# AC

## Plan

#### I affirm: The appropriation of outer space by nuclear command and control satellites by private entities is unjust.

#### Thus the plan: States ought to ban appropriation of outer space by nuclear command and control satellites by private entities.

#### Limited orbital spots means satellites violates non-appropriation.

Thornburg ND [Are the Non-appropriation Principle and the Current Regulatory Regime Governing Geostationary Orbit Equitable for All of Earth’s States?, MATTHEW THORNBURG, <http://www.mjilonline.org/are-the-non-appropriation-principle-and-the-current-regulatory-regime-governing-geostationary-orbit-equitable-for-all-of-earths-states/>] [SS]

Notions of fairness and common benefit ring throughout the body of international law governing outer space. Indeed, the very preamble of the Outer Space Treaty (“OST”) declares that: [T]he exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development…”[1] However, such noble, egalitarian ideas for the future use of outer space may actually create unequal outcomes down on Earth. This blog seeks to briefly highlight just one example of the unfair limits on the use of outer space for less-developed countries as a result of the Outer Space Treaty’s (“OST”) non-appropriation principle. As the law currently stands, geostationary orbit – a constant orbital position above Earth’s equator – is governed by the OST and is therefore subject to the treaty’s attendant ban on national appropriation. Spaces, or slots, in geostationary orbit[2] are desired because they are exceedingly convenient for communicating with earth. They are highly limited and as a consequence, highly valuable. Moreover, these spaces are allotted on a first-come-first-served basis[3] making them virtually unattainable by less scientifically and economically advanced states[4], or those that are just plain late to the game. The ban on national appropriation is enumerated in the Second Article of the OST, which states: “Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by other means.”[5] The geostationary orbital position is generally agreed upon by experts[6] as part of “outer space” and consequently, forbidden from appropriation. The OST is clear in prohibiting claims of sovereignty, but the subsequent clauses leave much to interpretation when considering what other acts constitute “national appropriation.” In other words, the question surrounding geostationary orbital slots is “whether the continued exclusive occupation by a geostationary satellite of the same physical area is a violation of the ban on national appropriation”[7] by use, occupation, or other means. In his article, Major Legal Issues Arising from the Use of the Geostationary Orbit, Stephen Gorove says that, “it is not clear that a satellite in geostationary orbit would be able to maintain its exact position and occupy the same area over a period of time…” so as to “appropriate” and thus violate Article II of the OST. The analysis should not turn on whether the satellites in geostationary orbit maintain their exact position. Instead, it is the continual use of the orbital slot that should be examined in light of the OST prohibition. The average lifespan of a geostationary satellite is 15-20 years,[8] effectively shutting out any other state’s use of that slot for at least that long. A time frame of this nature seems to be the exact type of “use or occupation” the treaty seeks to foreclose because of the consequent unequal access to the use of space, and the consequent potential to cement the economic interests of certain nations and firms. Compounding this concern is the fact that operators of the geostationary satellites need only refile with the International Telecommunications Union (“ITU”) to “renew” a slot and replace old satellites with new ones.[9] Essentially, such operators keep the orbital slot indefinitely. In light of the OST – a treaty dominated by goals of fair and equitable use and access to space – endless use of these valuable slots should rise to the level of national appropriation by means of use, occupation, or other means. The system of geostationary orbital space allocation has elicited several responses, the most famous of which was the Bogotá Declaration (“Declaration”), drafted in resistance to the non-appropriation principle. This was a proclamation by eight equatorial states, which claimed that the geostationary orbit directly above their borders was an integral part of the land over which they exercised complete and exclusive sovereignty.[10] Accordingly, each state claimed that its sovereignty had been breached by the presence of foreign satellites. This argument failed to garnish much support and the Declaration was not signed by a single space faring nation. The Declaration’s opponents refused to entertain the idea of sovereignty over geostationary orbit as it would be an affront to the non-appropriation principle. Though according to the Declaration, this principle is exactly what “enabled the de facto sovereignty [over geostationary orbit] of dominant, global north states”[11] in the first place. By simply appealing to the non-appropriation principle, scientifically and economically advanced states can reject arguments similar to the Bogotá Declaration out of hand while maintaining their own unfettered use of space. The non-appropriation principle makes orbital slots available to “all” states by law, but in reality they are only available to states with the scientific and economic means to use them. In a world where the non-appropriation principle has become customary international law,[12] less developed states have attempted to benefit from outer space in other ways. For example, in 1991 the ITU granted Tonga six orbital positions, but shortly thereafter, its national satellite company began renting and auctioning its spaces to other satellite companies, including a Colorado firm.[13] There were various rebukes of Tonga’s actions by both states and private companies, describing the practice as “a transparent attempt to secure as many orbital slots as possible to trade as a commodity for pecuniary gain.”[14] It was also viewed as a violation of the fundamental principle of non-appropriation. In an effort to avoid such situations occurring again in the future, the ITU now conducts rigorous reviews in an effort to ensure that there are genuine intentions for orbital slots.[15] Following Tonga, it’s clear that states cannot trade an orbital slot granted to them as a pseudo-commodity claim. Based on the lukewarm response to the Bogotá Declaration, it also seems that the international community will not recognize orbital slights by virtue of a nation’s sovereign right to the space over its territory. Of course, there are valid arguments supporting the international rejection of the Bogota Declaration, especially since the national-appropriation principle constitutes international law. But as shown by Tonga, under the current system, even if a less-developed state is afforded geostationary slots, the non-appropriation principle prevents the financial benefit from the sale or lease of such slot.[16] In contrast, private communications firms, and by proxy their home states, are able to benefit financially by selling a stable stream of satellite transmissions to consumers. If the non-appropriation principle allows such private financial gain, why shouldn’t it allow a state to gain in any way it sees fit from the allocation of orbital slots? The principle’s net effect is maintaining the status quo for those states that won the race of placing satellites in geostationary orbit. Effectively then, orbital slots are only valuable for one reason: their use. Only those states with the capabilities to support government space programs, or the economic stability to support space-capable private firms, will be able to place satellites into geostationary orbit. It seems that the non-appropriation principle has had the effect of replicating in space the global financial imbalance on Earth. While the non-appropriation principle has appeared to create disproportionate results regarding the use of outer space, such results do appear to be the unintended consequences of an optimistic treaty governing space. Nevertheless, it is critical that the international community begins to reconsider the effects of that treaty, and the legal regime as a whole, on the equitable use of space. As the economic potential of outer space is further unlocked, the function of the non-appropriation principle may have become outdated. Certainly, any change to longstanding international law – namely a revision of the ban on national appropriation – would have significant unintended consequences of its own. However, with the increasing exploitation of outer space for financial gain, the effect of the non-appropriation principle on geostationary orbital allotment will be one of many examples of less developed states being foreclosed from participating in, and benefiting from, the use of space.

#### Cost cutting drives vulnerabilities.

Verco 21, Edward. "Satellites are Cyber Insecure: We Need Regulation to Avoid a Disaster." ANU Journal of Law and Technology 2.2 (2021): 57-94. (a law graduate of the University of Adelaide and a lawyer admitted to practice in the Supreme Court of South Australia. He is currently employed as a Contracts Management Associate at Lockheed Martin Australia, and his research areas of interest include regulation in the space and cybersecurity sectors, as well as the defence industry in general.)//Elmer

C Perilous Commercial Practices The perilous actions of many commercial entities compound the cyber vulnerabilities of satellites. Malicious actors target satellites as commercial entities favour lower operational costs over increased cybersecurity spending.65 This vulnerability is particularly evident in smallsats as the low-cost, ‘off-the-shelf’ technology required for production correlates directly to the absence of onboard cybersecurity services.66 It is also suggested that as the cost of developing smallsats decreases, their complexity and cost to harden for cybersecurity increases.67 Therefore, adequate cybersecurity often out-costs the satellites themselves.68 Even for companies with intentions to implement adequate cybersecurity, it often becomes uncommercial and hence not sufficiently achieved.69 Therefore in practice, many private commercial entities, knowingly or otherwise, develop their satellites as vulnerable to cyberattacks.70 Many cybersecurity non-specialists and satellite enthusiasts in the commercial sector simply do not appreciate the cyber-related risks associated with launching smallsats.71 This is partially because smallsat operators traditionally favour innovation over management solutions.72 This reflects the argument that commercial entities recognise a dramatic cyberbreach of a satellite is yet to occur and therefore falsely believe against the essentiality of protecting against hypothetical attacks.73 The increasing volume of satellites in orbit increases the risk associated with the collision of any two satellites, which is also a risk for corporations.74 This information is presented in Table 7 and emphasises the increasing requirement for hardened cybersecurity.

#### Lack of sovereign immunity makes commercial sats an easier target.

Dunnmon ’16 [Nuclear Command and Control in the Twenty-First Century: Maintaining Surety in Outer Space and Cyberspace, Jared Dunnmon, 2016, <https://www.jstor.org/stable/resrep23162.5>] [SS]

Jurisdiction and Sovereign Immunity Jurisdiction, which refers to the “authority to prescribe, enforce, and adjudicate,” is allocated for cyber activities to any state “over (a) persons engaged in cyber activities in its territory, (b) cyber infrastructure located on its territory, and (c) extraterritorially, in accordance with international law.” Importantly, national security threats including “any cyber operation that interferes with a state’s military defensive systems (early warning radar and air defense)” constitute a valid justification for extraterritorial action. Further, the Tallinn Manual specifically states that “the fact that a State is capable of taking control of a piece of cyber infrastructure does not affect jurisdiction—specifically, a state can’t take control of [a] commercial drone operated by another state over international waters.” Logically, this should extend to satellites in the internationally accessible space domain as well. Sovereign immunity fundamentally safeguards the right of a government to control its own sys- tems. Specifically, “Sovereign immunity provides that assets controlled by the government of one sovereignty cannot be taken control of by another sovereignty without a violation of sovereignty— this includes vessels, aerial assets, and space assets.” The jurisdictional and sovereign immunity arguments above indicate that any action taken against a satellite owned by a particular country would be generally prohibited outside of wartime. How- ever, the GoE proposed several specific exceptions to this rule. First, in order to enjoy sovereign immunity, a particular platform must be exclusively performing government functions. In particu- lar, the GoE makes the point that satellites with different transponders for commercial and non- commercial traffic do not have sovereign inviolability, meaning that countries could reasonably argue they are not violating U.S. sovereignty by interfering with satellites that perform key NC3 functions, but have other nongovernmental purposes as well.37 Thus, even if broadly accepted, this specific portion of international law would not seem to provide a strong formulaic disincentive to cyber attacks on either dedicated NC3 communications satellites or those (e.g., AEHF) perform- ing multiple functions including NC3. This is particularly true given that the Talllinn Manual only stipulates that a state should not “knowingly allow cyber infrastructure located within its territory or under its exclusive government control to execute operations harmful to another state.” The question of what states should reasonably be expected to know about cyber infrastructure within their borders remains open.38

## Advantage

#### Commercial nuclear command and control coming now.

Strout ’19 [Can commercial satellites revolutionize nuclear command and control? By Nathan Strout, <https://www.c4isrnet.com/battlefield-tech/c2-comms/2019/07/12/can-commercial-satellites-revolutionize-nuclear-command-and-control/>, July 12 2019] [SS]

During a speech June 26, Air Force Chief of Staff Gen. David Goldfein said that the service — which oversees both the United States’ ground-based intercontinental ballistic missiles, as well as strategic bombers capable of delivering nuclear warheads — was open to the idea of using private sector satellites. “Whether it’s Silicon Valley or commercial space, there’s unlimited opportunities ahead right now for us in terms of how we think differently on things like nuclear command and control,” said Goldfien. “I, for one, am pretty excited about it.” The military has increasingly turned to the commercial sector to expand its capabilities more cost efficiently. For instance, the National Reconnaissance Office — the agency in charge of the nation’s spy satellites — announced that it was looking to expand the amount of satellite imagery it buys from commercial companies. The Air Force has also expressed interest in developing a hybrid architecture for satellite communications, which would see war fighters able to switch between commercial and military satellites as they move through coverage areas. RELATED How the NRO learned to stop worrying and love the commercial imagery The National Reconnaissance Office is dipping its toe into the world of commercial data, awarding three study contracts that will put it on track to start purchasing commercial satellite imagery. By Nathan Strout According to Goldfein, there’s no reason that commercial capabilities could not similarly be applied to nuclear C2. “The work that we’re doing in connecting the force and building a network force around the services in the conventional side has equal applications to the nuclear command and control side, because at the end of the day what we need is resilient capable architecture that keeps the commander in chief connected,” said Goldfien. “So one of the areas that I think we’re going to be able to leverage significantly is the rapid and exciting expansion of commercial space in bringing low-Earth orbit capabilities that will allow us to have resilient pathways to communicate.” Currently, the military relies primarily on the Advanced Extremely High Frequency System for the nuclear sector. With four satellites in orbit and a fifth to be launched later this month, AEHF provides highly secure, anti-jamming communications for the military and national leaders like the commander in chief. It wasn’t clear in Goldfein’s comments whether he was interested in using commercial capabilities to augment, replace or work as a backup to AEHF and other military satellite systems. He did note that the sheer volume of satellites in some commercial constellations provides increased survivability for the network. “We want to get to a point both in conventional and unconventional, or conventional and nuclear, where if some portion of the network is taken out, our answer ought to be, ‘Peh, I’ve got five other pathways. And you want to take out 1,000 satellites of my constellation, of which I have five? Knock yourself out.’ That’s what I see is going to be a significant way that we’re going to be able to leverage,” said Goldfein. The possibility of lowering costs is another major incentive to turning to the commercial sector to begin providing the communications necessary. “What we want to eventually get to is the reversal of the cost curve. Right now it actually costs us more to defend than it takes to shoot. And we want to reverse that so it actually costs them more to shoot than it takes for us to defend,” explained Goldfien. Goldfein pointed to commercial launches as an area where competition had helped drive down costs. “Increased access to affordable launch and smaller payloads that are more capable has caused this rapid expansion of commercial capabilities in space,” he said. “That may be one of the most exciting developments that we have going forward, because industry is going to help us solve many of these problems.”

#### Space race is expanding private sector investment. Space is shifting to cheapsats – US investments are modeled globally.

Grest ’20 [New Space Advantage or Threat for the Military? By Lieutenant Colonel Heiner Grest, DEU AF, JAPCC, <https://www.japcc.org/new-space-advantage-or-threat-for-the-military/>, 2019/2020 Issue of JAPC Journal 29, Lieutenant Colonel Heiner Grest (DEU AF) is currently serving in the C4ISR+S Branch as a Space SME. In 1982 he began his military career as a conscript. In previous appointments he has been working in various command and staff positions in the area of Surface-Based Air and Missile Defence as well as in different national staff positions. He was deployed to the NATO mission in Afghanistan at ISAF HQ. Lieutenant Colonel Grest holds a diploma in business administration from the Bundeswehr University Hamburg.] [SS]

In the early 2000s, a paradigm shift for Space took place. Private actors started to invest heavily in the United States (US) Space sector. Ten years later, major changes occurred worldwide, especially in the two main areas – Space economy and Space technology. Private companies discover Space as a new investing opportunity at their own risk, looking to provide specific Space-based services that have the economic potential to generate substantial financial returns. Modern forms of financing (Crowd Funding, Venture Capital Investments) and business models have been increasingly applied. The headline ‘Space, the final Economic Frontier’ is an accurate characterization of the shifting development direction of Space.1 The trend to smaller satellites (mini, micro, nano, pico, femto2) is the most significant aspect of the technological area. A forecast of expected launches into the Low Earth Orbit (LEO)3 until 2030 shows, that 68% will be small satellites weighing one to 15kg and an additional 25% weighing 16 to 75kg.4 Standardized interfaces and form factors, as well as the use of industry, certified Commercial Off-The-Shelf (COTS) components and pre-qualified parts and systems are common characteristics. Rapid design times of less than one year, paired with shorter mission lifetimes of up to seven years and quick-launch capabilities (newly specified spaceports like ‘Spaceport America’, ‘Mojave Air and Space Port’, ‘Mid-Atlantic Regional Spaceport’) at affordable cost are additional attributes of ‘New Space’. Short delivery times, serial production, a high degree of standardization and lower prices are the results of the previously mentioned changes in Space economy and Space technology areas. Access to Space is easier for an increasing number of countries, organizations and companies. This entails a massive expansion of Space protagonists. More actors from nations and commercial organizations mean more opportunities and more competition. This leads to a new ‘Space Race’ for scientific and technological advantages as well as social and economic challenges. These ‘big steps’ of improvements in Space-based services are a consequence of shorter and quicker decision processes in civilian companies compared to governmental and military organizations. Additionally ‘New Space’, ‘Industry 4.0’ and in particular the Information Technology (IT)-sector (Smart Manufacturing, Industrial Internet of Things, or Cloud Computing) are heavily interacted and dependent on each other. ‘Old Space’ was mainly a research area. ‘New Space’ is characterized by a technological approach of innovation and products, as well as new business models with a high degree of commercialization and decentralization. It is a highly dynamic and visionary process that opens up new commercial areas beyond the traditional aerospace sector. Public funding is still a significant source for large Space programmes, but in the area of small satellites, private funding is rapidly growing.

#### Commercial satellites used for nuclear command and control are coming now – commercial sats uniquely increase risk of extinction via: hacking, spoofing, on the ground interference, foreign parts, miscalc, collisions, and more.

Thompson ’19 [Using Commercial Satellites To Control Nuclear Weapons Is A Bad Idea -- But It's Being Discussed Loren Thompson, 6/23/19, <https://www.forbes.com/sites/lorenthompson/2019/07/23/using-commercial-satellites-to-control-nuclear-weapons-is-a-bad-idea-but-its-being-discussed/?sh=2faaac131dfa>] [SS]

Next month marks the 70th anniversary of the day in 1949 when U.S. intelligence discovered the Soviet Union had conducted its first successful test of a nuclear weapon. From that day forward, most Americans have understood that nuclear war would likely be the worst fate that could ever befall our republic. With the collapse of the Soviet Union and the appearance of new threats, though, the sense of urgency about nuclear security has waned. The infrastructure supporting nuclear deterrence has decayed to a point where all three legs of the strategic “triad”—land-based missiles, sea-based missiles and long-range bombers—need to be replaced. Meanwhile, the architecture used to command and control nuclear forces has changed little since the Reagan era. Against this backdrop, the Chief of Staff of the U.S. Air Force said something curious at a meeting of the Mitchell Institute on June 26. The institute recently produced a report focused on the need to modernize technology for nuclear command and control. General David Goldfein opined that ongoing efforts to network the Air Force were as relevant to control of nuclear forces as conventional forces. In particular, he mentioned the “rapid and exciting expansion of commercial space” as a trend that might facilitate the creation of resilient links for communicating with nuclear forces. I was unaware of the chief’s comments until I saw a story by Mandy Mayfield of National Defense Magazine entitled, “Air Force Wants To Utilize Commercial Satellites For Nuclear Command, Control.” The Air Force is responsible for most of the 200 systems comprising the nuclear command and control system, so General Goldfein’s thoughts have to be taken seriously even if they are just random musings. One advantage to having bombers like this B-52 in the nuclear force is that if circumstances change,... [+] the plane and its weapons can be recalled or retargeted. But that depends on having a command and control system that can communicate with the bomber. One advantage to having bombers like this B-52 in the nuclear force is that if circumstances change,... [+] WIKIPEDIA This particular idea is dangerous. Commercial satellites lack virtually all of the security features that would be necessary to assure control of the nuclear arsenal in a crisis. First of all, they are not survivable against a wide array of threats that China and Russia have begun posing to U.S. orbital assets, ranging from kinetic attacks to electronic jamming to electromagnetic pulse. Second, they are susceptible to cyber intrusion via their ground stations that could impede their performance. Third, they frequently contain foreign components, including in-orbit propulsion technology made in Russia, which might be manipulated in a crisis or simply become unavailable during wartime. Air Force planners presumably know all this, so why would General Goldfein suggest relying on commercial satellites to execute the military’s most fateful decisions? Perhaps for the same reason that the Army is backing into reliance on commercial satellites for its next-generation battlefield networks. There are so many commercial constellations in operation that it seems unlikely America’s enemies could shut them all down in wartime, and they are a lot cheaper to use than orbiting dedicated military satcoms with the requisite capacity and redundancy. “Resilience” has become the watchword for modernizing military space activities, and one way of creating resilience is to proliferate the pathways available for vital communications to a point where adversaries can’t keep up with all the possible options available to U.S. commanders. The same logic is leading technologists to propose large numbers of cheap satellites in low-earth orbit as an adjunct to existing military satcoms. These “cheapsats” wouldn’t be anywhere near as capable as the secure communications assets that Washington has placed in geostationary orbits, but there would be so many that links could be sustained even in highly stressed circumstances, such as the “trans-attack” phase of a nuclear war. Or at least, so the reasoning goes. There’s a lot of technological ferment within the Air Force and Army these days, and it isn’t all high-caliber. Planners understand that command and control networks need to be modernized with an eye to greater resilience and functionality, and that they will have to operate during a new era of great-power military competition. So the threats to their effectiveness likely will be diverse and demanding. Maybe a lot of low-cost nodes could be more resilient than a handful of high-end systems. Maybe. But the idea of relying on commercial satellites for command and control of nuclear forces takes this reasoning a step too far, because market forces preclude any of the hardening and other protective features that might be required in dedicated military birds. For instance, an adversary might suppress much of the space-based commercial capability by detonating a handful of nuclear weapons in space. There would be only modest blast and heat effects in the vacuum of space, but the resulting electromagnetic pulse would travel thousands of miles until it was captured by conductive material like antennas on commercial satcoms, potentially frying delicate electronic equipment. Even if this scenario did not unfold, think of all the ways an adversary like China might seek to interfere with commercial satellites through their ground stations and uplinks, such as insertion of malware via hacking and jamming of signals. Military satcoms have been configured to counter these kinds of exploits while withstanding nuclear effects such as scintillation. But it would cost an arm and a leg to build commercial satellites with such features so nobody does. Their reliability in wartime is thus highly suspect. It isn’t hard to see where General Goldfein might have been coming from with his remarks at the Mitchell Institute. The packet-switching protocol that underpins the Internet was originally conceived, at least in part, to fashion a more resilient way of sustaining connectivity than the traditional circuit-switched telecom system. It would have functioned better in a nuclear war. But the Internet was created under military oversight and today’s commercial satcoms were not. We can’t even guarantee the security of the supply chain from which key components are obtained. So let’s not get too carried away with all the fashionable talk about networking the Air Force. Yes it’s a revolution, but when it comes to command and control of nuclear weapons, we need to be real careful about how we define progress.

#### Debris and miscalc leads to extinction via nuclear command and control satellites.

Acton and McDonald ’21 [Nuclear Command-and-Control Satellites Should Be Off Limits, By JAMES ACTON and THOMAS MACDONALD DECEMBER 10, 2021, <https://www.defenseone.com/ideas/2021/12/nuclear-command-and-control-satellites-should-be-limits/187472/>, James M. Acton is a senior associate in the Nuclear Policy Program at the Carnegie Endowment for International Peace in Washington.] [SS]

When Russia blew up an old satellite with a new missile on November 15, it created an expanding cloud of debris that will menace the outer space environment for years to come. Hypersonic fragments from the collision with Moscow’s ground-launched, anti-satellite weapon risk destroying other satellites used for communications, meteorology, and agriculture. They even pose a danger to China’s Tiangong Space Station and the International Space Station, where personnel—including Russia’s own cosmonauts—were forced to don spacesuits and flee into their escape capsules ahead of approaching debris. But the greatest danger that this careless stunt highlighted is to a different potential target: high-altitude satellites used for nuclear command and control. Those critical satellites face the threat of being attacked by co-orbital anti-satellite weapons, that is, other spacecraft with offensive capabilities. Destroying a nuclear command-and-control satellite, even unintentionally, could lead a conventional conflict to escalate into a nuclear war. As such, the United States, China, and Russia have a shared interest in ensuring the security of each other’s high-altitude satellites. Satellites are integral to the United States’ nuclear command-and-control system. They would be the preferred means to transmit a presidential order to use nuclear weapons and would provide the first warning of an incoming nuclear attack. Russia uses satellites for similar purposes, even if it appears not to rely on them quite as much as the United States. While little is publicly known about China’s nuclear command-and-control system, the U.S. Department of Defense has assessed that China is in the process of developing a space-based early-warning system. The most important nuclear command-and-control satellites—those for communications and early warning—are located in high-altitude orbits. Fortunately, most are strung out about 22,500 miles above the equator—far above the debris from Russia’s ground-launched anti-satellite weapon test. These satellites, however, are growing more vulnerable, particularly to co-orbital anti-satellite weapons. Nuclear command-and-control satellites might be attacked deliberately, as the prelude to a nuclear war. In a conventional conflict, if China, Russia, or the United States decided to use nuclear weapons first—or believed that its opponent was about to do so—it might try to degrade the adversary’s nuclear command-and-control system preemptively. China, for example, might attack U.S. early-warning satellites to weaken the United States’ homeland missile defenses. Conversely, the United States might target Chinese communication satellites to interfere with Beijing’s ability to wield its nuclear forces. In a conventional war, however, nuclear command-and-control satellites might be attacked and threatened for altogether different reasons—creating the risk that nuclear war might be triggered inadvertently. The United States, in particular, is deeply reliant on satellites to enable conventional operations. Moreover, most, if not all, nuclear command-and-control satellites also support nonnuclear missions—making them tempting targets even in a purely conventional conflict. For example, some U.S. satellites transmit orders to both U.S. conventional and nuclear forces. Russia might attack these satellites to try to undermine the United States’ ability to prosecute a conventional war, but with the added and unintended effect of degrading the U.S. nuclear command-and-control system. Washington would be hard pressed to determine the intent behind such attacks. It could easily misinterpret them as preparations for a nuclear war and respond accordingly. It might threaten to use nuclear weapons unless its adversary backed off. In fact, the Trump administration’s nuclear policy explicitly threatened the use of nuclear weapons in precisely this circumstance. The Biden administration can and should remove this threat as part of its ongoing Nuclear Posture Review. To make matters worse, it might not take actual attacks against nuclear command-and-control satellites to spark this kind of escalation. Satellites in high-altitude orbits are periodically moved to different positions to optimize their performance. Especially in a conventional conflict, a repositioning operation that led one spacecraft to approach a nuclear command-and-control satellite might appear to the latter’s owner as the beginning of an attack against its nuclear command-and-control system. Once again, the potential consequences could be catastrophic. “Keep-out zones” around high-altitude satellites would be a straightforward way to mitigate these risks. Specifically, the United States, China, and Russia should agree not to maneuver their spacecraft within a certain distance—we propose 430 miles—of one another’s high-altitude satellites. (Exceptions could be made to accommodate occasional repositioning under tightly controlled conditions. Most importantly, the state conducting the maneuver should warn the others at least 24 hours in advance.) In a conflict, if the belligerents had no intention of attacking each other’s high-altitude satellites, they would have strong reasons of self-interest to respect keep-out zones. If a state did seek to launch such attacks, keep-out zones couldn’t stop it from doing so—but they would buy time that the targeted state could use to try to evade the attack. Negotiating keep-out zones during a conflict, when they would be most useful, would be next-to impossible. So, Washington, Beijing, and Moscow shouldn’t wait—they should start negotiating right away.

#### Collisions with nuclear command satellites specifically lead to miscalc and escalation – magnified by Kessler.

**Blatt 20** [Talia, joint concentration in Social Studies and Integrative Biology at Harvard, specialization in East Asian geopolitics and security issues] “Anti-Satellite Weapons and the Emerging Space Arms Race,” Harvard International Review, May 26, 2020, <https://hir.harvard.edu/anti-satellite-weapons-and-the-emerging-space-arms-race/> TG

Despite their deterrent functions, ASATs are more likely to provoke or exacerbate conflicts than dampen them, especially given the risk they [pose](https://thebulletin.org/2019/06/arms-control-in-outer-space-the-russian-angle-and-a-possible-way-forward/) to early warning satellites. These satellites are a crucial element of US ballistic missile defense, capable of [detecting missiles](https://www.globalsecurity.org/space/world/japan/warning.htm) immediately after launch and tracking their paths.

Suppose a US early warning satellite goes dark, or is shut down. Going dark could signal a glitch, but in a world in which other countries have ASATs, it could also signal the beginning of an attack. Without early warning satellites, the United States is much more susceptible to nuclear missiles. Given the strategy of counterforcing—[targeting](https://www.belfercenter.org/sites/default/files/files/publication/isec_a_00273_LieberPress.pdf) nuclear silos rather than populous cities to prevent a nuclear counterattack—the Americans might believe their nuclear weapons are imminently at risk. It could be [twelve hours](https://books.google.com/books?id=ET8lDwAAQBAJ&pg=PA1&lpg=PA1&dq=%22Protecting+Space+Assets%22+johnson-freese&source=bl&ots=6Oq0IdeBjw&sig=ACfU3U1G6Hj8QdP4JlCRNxA6i5XplZwHyg&hl=en&sa=X&ved=2ahUKEwj1n-jT2YzpAhUugnIEHUuMCu4Q6AEwA3oECAkQAQ#v=onepage&q=%22Protecting%20Space%20Assets%22%20johnson-freese&f=false) before the United States regains satellite function, which is too long to wait to put together a nuclear counterattack. The United States, therefore, might move to mobilize a nuclear attack against Russia or China over what might just be a piece of debris shutting off a satellite.

Additionally, accidental warfare, or strategic miscalculation, is uniquely likely in space. It is [much easier](https://books.google.com/books?id=VyXTDwAAQBAJ&pg=PA339&lpg=PA339&dq=space+offense+dominant&source=bl&ots=Mw0bgJ51qf&sig=ACfU3U3DeZiEHpr9nfszlCbJZIoyyssIpg&hl=en&sa=X&ved=2ahUKEwjrs-WD3IzpAhVulHIEHbL0AE4Q6AEwCXoECAoQAQ#v=onepage&q=space%20offense%20dominant&f=false) to hold an adversary’s space systems in jeopardy with destructive ASATs than it is to [sustainably defend](https://www.cnas.org/publications/commentary/the-us-military-should-not-be-doubling-down-on-space) a system, which is expensive and in some cases not technologically feasible because of limitations on satellite movement. Space is therefore [considered](https://books.google.com/books?id=VyXTDwAAQBAJ&pg=PA339&lpg=PA339&dq=space+offense+dominant&source=bl&ots=Mw0bgJ51qf&sig=ACfU3U3DeZiEHpr9nfszlCbJZIoyyssIpg&hl=en&sa=X&ved=2ahUKEwjrs-WD3IzpAhVulHIEHbL0AE4Q6AEwCXoECAoQAQ#v=onepage&q=space%20offense%20dominant&f=false) offense-dominant; offensive tactics like weapons development are prioritized over defensive measures, such as [improving GPS](https://www.politico.com/story/2018/04/06/outer-space-war-defense-russia-china-463067) or making satellites more resistant to jamming.

As a result, countries are left with poorly defended space systems and rely on offensive posturing, which increases the risk that their actions are perceived as aggressive and incentivizes rapid, risky counterattacks because militaries cannot rely on their spaced-based systems after first strikes.

There are several hotspots in which ASATs and offensive-dominant systems are particularly relevant. Early warning satellites [play](https://www.politico.com/story/2018/04/06/outer-space-war-defense-russia-china-463067) a central role in US readiness in the event of a conflict involving North Korea. News of North Korean missile launches comes from these satellites. Given North Korea’s [history](https://www.bbc.com/news/world-asia-pacific-11813699) of nuclear provocations, unflinchingly hostile rhetoric towards the United States and South Korea, and diplomatic opacity, North Korea is always a threatening, unknowable adversary, but recent developments have magnified the risk. With the health of Kim Jong-un [potentially in jeopardy](https://apnews.com/f5d302ae65b03838173e40848223b771), a succession battle or even civil war on the peninsula [raises the chances](https://www.express.co.uk/news/world/1273890/Kim-Jong-un-dead-North-Korea-nuclear-weapon-news-latest-death-US) of loose nukes. If the regime is terminal, traditional MAD risk calculus will become moot; with nothing to lose, North Korea would have no reason to hold back its nuclear arsenal. Or China [might decide](https://foreignpolicy.com/2020/04/28/kim-jong-un-china-north-korea/) to seize military assets and infrastructure of the regime. If the US does not have its early warning satellites because they have been taken out in an ASAT attack, the US, South Korea, and Japan are all in imminent nuclear peril, while China could be in a position to fundamentally reshape East Asian geopolitics.

The South China Sea is another hotspot in which ASATs could risk escalation. China [is developing](https://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/china-anti-access-area-denial-coming-soon/) Anti-Access Area Denial (A2/AD) in the South China Sea, a combination of long range radar with air and maritime defense meant to deny US freedom of navigation in the region. Given the disputed nature of territory in the South China Sea, the United States and its allies do not want China to successfully close off the region.

#### Nuke war causes extinction.

* Checked

PND 16. internally citing Zbigniew Brzezinski, Council of Foreign Relations and former national security adviser to President Carter, Toon and Robock’s 2012 study on nuclear winter in the Bulletin of Atomic Scientists, Gareth Evans’ International Commission on Nuclear Non-proliferation and Disarmament Report, Congressional EMP studies, studies on nuclear winter by Seth Baum of the Global Catastrophic Risk Institute and Martin Hellman of Stanford University, and U.S. and Russian former Defense Secretaries and former heads of nuclear missile forces, brief submitted to the United Nations General Assembly, Open-Ended Working Group on nuclear risks. A/AC.286/NGO/13. 05-03-2016. <http://www.reachingcriticalwill.org/images/documents/Disarmament-fora/OEWG/2016/Documents/NGO13.pdf> //Re-cut by Elmer

Consequences human survival 12. Even if the 'other' side does NOT launch in response the smoke from 'their' burning cities (incinerated by 'us') will still make 'our' country (and the rest of the world) uninhabitable, potentially inducing global famine lasting up to decades. Toon and Robock note in ‘Self Assured Destruction’, in the Bulletin of Atomic Scientists 68/5, 2012, that: 13. “A nuclear war between Russia and the United States, even after the arsenal reductions planned under New START, could produce a nuclear winter. Hence, an attack by either side could be suicidal, resulting in self assured destruction. Even a 'small' nuclear war between India and Pakistan, with each country detonating 50 Hiroshima-size atom bombs--only about 0.03 percent of the global nuclear arsenal's explosive power--as air bursts in urban areas, could produce so much smoke that temperatures would fall below those of the Little Ice Age of the fourteenth to nineteenth centuries, shortening the growing season around the world and threatening the global food supply. Furthermore, there would be massive ozone depletion, allowing more ultraviolet radiation to reach Earth's surface. Recent studies predict that agricultural production in parts of the United States and China would decline by about **20 percent** for four years, and by 10 percent for a decade.” 14. A conflagration involving USA/NATO forces and those of Russian federation would most likely cause the deaths of most/nearly all/all humans (and severely impact/extinguish other species) as well as destroying the delicate interwoven techno-structure on which latter-day 'civilization' has come to depend. Temperatures would drop to below those of the last ice-age for up to 30 years as a result of the lofting of up to 180 million tonnes of very black soot into the stratosphere where it would remain for decades. 15. Though human ingenuity and resilience shouldn't be underestimated, human survival itself is arguably problematic, to put it mildly, under a 2000+ warhead USA/Russian federation scenario. 16. The Joint Statement on Catastrophic Humanitarian Consequences signed October 2013 by 146 governments mentioned 'Human Survival' no less than 5 times. The most recent (December 2014) one gives it a highly prominent place. Gareth Evans’ ICNND (International Commission on Nuclear Non-proliferation and Disarmament) Report made it clear that it saw the threat posed by nuclear weapons use as one that at least threatens what we now call 'civilization' and that potentially threatens human survival with an immediacy that even climate change does not, though we can see the results of climate change here and now and of course the immediate post-nuclear results for Hiroshima and Nagasaki as well.

#### The risk of miscalc is real and growing – an accidental launch can trigger a nuclear war or directly cause extinction.

Schlosser ‘16 [World War Three, by Mistake, Eric Schlosser, December 23, 2016, <https://www.newyorker.com/news/news-desk/world-war-three-by-mistake>] [SS]

My book “Command and Control” explores how the systems devised to govern the use of nuclear weapons, like all complex technological systems, are inherently flawed. They are designed, built, installed, maintained, and operated by human beings. But the failure of a nuclear command-and-control system can have consequences far more serious than the crash of an online dating site from too much traffic or flight delays caused by a software glitch. Millions of people, perhaps hundreds of millions, could be annihilated inadvertently. “Command and Control” focusses on near-catastrophic errors and accidents in the arms race between the United States and the Soviet Union that ended in 1991. The danger never went away. Today, the odds of a nuclear war being started by mistake are low—and yet the risk is growing, as the United States and Russia drift toward a new cold war. The other day, Senator John McCain called Vladimir Putin, the President of the Russian Federation, “a thug, a bully, and a murderer,” adding that anyone who “describes him as anything else is lying.” Other members of Congress have attacked Putin for trying to influence the Presidential election. On Thursday, Putin warned that Russia would “strengthen the military potential of strategic nuclear forces,” and President-elect Donald Trump has responded with a vow to expand America’s nuclear arsenal. “Let it be an arms race,” Trump told one of the co-hosts of MSNBC’s “Morning Joe.” “We will outmatch them at every pass and outlast them all.” The harsh rhetoric on both sides increases the danger of miscalculations and mistakes, as do other factors. Close encounters between the military aircraft of the United States and Russia have become routine, creating the potential for an unintended conflict. Many of the nuclear-weapon systems on both sides are aging and obsolete. The personnel who operate those systems often suffer from poor morale and poor training. None of their senior officers has firsthand experience making decisions during an actual nuclear crisis. And today’s command-and-control systems must contend with threats that barely existed during the Cold War: malware, spyware, worms, bugs, viruses, corrupted firmware, logic bombs, Trojan horses, and all the other modern tools of cyber warfare. The greatest danger is posed not by any technological innovation but by a dilemma that has haunted nuclear strategy since the first detonation of an atomic bomb: How do you prevent a nuclear attack while preserving the ability to launch one? “The pattern of the use of atomic weapons was set at Hiroshima,” J. Robert Oppenheimer, the scientific director of the Manhattan Project, said in November, 1945, just a few months after the Japanese city’s destruction. “They are weapons of aggression, of surprise, and of terror.” Nuclear weapons made annihilation vastly more efficient. A single bomb could now destroy a target whose elimination had once required thousands of bombs. During an aerial attack, you could shoot down ninety-nine per cent of the enemy’s bombers—and the plane that you missed could obliterate an entire city. A war between two countries with nuclear weapons, like a Wild West shoot-out, might be won by whoever fired first. And a surprise attack might provide the only hope of national survival—especially for the country with an inferior nuclear arsenal. During the same month that Oppenheimer made his remarks, Bernard Brodie, a political scientist at Yale University, proposed a theory of nuclear deterrence that has largely guided American policy ever since. Brodie argued that the threat of retaliation offered the only effective defense against a nuclear attack. “We must do what we can to reduce the advantage that might accrue to the enemy if he hit first,” Brodie wrote, after the Soviet Union had obtained its own nuclear weapons. Despite all the money spent on building nuclear weapons and delivery systems, their usefulness would be mainly psychological. “What deters is not the capabilities and intentions we have, but the capabilities and intentions the enemy thinks we have,” a classified Pentagon report explained. “The mission is persuasion.” The fear of a surprise attack and the necessity for retaliation soon dominated the strategic thinking of the Cold War. Every year, technological advances compressed time and added more urgency to decision-making. At a top-secret briefing in 1961, Secretary of Defense Robert McNamara was told that a Soviet surprise attack on just five targets—the Pentagon, the White House, Camp David, Site R, and High Point, a bunker inside Mount Weather, Virginia—had a good chance of wiping out the civilian leadership of the United States. By striking an additional nine targets, as part of a “decapitation” attack, the Soviet Union could kill America’s military leadership as well. The Soviets might be able to destroy America’s nuclear command-and-control system with only thirty-five missiles. Under McNamara’s guidance, the Kennedy Administration sought ways to maintain Presidential control over nuclear weapons. The Pentagon deployed airborne command posts, better communications and early-warning systems, Minuteman missiles that could be quickly launched, and a large fleet of ballistic-missile submarines. VIDEO FROM THE NEW YORKER Sha’Carri Richardson on the Meaning of Time in Running and in Life Many of these elements were put to the test during the Cuban Missile Crisis, when a series of misperceptions, miscalculations, and command-and-control problems almost started an accidental nuclear war—despite the determination of both John F. Kennedy and Nikita Khrushchev to avoid one. In perhaps the most dangerous incident, the captain of a Soviet submarine mistakenly believed that his vessel was under attack by U.S. warships and ordered the firing of a torpedo armed with a nuclear warhead. His order was blocked by a fellow officer. Had the torpedo been fired, the United States would have retaliated with nuclear weapons. At the height of the crisis, while leaving the White House on a beautiful fall evening, McNamara had a strong feeling of dread—and for good reason: “I feared I might never live to see another Saturday night.” Today, the United States has four hundred and forty Minuteman III intercontinental ballistic missiles, sitting in underground silos scattered across the plains of Colorado, Nebraska, Wyoming, Montana, and North Dakota. The missiles are kept on alert, at all times, ready to take off within two minutes, as a means of escaping a surprise attack. Each missile carries a nuclear warhead that may be as much as thirty times more powerful than the bomb that destroyed Hiroshima. The Minuteman III was first deployed in 1970 and scheduled for retirement in the early nineteen-eighties. The age of the weapon system is beginning to show. Most of the launch complexes were built during the Kennedy Administration, to house an earlier version of the Minuteman, and some of the complexes are prone to flooding. The command centers feel like a time capsule of late-twentieth-century technology. During a recent visit to a decommissioned Minuteman site, I was curious to see the big computer still used to receive Emergency Action Messages—launch orders from the President—via landline. The computer is an I.B.M. Series/1, a state-of-the-art machine in 1976, when it was introduced. “Replacement parts for the system are difficult to find because they are now obsolete,” a report by the Government Accountability Office said last May, with some understatement, about a computer that relies on eight-inch floppy disks. You can buy a smartphone with about a thousand times the memory. The personnel who command, operate, and maintain the Minuteman III have also become grounds for concern. In 2013, the two-star general in charge of the entire Minuteman force was removed from duty after going on a drunken bender during a visit to Russia, behaving inappropriately with young Russian women, asking repeatedly if he could sing with a Beatles cover band at a Mexican restaurant in Moscow, and insulting his military hosts. The following year, almost a hundred Minuteman launch officers were disciplined for cheating on their proficiency exams. In 2015, three launch officers at Malmstrom Air Force Base, in Montana, were dismissed for using illegal drugs, including ecstasy, cocaine, and amphetamines. That same year, a launch officer at Minot Air Force Base, in North Dakota, was sentenced to twenty-five years in prison for heading a violent street gang, distributing drugs, sexually assaulting a girl under the age of sixteen, and using psilocybin, a powerful hallucinogen. As the job title implies, launch officers are entrusted with the keys for launching intercontinental ballistic missiles. The Minuteman III is a relic of the Cold War not only in design but also in its strategic purpose. The locations of the silos, chosen more than half a century ago, make the missile useful only for striking targets inside Russia. The silos aren’t hardened enough to survive a nuclear detonation, and their coördinates are well known, so the Minuteman III is extremely vulnerable to attack. The President would be under great pressure, at the outset of a war with Russia, to “use them or lose them.” The missiles now have two principal roles in America’s nuclear-war plans: they can be launched as part of a first strike, or they can be launched when early-warning satellites have determined that Russian warheads are heading toward the United States. After being launched, a Minuteman III cannot be remotely disabled, disarmed, or called back. From the very beginning of the Minuteman program, the Air Force has successfully fought against adding a command-destruct mechanism, fearing that an adversary might somehow gain control of it and destroy all the missiles mid-flight. “Once they’re gone, they’re gone,” an Air Force officer told “60 Minutes” a few years ago. The dangers of “launch-on-warning” have been recognized since the idea was first proposed, during the Eisenhower Administration. After the Cuban Missile Crisis, McNamara advised Kennedy that the United States should never use its nuclear weapons until a nuclear detonation had occurred on American soil, and could be attributed to an enemy attack. The first Minuteman missiles had already become a great source of stress for McNamara. The control system of the original model had a design flaw: small fluctuations in the electricity entering the command center could mimic the series of pulses required by the launch switch. An entire squadron of fifty missiles might be launched accidentally without anyone turning a key. “I was scared shitless,” an engineer who worked on the system later confessed. “The technology was not to be trusted.” McNamara insisted that the control system be redesigned, at great expense. The destruction of fifty Soviet cities because of a mechanical glitch, a classified history of the Minuteman program later noted, would be “an accident for which a later apology might be inadequate.” The launch-on-warning policy became controversial during the nineteen-seventies, once it was publicly known. The hundreds of missiles based on American submarines, almost impossible to find in the depths of the ocean, seemed more than adequate to deter a Soviet attack. During testimony before the House Armed Services Committee in 1979, Fred Iklé, a conservative Republican who later became a top Pentagon official during the Reagan Administration, said, “If any witness should come here and tell you that a totally reliable and safe launch-on-warning posture can be designed and implemented, that man is a fool.” The Pentagon repeatedly denied that launch-on-warning was American policy, claiming that it was simply one of many options for the President to consider. A recent memoir, “Uncommon Cause,” written by General George Lee Butler, reveals that the Pentagon was not telling the truth. Butler was the head of the U.S. Strategic Command, responsible for all of America’s nuclear weapons, during the Administration of President George H. W. Bush. According to Butler and Franklin Miller, a former director of strategic-forces policy at the Pentagon, launch-on-warning was an essential part of the Single Integrated Operational Plan (siop), the nation’s nuclear-war plan. Land-based missiles like the Minuteman III were aimed at some of the most important targets in the Soviet Union, including its anti-aircraft sites. If the Minuteman missiles were destroyed before liftoff, the siop would go awry, and American bombers might be shot down before reaching their targets. In order to prevail in a nuclear war, the siop had become dependent on getting Minuteman missiles off the ground immediately. Butler’s immersion in the details of the nuclear command-and-control system left him dismayed. “With the possible exception of the Soviet nuclear war plan, [the siop] was the single most absurd and irresponsible document I had ever reviewed in my life,” Butler concluded. “We escaped the Cold War without a nuclear holocaust by some combination of skill, luck, and divine intervention, and I suspect the latter in greatest proportion.” The siop called for the destruction of twelve thousand targets within the Soviet Union. Moscow would be struck by four hundred nuclear weapons; Kiev, the capital of the Ukraine, by about forty. After the end of the Cold War, a Russian surprise attack became extremely unlikely. Nevertheless, hundreds of Minuteman III missiles remained on alert. The Cold War strategy endured because, in theory, it deterred a Russian attack on the missiles. McNamara called the policy “insane,” arguing that “there’s no military requirement for it.” George W. Bush, while running for President in 2000, criticized launch-on-warning, citing the “unacceptable risks of accidental or unauthorized launch.” Barack Obama, while running for President in 2008, promised to take Minuteman missiles off alert, warning that policies like launch-on-warning “increase the risk of catastrophic accidents or miscalculation.” Twenty scientists who have won the Nobel Prize, as well as the Union of Concerned Scientists, have expressed strong opposition to retaining a launch-on-warning capability. It has also been opposed by former Secretary of State Henry Kissinger, former Secretary of State George Shultz, and former Senator Sam Nunn. And yet the Minuteman III missiles still sit in their silos today, armed with warheads, ready to go. William J. Perry, who served as Secretary of Defense during the Clinton Administration, not only opposes keeping Minuteman III missiles on alert but advocates getting rid of them entirely. “These missiles are some of the most dangerous weapons in the world,” Perry wrote in the Times, this September. For many reasons, he thinks the risk of a nuclear catastrophe is greater today than it was during the Cold War. While serving as an Under-Secretary of Defense in 1980, Perry also received a late-night call about an impending Soviet attack, a false alarm that still haunts him. “A catastrophic nuclear war could have started by accident.” Bruce Blair, a former Minuteman launch officer, heads the anti-nuclear group Global Zero, teaches at Princeton University, and campaigns against a launch-on-warning policy. Blair has described the stresses that the warning of a Russian attack would put on America’s command-and-control system. American early-warning satellites would detect Russian missiles within three minutes of their launch. Officers at norad would confer for an additional three minutes, checking sensors to decide if an attack was actually occurring. The Integrated Tactical Warning/Attack System collects data from at least two independent information sources, relying on different physical principles, such as ground-based radar and satellite-based infrared sensors. If the norad officials thought that the warning was legitimate, the President of the United States would be contacted. He or she would remove the Black Book from a briefcase carried by a military aide. The Black Book describes nuclear retaliatory options, presented in cartoon-like illustrations that can be quickly understood. Missiles launched from Russia would give the President about twenty minutes to make a decision, after consultation with the head of the U.S. Strategic Command. The President might have as few as five minutes, if missiles had been launched from Russian submarines in the western Atlantic. A decision to retaliate at once, to launch Minuteman missiles before they could be destroyed, runs the risk of killing millions of people by mistake. A decision to wait—to make sure that the attack is for real, to take no action until Russian warheads began to detonate in the United States—runs the risk losing the ability of the command-and-control system to order a retaliation. In that desperate situation, with the fate of the world in the balance, the temperament of the President would be less important than the quality of the information being offered by the system. Could you trust the sensors?

#### Newspace leads to a profit mindset resulting in cheap, vulnerable sats.

Manulis ’20 [Cyber security in New Space, <https://link.springer.com/article/10.1007/s10207-020-00503-w#Sec1>, May 12 2020, M. Manulis, C. P. Bridges, R. Harrison, V. Sekar & A. Davis] [SS]

Since this time, the boom of the consumer microelectronics industry, more rapid research and development practices and the lower costs of launch means that space is viewed now as a highly valued resource for business. This private sector interest has expanded the space market globally (estimated to be worth $269 billion as of 2017 [1]) and brought different players and projects to the table. The change in the economics of space to one which is profit-driven has prompted R&D to have a quicker turnaround with smaller agile teams, mirroring the IT industry rather than traditional aerospace or military outfits [2]. This agility pattern born from incorporating standard modules and components whilst making space travel cheaper and more widespread across industries is characterized by the term “New Space”. This ecosystem, as Paikowsky [3] calls it, is also moving towards other trends such as large satellite constellations of the orders of hundreds and thousands, and small satellite (weighing 600 kg or less) production. In 2018, 328 small satellites were launched, six times as many as in 2012, with and half of them for commercial purposes [4]. Commercial-off-the-shelf (COTS) components are now commonplace in satellites and ground control systems, decreasing construction times and costs. Companies are taking more risks with their satellites, leading to more innovative applications and technologies. Major applications of New Space The academic sector is striving to push the innovative boundaries of New Space by exhibiting new technologies in space. Missions such as STRaND-1Footnote1 demonstrated the feasibility of using smartphone electronics in satellites. A surge of investment in the Earth observation market has been powered by the applications of satellite imagery and signals intelligence, namely business intelligence products [5], as well as environmental conservation efforts. Companies such as PlanetFootnote2 and HawkEye 360Footnote3 are operating constellations of small satellites in low Earth orbit (LEO). Global broadband services, another major applications emerging in New Space, aim to bring connectivity to rural and remote areas and provide fault-tolerant networks for critical services. Satellite broadband revenue has shown steady growth in the last five years, with more rapid growth predicted as proposed satellite constellations of the order of hundreds and thousands become operational [1, 5], such as Starlink, OneWeb, Telesat and LeoSat. Satellite geolocation services, providing precise time and position data to dedicated receivers, have been a steady addition to several industries, enabling applications including route planning, fleet management and time-critical purposes used in the financial and energy sectors. Many sectors to which Global Navigation Satellite Systems (GNSS) can be applied have developed the global ground equipment market. In 2016, GNSS equipment revenue made $84.6 billion of the total ground equipment revenue of $113.4 billion, which has been on a steady incline since 2012 [5]. The use of satellites in warfare has a leading role to play in the modern era, with 68% of munitions being guided by satellites in the 2004 Iraq war [6]. These systems have stricter security requirements and to employ features such as encryption, anti-jamming techniques and frequency hopping. The US military’s use of commercial satellites has increased in recent conflicts and pushed further with legislation passed in the Bush era [7, 8]. Small satellites are being increasingly used to support military functions, with USA, Russia and China launching 39, 20 and 17 small satellites, respectively, between 2012 and 2018 [4]. This paper therefore aims to provide an analysis of the New Space era in terms of the previous security threats, emerging security challenges and key technologies which are advancing and innovating the space and satellite industry. Security challenge Being able to manipulate such remote objects as satellites provides a new challenge to the hacking community. Scarce documentation and source code provide the ultimate “black box” challenge. Combined with the “security through obscurity” mentality with which vendors develop these products, major vulnerabilities in satellite systems are being discovered. The security analysis of satellite user terminals in [9, 10] brought to light numerous vendor’s use of hard-coded credentials, insecure protocols and weak authentication mechanisms. This ageing mentality is not suitable for systems making use of cyber technologies, especially those which support critical infrastructure which are piquing the interest of the hacking community. Fig. 1 figure 1 Typical satellite architecture. Dotted orange arrows denote radio links; solid black arrows denote ground network links. Figure from [13] Full size image Security is now no longer an afterthought for terrestrial enterprises; standards, regulations and organizational security-driven mindsets have prompted the integration security practices both retrospectively and from a foundation level. An attack may not succeed using terrestrial methods and may be easier or more beneficial to target a satellite-based system which the organization uses. For instance, to negatively impact an economy may be more easily achieved by targeting satellites providing point-of-sale card services for many commercial entities [11].

#### Three internal links to hacking: ground based terror, communication hijacks, and space attacks.

Greenbaum 1/8 [Who is going to stop space terrorists?, Dov Greenbaum, 1/8/22, <https://www.calcalistech.com/ctech/articles/0,7340,L-3926737,00.html>] [SS]

Generally, its thought that there are at least three major types of space terrorism. The first is through attacking the ground-based operations of spacecrafts and their crews. A security breach at a launch site is a real and constant fear, and was portrayed in the science fiction film Contact. In 1972, the Palestinian terror group Black September threatened to murder and kidnap the crew and families of the Apollo 17 mission, and in 2003, NASA increased security around its shuttle launch because of fears that Ilan Ramon might be a target. The second possible manifestation of space terrorism is through the hijacking or jamming of radio communication between satellites and ground. Reportedly, in 2002 and 2004 the Falun Gong group, a religious movement in in China, allegedly hacked transmissions from Chinese satellites. The Sri Lankan militant group, the Tamil Tigers, also successfully did this to an Intelsat communication satellite in 2007. Subsequently, there have also been many other incidences of hacking that allowed rogue groups to access and control satellites in outer space. Hacking a satellite can do more than simply jamming or pirating the legitimate signal; even a small satellite at supersonic speeds can potentially be repurposed into a putative space weapon by an unscrupulous faction, especially in command and control of that satellite isn’t protected and encrypted. A cybersecurity expert even provided a step-by-step hypothetical outline for hacking a Starlink satellite. A third way that terrorists could threaten space resources is through a direct in-space attack on a spacecraft. Arguably, this might be the most difficult to prevent. The Union of Concerned Scientists has thoroughly documented the numerous continuing efforts by nation states, stretching back more than half a century, to develop destructive anti-satellite weapons (ASATs). These were often overt programs: in 1964 U.S. President Lyndon Johnson gave a speech describing American efforts to counter potential bomb-carrying Soviet satellites, effectively publicly launching Program 437, a nuclear ASAT system. There has subsequently been a resurgence in ASAT efforts worldwide since the 2000s, which may or may not include the US Air Force’s secretive X-37B mini shuttle as well as ground-based ASAT lasers.

#### More cheapsats don’t work – increases risk of hacking.

Graczyk et al 21, Rafal, Paulo Esteves-Verissimo, and Marcus Voelp. "Sanctuary lost: a cyber-physical warfare in space." arXiv preprint arXiv:2110.05878 (2021). (University of Luxembourg, Interdisciplinary Center for Security, Reliability and Trust (SnT) - CritiX group)//Elmer

NewSpace is on course of enabling satellites to become interconnected, creating orbital networks with many nodes and numerous points of entry that are eventually connected to the Internet. It leads to the creation of (mega-)constellations (i.e., formations of spacecrafts cooperating in achieving a common goal, typically for telecommunication but also for real-time Earth observation and similar activities [36]), which on the one hand enables operators and users to utilize the greater potential of these new services and increases the availability and robustness against accidental faults. At the same time, NewSpace approach, and use of large constellations in particular, also increases the attack surface, making it harder to defend and maintain control on the system. The trend of increasing the size of satellite constellation along with simplifying and miniaturizing the satellites themselves starts to spill into the traditional space industry [37], and most likely will become even more significant in the future.

#### Nuclear CNC is key to nuclear deterrence.

Farley 1/9

[Does A Space War Mean A Nuclear War?, Robert Farley, 1/9/22, Dr. Robert Farley has taught security and diplomacy courses at the Patterson School since 2005. He received his BS from the University of Oregon in 1997, and his Ph.D. from the University of Washington in 2004. Dr. Farley is the author of Grounded: The Case for Abolishing the United States Air Force (University Press of Kentucky, 2014), the Battleship Book (Wildside, 2016), and Patents for Power: Intellectual Property Law and the Diffusion of Military Technology (University of Chicago, 2020). He has contributed extensively to a number of journals and magazines, including the National Interest, the Diplomat: APAC, World Politics Review, and the American Prospect. Dr. Farley is also a founder and senior editor of Lawyers, Guns and Money., <https://www.19fortyfive.com/2022/01/does-a-space-war-mean-a-nuclear-war/>] [SS]

The recent Russian anti-satellite test didn’t tell the world anything new, but it did reaffirm the peril posed by warfare in space. Debris from explosions could make some earth orbits remarkably risky to use for both civilian and military purposes. But the test also highlighted a less visible danger; attacks on nuclear command and control satellites could rapidly produce an extremely dangerous escalatory situation in a war between nuclear powers. James Acton and Thomas Macdonald drew attention to this problem in a recent article at Inside Defense. As Acton and MacDonald point out, nuclear command and control satellites are the connective tissue of nuclear deterrence, assuring countries that they’re not being attacked and that they’ll be able to respond quickly if they are. For a long time, these strategic early-warning satellites were akin to a center of gravity in ICBM warfare. Nuclear deterrence requires awareness that an attack is underway. Attacks on the monitoring system could easily be read as an attempt to blind an opponent in preparation for general war, and could themselves incur nuclear retaliation. Thus, the nuclear command and control satellites are critical to the maintenance of nuclear deterrence. They make it possible to distribute an order from the chief of government to the nuclear delivery systems themselves. Consequently, their destruction might lead to hesitation or delay in performing a nuclear launch order.

#### Deterrence theory is true for CBWs.

Dodge and Lowther 16 Michaela Dodge and Adam Lowther, 10-4-2016, "A No-First-Use Policy Would Make the United States Less Secure," E-International Relations, [Michaela Dodge is a Senior Policy Analyst for Defense and Strategic Policy at The Heritage Foundation. Adam Lowther, Ph.D., is a Director of the School for Advanced Nuclear Deterrence Studies.], https://www.e-ir.info/2016/10/04/a-no-first-use-policy-would-make-the-united-states-less-secure/, SJBE

A no-first-use nuclear weapons policy means that a country vows not to use nuclear weapons unless it is first attacked with nuclear weapons. Such a declaration would be a departure from the current U.S. policy of “calculated ambiguity.” Since the dawn of the atomic age, the United States has [refused](https://www.amazon.com/Deterrence-Second-Nuclear-Keith-Payne/dp/0813108950) to specify exactly which scenarios would lead to the use of its nuclear weapons. The ambiguity created by having an undefined “red line” contributed greatly to deterrence during the Cold War—including deterrence of large-scale attacks conducted with non-nuclear weapons—and continues to do so today. The effect of changing this policy would be to make the United States and its allies less secure while failing to provide tangible nonproliferation benefits. The very term “no-first-use” is misleading. While a nuclear weapon has not been used in anger for over 70 years, nuclear weapons are used every single day to deter large-scale conventional and nuclear attacks. Former Air Force Chief of Staff General Larry Welch [points out](http://www.afgsc.af.mil/News/ArticleDisplay/tabid/2612/Article/454795/conference-room-dedicated-to-former-af-chief-of-staff.aspx) that “we have used the nuclear forces every second of every day for 50 years.” Moreover, during those 50 years, humankind has experienced the most peaceful period in its history as measured by the number of conflict-related casualties as a proportion of the world’s population. This is due in large part to the devastating risks that nuclear weapons pose to any society that is attacked with them. For the United States and the Soviet Union, a large-scale nuclear exchange meant the end of society as Americans and Russians had known it. That risk led American and Soviet leaders to exercise a level of caution and restraint that was not exercised by German, Japanese, and other world leaders in the years leading up to World War II. If the United States were to adopt a no-first-use policy, the perceived threat of nuclear conflict admittedly would decline. While a decline in the perceived threat of nuclear weapons use may seem like a good thing, however, it is actually dangerous because it is that very perceived threat that gives leaders who may be contemplating the use of force the chance for second thoughts that can prevent great-power war. This is an important point. Opening the door to great-power conflict, even if ever so slightly, is obviously a step in the wrong direction. Nor are great-power conflicts the only dangerous challenge that nuclear weapons deter. Biological, chemical, and even well-organized and targeted cyber-attacks can be as devastating as nuclear attacks. [Some proponents](https://fsi.stanford.edu/sites/default/files/51-3_12_Sagan_author_proof.pdf) may claim that the combination of a no-first-use policy and American conventional superiority plays to America’s strength, but recent history suggests that simply using our conventional forces rarely achieves our political objectives. It is also worth noting that the U.S. military is [overstretched](http://index.heritage.org/military/2016/) and on the verge of a readiness crisis. In the European theater, for example, North Atlantic Treaty Organization (NATO) forces are judged by many to be insufficient to counter a Russian military advance into the Baltics. Most important, the point of deterrence is to prevent a war from happening, which is frequently preferable to becoming engaged in a war even if one wins at the end of the day.

#### The perception (or reality) of weak nuclear deterrence due to hacking or miscalc triggers conventional warfare – specifically use of CBWs. Independently non uniques all DAs – failure of nuclear deterrence makes war certain.

Heinrichs ‘21 [What We Risk If We Fail to Fully Modernize the US Nuclear Deterrent, <https://www.hudson.org/research/17341-what-we-risk-if-we-fail-to-fully-modernize-the-us-nuclear-deterrent>, Rebeccah L. Heinrichs, October 20 2021, quals: <https://www.hudson.org/experts/1054-rebeccah-l-heinrichs>] [SS]

Central to the effectiveness of U.S. strategic deterrence is convincing our enemies of our resolve to defend American vital interests from aggression with whatever combinations of weapons are necessary. Weapons within the arch of strategic deterrence include conventional and missile defenses, but the nuclear deterrent is the keystone. The primary purpose of U.S. nuclear weapons, as expressed in the 2018 Nuclear Posture Review (NPR), is to deter a nuclear attack, whether small or large in scale, against a U.S. ally or the United States itself. But that is not their sole purpose. They are also intended to prevent large-scale conventional warfare that threatens U.S. vital interests, as well as a chemical and biological weapons attack, and provide assurances to allies who have chosen not to acquire their own nuclear capabilities, which is more conducive to preventing a nuclear exchange. At the heart of effective nuclear deterrence is the credible threat that the United States is willing to employ nuclear weapons to defend its vital interests when absolutely necessary. By maintaining a force that could reliably contribute to terminating a war with as little damage as possible, should deterrence fail, on terms most favorable to the United States, the United States strengthens deterrence. Since the end of the Cold War, the United States has sought to move away from nuclear weapons in its national defense strategy, and as recently as the Administration of President Barack Obama, U.S. leaders downplayed major-power conflict as a thing of the past.1 Regrettably, adversaries of the U.S. have not agreed and have invested in the weapons they deem most able to thwart U.S. aims and threaten U.S. security. The global threat environment is more complex and more dynamic than at any time since the end of the Cold War, and the peace that America has enjoyed for 70 years is tenuous. There are many factors that have led us here, but the crux of the problem is that as our enemies become more able to challenge the United States, they simultaneously perceive an inverse correlation in the strength of American resolve to defend its stated vital national interests. Their doubt in U.S. resolve is abetting the deterioration of the credibility of strategic deterrence that has underpinned the post–World War Two order. The United States, by failing to invest sufficiently in a modern nuclear enterprise and a reliable triad of modern nuclear delivery systems, has given adversaries reason to doubt. An American observer might enthusiastically disagree with the notion that American resolve has weakened, but what matters for deterrence is our adversaries’ perception of our resolve, and the United States has given them reason to doubt. When the stakes are as high as they are, especially in the context of competition against two adversaries—China and Russia—contesting the United States in multiple theaters, the risk of a regional conventional conflict escalating with dire implications increases. While the focus of much public commentary is on how the United States ought to shift and add conventional firepower and defensive systems, we cannot miss the salience of the unique contributions of our nuclear deterrent in today’s dynamic threat context. Our nuclear forces complement our conventional forces and provide a backstop to their use. Our nuclear deterrent signals to adversaries that should they decide to attack U.S. interests with conventional weapons and then escalate to a larger-scale conventional war with strategic effects, they will not be able to do so with a reasonable hope that the United States will ultimately back down. Our nuclear deterrent therefore strengthens the deterrent effect of our conventional weapons and strategies. This means that U.S. military planners and operators, whether they realize it or not, rely heavily on the effectiveness of nuclear deterrence when they project power in the face of our adversaries’ provocations and threats. Our nuclear deterrent is therefore in use every minute of every day, and the importance of the deterrent effect’s remaining sound cannot be overstated. To demonstrate a real, as opposed to merely rhetorical, commitment to America’s nuclear deterrent and do so clearly, the United States must fully modernize its nuclear capabilities, especially given the actions of our adversaries. Failing to do this with a sense of urgency and willingness to adapt risks three major outcomes: Adversaries could employ nuclear weapons, whether in a regional context because they believe that a nuclear employment, however small in scale, will cause the United States to back down and sue for peace or, in the case of rogue nations, against U.S. soil. Adversaries could either initiate a conventional war against U.S. vital interests that could escalate to nuclear employment or employ chemical or biological weapons. Allies could doubt the U.S. commitment to their security and acquire their own nuclear weapons, tempting other nations to do the same and creating a far more precarious global security environment.

#### Bioweapons cause extinction

Piers Millett 17, PhD, is a Senior Research Fellow @ Oxford, “Existential Risk and Cost-Effective Biosecurity”, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5576214/

In the decades to come, advanced bioweapons could threaten human existence. Although the probability of human extinction from bioweapons may be low, the expected value of reducing the risk could still be large, since such risks jeopardize the existence of all future generations. We provide an overview of biotechnological extinction risk, make some rough initial estimates for how severe the risks might be, and compare the cost-effectiveness of reducing these extinction-level risks with existing biosecurity work. We find that reducing human extinction risk can be more cost-effective than reducing smaller-scale risks, even when using conservative estimates. This suggests that the risks are not low enough to ignore and that more ought to be done to prevent the worst-case scenarios. How worthwhile is it spending resources to study and mitigate the chance of human extinction from biological risks? The risks of such a catastrophe are presumably low, so a skeptic might argue that addressing such risks would be a waste of scarce resources. In this article, we investigate this position using a cost-effectiveness approach and ultimately conclude that the expected value of reducing these risks is large, especially since such risks jeopardize the existence of all future human lives. Historically, disease events have been responsible for the greatest death tolls on humanity. The 1918 flu was responsible for more than 50 million deaths,1 while smallpox killed perhaps 10 times that many in the 20th century alone.2 The Black Death was responsible for killing over 25% of the European population,3 while other pandemics, such as the plague of Justinian, are thought to have killed 25 million in the 6th century—constituting over 10% of the world's population at the time.4 It is an open question whether a future pandemic could result in outright human extinction or the irreversible collapse of civilization. A skeptic would have many good reasons to think that existential risk from disease is unlikely. Such a disease would need to spread worldwide to remote populations, overcome rare genetic resistances, and evade detection, cures, and countermeasures. Even evolution itself may work in humanity's favor: Virulence and transmission is often a trade-off, and so evolutionary pressures could push against maximally lethal wild-type pathogens.5,6 While these arguments point to a very small risk of human extinction, they do not rule the possibility out entirely. Although rare, there are recorded instances of species going extinct due to disease—primarily in amphibians, but also in 1 mammalian species of rat on Christmas Island.7,8 There are also historical examples of large human populations being almost entirely wiped out by disease, especially when multiple diseases were simultaneously introduced into a population without immunity. The most striking examples of total population collapse include native American tribes exposed to European diseases, such as the Massachusett (86% loss of population), Quiripi-Unquachog (95% loss of population), and the Western Abenaki (which suffered a staggering 98% loss of population).9 In the modern context, no single disease currently exists that combines the worst-case levels of transmissibility, lethality, resistance to countermeasures, and global reach. But many diseases are proof of principle that each worst-case attribute can be realized independently. For example, some diseases exhibit nearly a 100% case fatality ratio in the absence of treatment, such as rabies or septicemic plague. Other diseases have a track record of spreading to virtually every human community worldwide, such as the 1918 flu,10 and seroprevalence studies indicate that other pathogens, such as chickenpox and HSV-1, can successfully reach over 95% of a population.11,12 Under optimal virulence theory, natural evolution would be an unlikely source for pathogens with the highest possible levels of transmissibility, virulence, and global reach. But advances in biotechnology might allow the creation of diseases that combine such traits. Recent controversy has already emerged over a number of scientific experiments that resulted in viruses with enhanced transmissibility, lethality, and/or the ability to overcome therapeutics.13-17 Other experiments demonstrated that mousepox could be modified to have a 100% case fatality rate and render a vaccine ineffective.18 In addition to transmissibility and lethality, studies have shown that other disease traits, such as incubation time, environmental survival, and available vectors, could be modified as well.19-21 Although these experiments had scientific merit and were not conducted with malicious intent, their implications are still worrying. This is especially true given that there is also a long historical track record of state-run bioweapon research applying cutting-edge science and technology to design agents not previously seen in nature. The Soviet bioweapons program developed agents with traits such as enhanced virulence, resistance to therapies, greater environmental resilience, increased difficulty to diagnose or treat, and which caused unexpected disease presentations and outcomes.22 Delivery capabilities have also been subject to the cutting edge of technical development, with Canadian, US, and UK bioweapon efforts playing a critical role in developing the discipline of aerobiology.23,24 While there is no evidence of state-run bioweapons programs directly attempting to develop or deploy bioweapons that would pose an existential risk, the logic of deterrence and mutually assured destruction could create such incentives in more unstable political environments or following a breakdown of the Biological Weapons Convention.25 The possibility of a war between great powers could also increase the pressure to use such weapons—during the World Wars, bioweapons were used across multiple continents, with Germany targeting animals in WWI,26 and Japan using plague to cause an epidemic in China during WWII.27 “cause a pandemic of unprecedented proportions," the report stated.

## Framework

#### Pleasure and pain are intrinsic value and disvalue – everything else regresses – robust neuroscience proves

Blum et al. 18 Kenneth Blum, 1Department of Psychiatry, Boonshoft School of Medicine, Dayton VA Medical Center, Wright State University, Dayton, OH, USA 2Department of Psychiatry, McKnight Brain Institute, University of Florida College of Medicine, Gainesville, FL, USA 3Department of Psychiatry and Behavioral Sciences, Keck Medicine University of Southern California, Los Angeles, CA, USA 4Division of Applied Clinical Research & Education, Dominion Diagnostics, LLC, North Kingstown, RI, USA 5Department of Precision Medicine, Geneus Health LLC, San Antonio, TX, USA 6Department of Addiction Research & Therapy, Nupathways Inc., Innsbrook, MO, USA 7Department of Clinical Neurology, Path Foundation, New York, NY, USA 8Division of Neuroscience-Based Addiction Therapy, The Shores Treatment & Recovery Center, Port Saint Lucie, FL, USA 9Institute of Psychology, Eötvös Loránd University, Budapest, Hungary 10Division of Addiction Research, Dominion Diagnostics, LLC. North Kingston, RI, USA 11Victory Nutrition International, Lederach, PA., USA 12National Human Genome Center at Howard University, Washington, DC., USA, Marjorie Gondré-Lewis, 12National Human Genome Center at Howard University, Washington, DC., USA 13Departments of Anatomy and Psychiatry, Howard University College of Medicine, Washington, DC US, Bruce Steinberg, 4Division of Applied Clinical Research & Education, Dominion Diagnostics, LLC, North Kingstown, RI, USA, Igor Elman, 15Department Psychiatry, Cooper University School of Medicine, Camden, NJ, USA, David Baron, 3Department of Psychiatry and Behavioral Sciences, Keck Medicine University of Southern California, Los Angeles, CA, USA, Edward J Modestino, 14Department of Psychology, Curry College, Milton, MA, USA, Rajendra D Badgaiyan, 15Department Psychiatry, Cooper University School of Medicine, Camden, NJ, USA, Mark S Gold 16Department of Psychiatry, Washington University, St. Louis, MO, USA, “Our evolved unique pleasure circuit makes humans different from apes: Reconsideration of data derived from animal studies”, U.S. Department of Veterans Affairs, 28 February 2018, accessed: 19 August 2020, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6446569/>, R.S.

**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.

#### **The standard is maximizing expected well being.**

Prefer:

#### **1] outweighs on actor specificity since governments make policies as a whole that benefit and help some people and side constraints freeze action – actor spec outweighs and turns since it’s better than no action, states don’t have wills and intentions since they are not indivuals actors, different agents have different obligations**

#### **2] no act omission distinction -- governments control everything that happens in the public sphere since they yes/no bills – act omission distinction would make the yemen war moral**

#### 3] use epistemic modesty – multiply probability of the fwk times the magnitude of the impacts A) clash – encourages both substantive and phil debates so that we talk about all the offense B) leads to the net most morality and proves that only beating fwk is not enough to win the debate

#### **4] extinction first**

Pummer 15 [Theron, Junior Research Fellow in Philosophy at St. Anne's College, University of Oxford. “Moral Agreement on Saving the World” Practical Ethics, University of Oxford. May 18, 2015] AT

There appears to be lot of disagreement in moral philosophy. Whether these many apparent disagreements are deep and irresolvable, I believe there is at least one thing it is reasonable to agree on right now, whatever general moral view we adopt: that it is very important to reduce the risk that all intelligent beings on this planet are eliminated by an enormous catastrophe, such as a nuclear war. How we might in fact try to reduce such existential risks is discussed elsewhere. My claim here is only that we – whether we’re consequentialists, deontologists, or virtue ethicists – should all agree that we should try to save the world. According to consequentialism, we should maximize the good, where this is taken to be the goodness, from an impartial perspective, of outcomes. Clearly one thing that makes an outcome good is that the people in it are doing well. There is little disagreement here. If the happiness or well-being of possible future people is just as important as that of people who already exist, and if they would have good lives, it is not hard to see how reducing existential risk is easily the most important thing in the whole world. This is for the familiar reason that there are so many people who could exist in the future – there are trillions upon trillions… upon trillions. There are so many possible future people that reducing existential risk is arguably the most important thing in the world, even if the well-being of these possible people were given only 0.001% as much weight as that of existing people. Even on a wholly person-affecting view – according to which there’s nothing (apart from effects on existing people) to be said in favor of creating happy people – the case for reducing existential risk is very strong. As noted in this seminal paper, this case is strengthened by the fact that there’s a good chance that many existing people will, with the aid of life-extension technology, live very long and very high quality lives. You might think what I have just argued applies to consequentialists only. There is a tendency to assume that, if an argument appeals to consequentialist considerations (the goodness of outcomes), it is irrelevant to non-consequentialists. But that is a huge mistake. Non-consequentialism is the view that there’s more that determines rightness than the goodness of consequences or outcomes; it is not the view that the latter don’t matter. Even John Rawls wrote, “All ethical doctrines worth our attention take consequences into account in judging rightness. One which did not would simply be irrational, crazy.” Minimally plausible versions of deontology and virtue ethics must be concerned in part with promoting the good, from an impartial point of view. They’d thus imply very strong reasons to reduce existential risk, at least when this doesn’t significantly involve doing harm to others or damaging one’s character. What’s even more surprising, perhaps, is that even if our own good (or that of those near and dear to us) has much greater weight than goodness from the impartial “point of view of the universe,” indeed even if the latter is entirely morally irrelevant, we may nonetheless have very strong reasons to reduce existential risk. Even egoism, the view that each agent should maximize her own good, might imply strong reasons to reduce existential risk. It will depend, among other things, on what one’s own good consists in. If well-being consisted in pleasure only, it is somewhat harder to argue that egoism would imply strong reasons to reduce existential risk – perhaps we could argue that one would maximize her expected hedonic well-being by funding life extension technology or by having herself cryogenically frozen at the time of her bodily death as well as giving money to reduce existential risk (so that there is a world for her to live in!). I am not sure, however, how strong the reasons to do this would be. But views which imply that, if I don’t care about other people, I have no or very little reason to help them are not even minimally plausible views (in addition to hedonistic egoism, I here have in mind views that imply that one has no reason to perform an act unless one actually desires to do that act). To be minimally plausible, egoism will need to be paired with a more sophisticated account of well-being. To see this, it is enough to consider, as Plato did, the possibility of a ring of invisibility – suppose that, while wearing it, Ayn could derive some pleasure by helping the poor, but instead could derive just a bit more by severely harming them. Hedonistic egoism would absurdly imply she should do the latter. To avoid this implication, egoists would need to build something like the meaningfulness of a life into well-being, in some robust way, where this would to a significant extent be a function of other-regarding concerns (see chapter 12 of this classic intro to ethics). But once these elements are included, we can (roughly, as above) argue that this sort of egoism will imply strong reasons to reduce existential risk. Add to all of this Samuel Scheffler’s recent intriguing arguments (quick podcast version available here) that most of what makes our lives go well would be undermined if there were no future generations of intelligent persons. On his view, my life would contain vastly less well-being if (say) a year after my death the world came to an end. So obviously if Scheffler were right I’d have very strong reason to reduce existential risk. We should also take into account moral uncertainty. What is it reasonable for one to do, when one is uncertain not (only) about the empirical facts, but also about the moral facts? I’ve just argued that there’s agreement among minimally plausible ethical views that we have strong reason to reduce existential risk – not only consequentialists, but also deontologists, virtue ethicists, and sophisticated egoists should agree. But even those (hedonistic egoists) who disagree should have a significant level of confidence that they are mistaken, and that one of the above views is correct. Even if they were 90% sure that their view is the correct one (and 10% sure that one of these other ones is correct), they would have pretty strong reason, from the standpoint of moral uncertainty, to reduce existential risk. Perhaps most disturbingly still, even if we are only 1% sure that the well-being of possible future people matters, it is at least arguable that, from the standpoint of moral uncertainty, reducing existential risk is the most important thing in the world. Again, this is largely for the reason that there are so many people who could exist in the future – there are trillions upon trillions… upon trillions. (For more on this and other related issues, see this excellent dissertation). Of course, it is uncertain whether these untold trillions would, in general, have good lives. It’s possible they’ll be miserable. It is enough for my claim that there is moral agreement in the relevant sense if, at least given certain empirical claims about what future lives would most likely be like, all minimally plausible moral views would converge on the conclusion that we should try to save the world. While there are some non-crazy views that place significantly greater moral weight on avoiding suffering than on promoting happiness, for reasons others have offered (and for independent reasons I won’t get into here unless requested to), they nonetheless seem to be fairly implausible views. And even if things did not go well for our ancestors, I am optimistic that they will overall go fantastically well for our descendants, if we allow them to. I suspect that most of us alive today – at least those of us not suffering from extreme illness or poverty – have lives that are well worth living, and that things will continue to improve. Derek Parfit, whose work has emphasized future generations as well as agreement in ethics, described our situation clearly and accurately: “We live during the hinge of history. Given the scientific and technological discoveries of the last two centuries, the world has never changed as fast. We shall soon have even greater powers to transform, not only our surroundings, but ourselves and our successors. If we act wisely in the next few centuries, humanity will survive its most dangerous and decisive period. Our descendants could, if necessary, go elsewhere, spreading through this galaxy…. Our descendants might, I believe, make the further future very good. But that good future may also depend in part on us. If our selfish recklessness ends human history, we would be acting very wrongly.” (From chapter 36 of On What Matters)

5] Role playing as policy makers is key to solving real world problems-so the role of the ballot is to evaluate the hypothetical consequences of the plan and vote for the best hypothetical policy action. Coverstone[[1]](#footnote-1) :

(Alan H., “Acting on Activism: Realizing the Vision of Debate with Pro-social Impact,” Paper presented at the National Communication Association Annual Conference, 11/17/05)

 After all, if democracy means anything, it means that citizens not only have the right, they also bear the obligation to discuss and debate what the government should be doing**.** Absent that discussion and debate, much of **the motivation for personal political activism is** also **lost**. Those who have co-opted Mitchellâ€™s argument for individual advocacy often quickly respond that nothing we do in a debate round can actually change government policy, and unfortunately, an entire generation of debaters has now swallowed this assertion as an article of faith. The best most will muster is, â€œOf course not, but you donâ€™t either!â€ The assertion that nothing we do in debate has any impact on government policy is one that carries the potential to undermine Mitchellâ€™s entire project. If there is nothing we can do in a debate round to change government policy, then we are left with precious little in the way of pro-social options for addressing problems we face. At best, we can pursue some Pilot-like hand washing that can purify us as individuals through quixotic activism but offer little to society as a whole. It is very important to note that Mitchell (1998b) tries carefully to limit and bound his notion of reflexive fiat by maintaining that because it â€œviews fiat as a concrete course of action, it is bounded by the limits of pragmatismâ€ (p. 20). Pursued properly, the debates that Mitchell would like to see are those in which **the relative efficacy of concrete political strategies** for pro-social change **is debated**. In a few noteworthy examples, this approach has been employed successfully, and I must say that I have thoroughly enjoyed judging and coaching those debates. The students in my program have learned to stretch their understanding of their role in the political process because of the experience. Therefore, those who say I am opposed to Mitchellâ€™s goals here should take care at such a blanket assertion. Â¶ However, **contest debate teaches students to combine personal experience with the language of political power.** Powerfulpersonal **narratives unconnected to** political **power are** regularly **co-opted** by those who do learn the language of power. One needlook no further than the annual state of the Union Address where personal story after personal story is used to support the political agenda of those in power. The so-called **role-playing** that public policy contest debates encourage **promotes**active **learning** ofthe vocabulary and levers of **power** in America**.** Imagining the ability to use our own arguments to influence government action is one of the great virtues of academic debate. Gerald Graff (2003) analyzed the decline of argumentation in academic discourse and found a source of student antipathy to public argument in an interesting place.Â¶ Iâ€™m up againstâ€¦their aversion to the role of public spokesperson that formal writing presupposes. Itâ€™s as if such students canâ€™t imagine any rewards for being a public actor or even imagining themselves in such a role. This lack of interest in the public sphere may in turn reflect a loss of confidence in the possibility that the arguments we make in public will have an effect on the world. Todayâ€™s students lack of faith in the power of persuasion reflects the waning of the ideal of civic participation that led educators for centuries to place rhetorical and argumentative training at the center of the school and college curriculum. (Graff, 2003, p. 57)Â¶ The power to imagine public advocacy that actually makes a difference is one of the great virtues of the traditional notion of fiat that critics deride as mere simulation. **Simulation of success**in the public realm **is**far more **empowering** to students than completely abandoning all notions of personal power in the face of governmental hegemony by teaching students that nothing they can do in a contest debate can ever make any difference in public policy.â€ Contest debating is well suited to rewarding public activism if it stops accepting as an article of faith that personal agency is somehow undermined by the so-called role playing in debate. Debate is role-playing whether we imagine government action or imagine individual action. **Imagining myself starting a socialist revolution** in America **is no less of a fantasy than imagining myself** making a difference **on Capitol Hill.** Furthermore, both fantasies influenced my personal and political development virtually ensuring a life of active, pro-social, political participation. Neither fantasy reduced the likelihood that I would spend my life trying to make the difference I imagined**. One fantasy**actually **does make a greater difference: the one that speaks the language of political power.**The **other** fantasy **disables action by making one a laughingstock** to those who wield the language of power.

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1. [MBA(Alan,ActingonActivism,[http://home.montgome... 17-2005).doc)]](http://home.montgomerybell.edu/~coversa/Acting%20on%20Activism%20(Nov%2017-2005).doc)%5D)

   An important concern emerges when Mitchell describes reflexive fiat as a contest strategy capable of â€œeschewing the power to directly control external actorsâ€ (1998b, p. 20). [↑](#footnote-ref-1)