discovered some critical ways that the brain processes pleasure.

Remarkably, there are pathways for ordinary liking and pleasure, which are limited in scope as described above in this commentary. However, there are **many brain regions**, often termed hot and cold spots, that significantly **modulate** (increase or decrease) our **pleasure or** even produce **the opposite** of pleasure— that is disgust and fear [39]. One specific region of the nucleus accumbens is organized like a computer keyboard, with particular stimulus triggers in rows— producing an increase and decrease of pleasure and disgust. Moreover, the cortex has unique roles in the cognitive evaluation of our feelings of pleasure [40]. Importantly, the interplay of these multiple triggers and the higher brain centers in the prefrontal cortex are very intricate and are just being uncovered.

Desire and reward centers

It is surprising that many different sources of pleasure activate the same circuits between the mesocorticolimbic regions (Figure 1). Reward and desire are two aspects pleasure induction and have a very widespread, large circuit. Some part of this circuit distinguishes between desire and dread. The so-called pleasure circuitry called “REWARD” involves a well-known dopamine pathway in the mesolimbic system that can influence both pleasure and motivation.

In simplest terms, the well-established mesolimbic system is a dopamine circuit for reward. It starts in the ventral tegmental area (VTA) of the midbrain and travels to the nucleus accumbens (Figure 2). It is the cornerstone target to all addictions. The VTA is encompassed with neurons using glutamate, GABA, and dopamine. The nucleus accumbens (NAc) is located within the ventral striatum and is divided into two sub-regions—the motor and limbic regions associated with its core and shell, respectively. The NAc has spiny neurons that receive dopamine from the VTA and glutamate (a dopamine driver) from the hippocampus, amygdala and medial prefrontal cortex. Subsequently, the NAc projects GABA signals to an area termed the ventral pallidum (VP). The region is a relay station in the limbic loop of the basal ganglia, critical for motivation, behavior, emotions and the “Feel Good” response. This defined system of the brain is involved in all addictions –substance, and non –substance related. In 1995, our laboratory coined the term “Reward Deficiency Syndrome” (RDS) to describe genetic and epigenetic induced hypodopaminergia in the “Brain Reward Cascade” that contribute to addiction and compulsive behaviors [3,6,41].

Furthermore, ordinary “liking” of something, or pure pleasure, is represented by small regions mainly in the limbic system (old reptilian part of the brain). These may be part of larger neural circuits. In Latin, hedus is the term for “sweet”; and in Greek, hodone is the term for “pleasure.” Thus, the word Hedonic is now referring to various subcomponents of pleasure: some associated with purely sensory and others with more complex emotions involving morals, aesthetics, and social interactions. The capacity to have pleasure is part of being healthy and may even extend life, especially if linked to optimism as a dopaminergic response [42].

Psychiatric illness often includes symptoms of an abnormal inability to experience pleasure, referred to as anhedonia. A negative feeling state is called dysphoria, which can consist of many emotions such as pain, depression, anxiety, fear, and disgust. Previously many scientists used animal research to uncover the complex mechanisms of pleasure, liking, motivation and even emotions like panic and fear, as discussed above [43]. However, as a significant amount of related research about the specific brain regions of pleasure/reward circuitry has been derived from invasive studies of animals, these cannot be directly compared with subjective states experienced by humans.

In an attempt to resolve the controversy regarding the causal contributions of mesolimbic dopamine systems to reward, we have previously evaluated the three-main competing explanatory categories: “liking,” “learning,” and “wanting” [3]. That is, dopamine may mediate (a) liking: the hedonic impact of reward, (b) learning: learned predictions about rewarding effects, or (c) wanting: the pursuit of rewards by attributing incentive salience to reward-related stimuli [44]. We have evaluated these hypotheses, especially as they relate to the RDS, and we find that the incentive salience or “wanting” hypothesis of dopaminergic functioning is supported by a majority of the scientific evidence. Various neuroimaging studies have shown that anticipated behaviors such as sex and gaming, delicious foods and drugs of abuse all affect brain regions associated with reward networks, and may not be unidirectional. Drugs of abuse enhance dopamine signaling which sensitizes mesolimbic brain mechanisms that apparently evolved explicitly to attribute incentive salience to various rewards [45].

Addictive substances are voluntarily self-administered, and they enhance (directly or indirectly) dopaminergic synaptic function in the NAc. This activation of the brain reward networks (producing the ecstatic “high” that users seek). Although these circuits were initially thought to encode a set point of hedonic tone, it is now being considered to be far more complicated in function, also encoding attention, reward expectancy, disconfirmation of reward expectancy, and incentive motivation [46]. The argument about addiction as a disease may be confused with a predisposition to substance and nonsubstance rewards relative to the extreme effect of drugs of abuse on brain neurochemistry. The former sets up an individual to be at high risk through both genetic polymorphisms in reward genes as well as harmful epigenetic insult. Some Psychologists, even with all the data, still infer that addiction is not a disease [47]. Elevated stress levels, together with polymorphisms (genetic variations) of various dopaminergic genes and the genes related to other neurotransmitters (and their genetic variants), and may have an additive effect on vulnerability to various addictions [48]. In this regard, Vanyukov, et al. [48] suggested based on review that whereas the gateway hypothesis does not specify mechanistic connections between “stages,” and does not extend to the risks for addictions the concept of common liability to addictions may be more parsimonious. The latter theory is grounded in genetic theory and supported by data identifying common sources of variation in the risk for specific addictions (e.g., RDS). This commonality has identifiable neurobiological substrate and plausible evolutionary explanations.

Over many years the controversy of dopamine involvement in especially “pleasure” has led to confusion concerning separating motivation from actual pleasure (wanting versus liking) [49]. We take the position that animal studies cannot provide real clinical information as described by self-reports in humans. As mentioned earlier and in the abstract, on November 23rd, 2017, evidence for our concerns was discovered [50]

In essence, although nonhuman primate brains are similar to our own, the disparity between other primates and those of human cognitive abilities tells us that surface similarity is not the whole story. Sousa et al. [50] small case found various differentially expressed genes, to associate with pleasure related systems. Furthermore, the dopaminergic interneurons located in the human neocortex were absent from the neocortex of nonhuman African apes. Such differences in neuronal transcriptional programs may underlie a variety of neurodevelopmental disorders.

In simpler terms, the system controls the production of dopamine, a chemical messenger that plays a significant role in pleasure and rewards. The senior author, Dr. Nenad Sestan from Yale, stated: “Humans have evolved a dopamine system that is different than the one in chimpanzees.” This may explain why the behavior of humans is so unique from that of non-human primates, even though our brains are so surprisingly similar, Sestan said: “It might also shed light on why people are vulnerable to mental disorders such as autism (possibly even addiction).” Remarkably, this research finding emerged from an extensive, multicenter collaboration to compare the brains across several species. These researchers examined 247 specimens of neural tissue from six humans, five chimpanzees, and five macaque monkeys. Moreover, these investigators analyzed which genes were turned on or off in 16 regions of the brain. While the differences among species were subtle, **there was** a **remarkable contrast in** the **neocortices**, specifically in an area of the brain that is much more developed in humans than in chimpanzees. In fact, these researchers found that a gene called tyrosine hydroxylase (TH) for the enzyme, responsible for the production of dopamine, was expressed in the neocortex of humans, but not chimpanzees. As discussed earlier, dopamine is best known for its essential role within the brain’s reward system; the very system that responds to everything from sex, to gambling, to food, and to addictive drugs. However, dopamine also assists in regulating emotional responses, memory, and movement. Notably, abnormal dopamine levels have been linked to disorders including Parkinson’s, schizophrenia and spectrum disorders such as autism and addiction or RDS.

Nora Volkow, the director of NIDA, pointed out that one alluring possibility is that the neurotransmitter dopamine plays a substantial role in humans’ ability to pursue various rewards that are perhaps months or even years away in the future. This same idea has been suggested by Dr. Robert Sapolsky, a professor of biology and neurology at Stanford University. Dr. Sapolsky cited evidence that dopamine levels rise dramatically in humans when we anticipate potential rewards that are uncertain and even far off in our futures, such as retirement or even the possible alterlife. This may explain what often motivates people to work for things that have no apparent short-term benefit [51]. In similar work, Volkow and Bale [52] proposed a model in which dopamine can favor NOW processes through phasic signaling in reward circuits or LATER processes through tonic signaling in control circuits. Specifically, they suggest that through its modulation of the orbitofrontal cortex, which processes salience attribution, dopamine also enables shilting from NOW to LATER, while its modulation of the insula, which processes interoceptive information, influences the probability of selecting NOW versus LATER actions based on an individual’s physiological state. This hypothesis further supports the concept that disruptions along these circuits contribute to diverse pathologies, including obesity and addiction or RDS.

**2] Substitutability—only consequentialism explains necessary enablers – deontology cant explain why we have to do intermediate steps if obligations depends on properties of an act**