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### 1AC - Advantage

#### New startups are thriving --- the private sector is growing exponentially and forms the backbone of the OOS industry

Mayfield 21 [Mandy Mayfield, writer for National Defense. “Industry Offering On-Orbit Satellite Servicing.” January 29, 2021. https://www.nationaldefensemagazine.org/articles/2021/1/29/industry-offering-on-orbit-satellite-servicing]

“When I first joined the satellite industry and we were thinking about refueling there were about eight satellite servicing companies that we identified,” said Jeremy Schiel, acting chair of the Consortium for Execution of Rendezvous and Servicing Operations, or CONFERS, executive committee. “There are now over 45, and that number only grows with every passing month,” he noted during the consortium’s Global Satellite Servicing Forum. The industry-led initiative received initial seed funding from the Pentagon’s Defense Advanced Research Projects Agency. As the satellite servicing industry continues to expand, so does the consortium, said Todd Master, DARPA’s program manager for CONFERS. Initially, Master said he saw resistance from industry members with regard to working alongside one another as they were competing for the same market space. That viewpoint has “gradually shifted to a recognition of: ‘We have to work together if we want that market space to exist and even to grow.’” Recently the consortium, which was established in 2016, has seen its members start to split into two groups: one focusing on the technical aspect of satellite servicing and the other on the policy element, Master said. The technical side is working to establish common standards for safe operations, and eventually, hardware standards so companies can start to define interfaces. On the policy side, work is being completed to put together a sound plan that convinces regulators that the consortium’s actions are logical and consistent with their desires as well as to help inform the regulatory framework, he said. “What that really indicates to me is we’ve got enough growing participation and enough interest from the industry in growing into a variety of different segmented things, all of which we considered to be under the umbrella of satellite servicing,” he said. “We’re really seeing things take off here.” While DARPA provided initial funding for the consortium, that has “tailed off” over the last couple of years, he noted. The agency is aiming to fully transfer CONFERS leadership and resourcing responsibilities to industry by 2021, according to the agency. “I’m seeing the ability for it to become self-sustaining and it makes it easier for us as a government to become more on the observer side, rather than the funding and expertise side,” Master said. Consortium members already have robotic on-orbit satellite servicing vehicles in space. SpaceLogistics, a subsidiary of Northrop Grumman, launched its first satellite servicing vehicle, the Mission Extension Vehicle, or MEV-1, in 2019. In early 2020, the vehicle successfully docked on Intelsat 901, a communications satellite that is positioned in geostationary orbit. The MEV-1 will provide the satellite with life-extension services for five years, Tom Wilson, president of SpaceLogistics, said during the forum. The Mission Extension Vehicle is designed to dock with satellites whose fuel is almost depleted. After docking, the MEV can use its thrusters and fuel supply to control the orbit of the satellite, providing what the company calls docked life extensions, said Joe Anderson, vice president of operations and business development at SpaceLogistics. Once the customer no longer needs the service, the MEV will undock and proceed on to its next client. “After docking, [MEV-1] took over both the orbit and attitude control of the combined vehicle stack, relocated the 901 to its new operational location over the Atlantic Ocean region while removing over one-and-a-half degrees of inclination,” Anderson said. “The MEV-1 remains docked to the 901 today providing critical life-extension services and is expected to continue operating this way for the next four-and-a-half years.” The successful docking of MEV-1 with Intelsat 901 shows major maturation in the industry, Master said. “That’s going to be a big proof of the business for everybody involved in this industry to move forward,” he added. The second iteration of the vehicle, MEV-2, is en route to Intelsat 10-02, another communications satellite. MEV-2, which launched in August, is expected to arrive in geostationary orbit in late January, Anderson said. Docking should occur in the February to March timeframe. SpaceLogistics is working on another robotic satellite servicing system called the Mission Robotic Vehicle, or MRV. DARPA selected the company as its commercial partner for the agency’s Robotic Servicing of Geosynchronous Satellites, or RSGS, program in March 2020. Objectives for the program include enhanced capabilities such as in-orbit repair, augmentation, assembly, detailed inspection and relocation of client satellites. Through the agreement, DARPA will provide the robotics payload for the MRV. The payload was developed by the Naval Research Laboratory and consists of two robotic arms and a number of other tools and sensors. SpaceLogistics will provide its Mission Robotic Vehicle which was developed by leveraging capabilities from its MEVs, the company said in a press release. Launch of this new system is planned for 2023. “From our perspective here at DARPA, the signing of ... another partnership with SpaceLogistics for our RSGS mission are all sorts of things that were big in moving this entire industry forward,” Master said. Meanwhile, another member of CONFERS is focusing its efforts on “in-space” transportations services. Momentus, a California-based startup, created a transportation vehicle to move satellites into different orbits, said Rob Schwarz, chief technology officer of the company. “The concept for our transfer vehicles is that initially we will launch with an assembly of small satellites — and larger vehicles will carry larger satellites — to the initial launch orbit,” Schwarz said. “We find the cheapest access into orbit whether it be on a large launch vehicle or a small one, and once we’re in space then we do the custom orbit delivery of our customers.” The servicing vehicle, known as Vigoride, was designed to support small satellites and cubesats in low-Earth orbit. Although Vigoride will eventually be de-orbited after use, the company’s next generation of vehicles will be reusable. This next-generation of platforms will be introduced in 2023, Schwarz said. The reusable vehicles will be equipped with robotic arms and are expected to be capable of performing proximity maneuvers, docking and refueling and other in-orbit servicing.

#### Commercial OOS are different from normal sats

Krolikowski, A., & David, E. (2013). Commercial On-Orbit Satellite Servicing: National and International Policy Considerations Raised by Industry Proposals. New Space, 1(1), 29–41. doi:10.1089/space.2013.0002

Proximity operations. Even if servicing spacecraft were not equipped with specialized cameras or robotics, the conduct of servicing missions could alarm other satellite operators because it constitutes a form of proximity operation on orbit. Proximity operations involve the approach on orbit of one satellite by another to within a distance of 25 km or less. Proximity operations are inherently risky and trigger concerns about co-orbital anti-satellite capabilities. A servicing vehicle such as MDA’s will be highly mobile and maneuverable. As it travels in and through its orbit, it may approach nontarget satellites and conduct operations in their vicinity, passing as close as within several kilometers. These nontarget satellites will include different countries’ government and commercial satellites, whose operators are likely to be concerned by these approaches and movements. Servicing accidents near their satellites could lead to collisions and unnecessary or uncontrolled close approaches. In addition, while travelling through the geostationary belt, a servicing vehicle could intentionally or unintentionally interfere with signals from other satellites on its course. While all commercial satellites in transit through that orbit pose this risk, the frequent movements expected of servicing satellites makes them a greater concern for other satellite operators. MDA representatives proposed to address this difficulty by extending existing protocols mitigating interference caused by transiting commercial satellites. These rules require them to disable their signal uplinks and downlinks while they are in range of other active satellites.35 Industry proponents advocate applying these rules to servicing craft. Beyond concerns about accidental interference, the advent of commercial servicing could raise suspicion and mistrust between countries with servicing industries and those whose national security space assets could be observed or disrupted with these new capabilities. For example, with no means to independently verify what a servicing vehicle is doing on orbit, decision makers in these countries might fear that an ostensibly commercial servicing craft conducting a close approach of another satellite is a disguised intelligence-gathering platform or military space weapon in development.36

#### Scenario 1 is dual use.

#### OOS and ADR are space stalkers --- dual use capabilities for RPO make them functionally ASATs

Chow 18 [Brian G. Chow is an independent policy analyst with over 25 years as a senior physical scientist specializing in space and national security. He holds a PhD in physics from Case Western Reserve University and an MBA with distinction and PhD in finance from the University of Michigan. “Space Arms Control: A Hybrid Approach.” *Strategic Studies Quarterly*. 2018. https://www.jstor.org/stable/pdf/26430818.pdf?refreqid=excelsior%3Af6af5543563608c17cad654c3a3caa9a&ab\_segments=&origin=]

In June 2018, the United Nations Office for Outer Space Affairs will celebrate the 50th anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space. The conference is an opportunity “for the international community to gather and consider the future course of global cooperation for the benefit of humankind.”1 Indeed, there is much to celebrate since the space age began because the world has reaped abundant benefits from satellites. We have established five treaties and a number of transparency and confidencebuilding measures for space activities.2 But, in spite of countless efforts, these treaties and measures focus on civil and commercial activities and cannot control space weapons other than weapons of mass destruction in orbit. One of the greatest emerging threats in space comes from unmanned proximity operations. These operations require maneuvering a spacecraft close enough to another object in space to make physical contact with the other object or affect the object in some way.3 To date, the intent of unmanned proximity operations has been for peaceful purposes such as active debris removal (ADR) or on-orbit servicing (OOS). However, a spacecraft that can perform ADR or OOS can also be readily commanded to grapple and destroy an adversary’s satellite. Currently the United States, China, Russia, the European Union, and other countries are pursuing R&D programs for satellites to perform ADR and OOS. Each nation is planning to provide such services in early 2020 and beyond. To perform these peaceful services, a country needs to master the skill of unmanned proximity operations.

#### Threat of space stalkers causes miscalculation

Chow ’17 - independent policy analyst with over 25 years as a senior physical scientist specializing in space and national security. He holds a PhD in physics from Case Western Reserve University and an MBA with distinction and PhD in finance from the University of Michigan

Brian G Chow, “Stalkers in Space:  Defeating the Threat,” Strategic Studies Quarterly 11, no. 2 (Summer 2017): 82-116, <https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-11_Issue-2/Chow.pdf>.

As threats from ground-based ASATs (such as traditional threats from ballistic missiles, lasers, and jammers and the newer cyber attacks8 ) grow, it is easy to continue focusing on these much more well-known ASATs and ignore China’s developing co-orbital ASAT—hereafter what this article refers to as space stalkers. In November 2015, the U.S.-China Economic and Security Review Commission released its annual report to Congress stating that “since 2008, China has tested increasingly complex space proximity capabilities.”9 It confirmed what it and others have been suggesting, that “China’s recent space activities indicate it is developing co-orbital antisatellite systems to target US space assets. These systems consist of a satellite armed with a weapon such as an explosive charge, fragmentation device, kinetic energy weapon, laser, radio frequency weapon, jammer, or robotic arm.”10 Space objects capable of rendezvous proximity operations and particularly equipped with a robotic arm could pose a game-changing threat as these objects could be placed in orbit during peacetime. During a crisis, such as China seizing Taiwan or territorial disputes in the South China Sea, these space objects could be maneuvered to tailgate US satellites and become space stalkers. They could simultaneously attack multiple critical satellites from such a close proximity that the United States would not have time to react. The space stalkers could destroy enough critical satellites to force the United States back toward General Hyten’s warning of fighting primitive “industrial age warfare” with greatly increased collateral damage. On 29 November 2016, CNN broadcast the documentary “War in Space: The Next Battlefield,” based on interviews of more than 10 high-ranking military personnel of the entire chain of command for space warfare. These interviews described the concerns of senior space officials about the threat from “kamikaze and kidnapper satellites launched by Russia and China.”11

Geosynchronous satellites have long been considered safe from attacks, especially simultaneous attacks, since direct-ascent ASAT ballistic missiles would typically take about four hours to reach geosynchronous satellites.12 However, these satellites could soon be under serious threat. Setting up the space stalkers to be co-orbital with, and in close proximity to, their prey is the easiest way to coordinate simultaneous attacks. If China could place these highly maneuverable space stalkers in close proximity to multiple US critical satellites, simultaneous attacks would be possible with little advance warning, leaving the United States inadequate time to save the targeted satellites.

The space-stalking threat is unique and cannot be mitigated by focusing on and responding to traditional satellite threats. Even if the United States could perfectly deter and defend against all the traditional ASAT threats and the newer cyber attacks, adversaries could still use multiple stalkers to mount a devastating first strike against critical US satellites. Thus, the United States must specifically deal with the emerging spacestalker threat. This article provides analysis and recommendations on how to develop an overarching strategy to deter and defend against space stalkers without ignoring other threats and while gaining international support for the new strategy.

One must first understand Chinese counterspace strategy to prescribe an effective US strategy and policy. The United States must also refocus its traditional space policies to address the emerging space-stalking threat— something neglected today. Additionally, the National Security Space Strategy must be updated to include a strategy to defend against and to deter space stalkers, including justified preemption as the last resort. Diplomacy alone with potential adversaries to lessen the space-stalking threat is important but not sufficient. Therefore, the new US strategy should include developing new international agreements on weapons in space and in particular space stalkers.

The space-stalker threat does not come from China alone. Russia has also been improving its close proximity operation capability, which is dual-use for non-ASAT and ASAT purposes. Its potential space-stalking capability would be more advanced than China’s.13 However, this article uses only Chinese scenarios since concerns about the threat and suggested measures for US response are essentially the same for both China and Russia.

#### Space is offense dominant which structurally increases first strike and use or lose pressures – only the plan restores crisis stability

Grego ’18 – senior scientist in the Global Security Program at the Union of Concerned Scientists, PhD in experimental physics at the California Institute of Technology

Laura Grego, “Space and Crisis Stability,” Union of Concerned Scientists, March 19, 2018, <https://www.law.upenn.edu/live/files/7804-grego-space-and-crisis-stabilitypdf>

Why crisis stability?

For the foreseeable future, military tensions between the United States, China, and Russia are likely to remain high, as are those between China and India. Even absent intentional confrontation, regional problems, such as those in the Baltics and East and South Asia, have the potential to draw these actors into conflict. Thus, it is imperative to pay attention to any pathways that could lead an actor considering crossing the nuclear threshold, or approaching it very closely.

The United States and Russia continue to retain large nuclear arsenals on high alert1 . Each are developing new strategic weapons, including hypersonic conventional prompt global strike systems with a suggestion mission of holding ground-based anti-satellite weapons at risk.2 Russia has declared the existence of novel nuclear delivery systems as a response to US missile defense systems,3 weapons which complicate the management of crises. China is reportedly considering increasing the size, capacity and alert status of its nuclear weapons delivery systems4 and is also developing new kinds of strategic weapons. China is also developing hypersonic weapons,5 and the ingredients for an arms race around these technologies is in place. India continues to increase the sophistication of its strategic posture. And India, China, Russia and the United States have or are pursuing missile defense technologies that are important both in the nuclear realm but in space issues, since missile defenses present demonstrated or inherent antisatellite capabilities.

Thus it is critical to ensure that in times of tension, no actor escalates the crisis inadvertently or against their better judgment, and that misperception does not play an important role in the initiation or progress of the crisis. And that hostilities, if initiated, resolve as quickly as possible.

Thomas Schelling‘s encapsulated an aspect of this idea in his landmark work this way:

This is the problem of surprise attack. If surprise carries an advantage, it is worth while [sic] to avert it by striking first. Fear that the other may be about to strike in the mistaken belief that we are about to strike gives us a motive for striking, and so justifies the other‘s motive. But if the gains from even successful surprise are less desired than no war at all, there is no ―fundamental‖ basis for an attack by each side. Nevertheless, it look as though a modest temptation on each side to sneak in the first place — a temptation too small by itself to motivate an attack — might become compounded through a process of interacting expectations, with additional motive for attack being produced by successive cycles of ―He thinks we think he thinks we think … he think we think he‘ll attack; so he thinks we will; so he will; so we must.6

This suggests that it is important to make the advantage of surprise attack negligible and the disadvantages as great as possible, to make sure that all actors understand this, and to make sure that actors have as clear an understanding of each other‘s motivations as possible to avoid miscalculation.

In the last twenty years, space assets have become important not only for strategic missions but also increasingly underpin conventional military force for modern militaries, and especially those with expeditionary forces, such as the United States. They are essential not only for militaries, but are a critical provider of essential civilian, commercial, and scientific services. Not only do satellites perform many more missions than they have in the past, there are many more spacefaring nations. While most satellites belong to the United States, Russia, and China, more than sixty countries own satellites or a large stake in one.7

At the same time, the technologies that are useful for holding satellites at risk have grown significantly in sophistication and capacity even in the last decade, and have become more widely available. This is particularly problematic because attacks on satellites can create or escalate terrestrial crises in potentially difficult to predict ways. The world is drifting towards a space regime that faces an ever more prevalent and more sophisticated anti-satellite technology and greater numbers and types of targets in space, with very little mutual understanding about how actions in space are perceived.

While space‘s foundational legal document, the 1967 Outer Space Treaty, sets out the principles by which space is used and provides a number of useful, most recognize that more is needed to secure lasting peace on earth and the long-term health of the space environment. Different stakeholders are tackling space security issues from different angles. Under the aegis of the United Nations Conference on Disarmament‘s (UNCD) Prevention of an Arms Race in Space (PAROS) agenda item, Russia and China have invested in the Treaty for the Prevention of the Placement of Weapons in Outer Space, a comprehensive ban on the deployment of space-based weapons and on threats of any kind against satellites. 8 The United States has stated that it sees little value in this treaty, but has not proposed revisions that would make it more acceptable nor suggested its own preferred legally-binding treaty. And the UNCD has struggled to extricate itself from a deadlock that has kept it from moving forward on discussions on this (and all other) topics. Others have suggested a ban on destructive anti-satellite weapons development and testing,9 and limits on exoatmospheric missile defense tests.10 These efforts have not yet produced any appreciable progress.

Others prefer the approach of starting with confidence building and transparency measures that are politically binding rather than legally binding. The European Union moved forward a Code of Conduct for Outer Space Activities, 11 which would set out rules of the road for space, creating transparency and building confidence. It did not address directly core security issues, and the gestures it made in this direction (the requirement by the United States that it include a specific reference to the right of self-defense) created disagreements serious enough to not be easily addressed in this format. The process hit a wall in 2015. A United Nations Group of Governmental Experts, convened to consider TCBMs for space, produced a consensus document,12 though for a number of reasons, little progress has been made on implementing them.13

Perhaps the greatest progress in creating new guidelines has come under the aegis of protecting the long-term sustainability of space. (While the long-term sustainability of space does imply that core security questions are solved enough to not threaten the space environment, work on this topic does not take the issue head-on.) The United Nations Committee on the Peaceful Uses of Outer Space has drafted a set of such guidelines which will be referred to the General Assembly in 2018.14

For its part, the United States, currently the most heavily invested in space in sheer capacity and in posture, is investing significant intellectual energy in creating a deterrence strategy to protect its military interests in space. While this is closely related to crisis stability, this work is distinctly from a US point of view.

Each of these approaches have something distinct to offer. The aim of this paper, however, is to look at the issue differently and to use crisis stability (rather than, e.g., preventing an arms race, preserving the space environment) as an organizing principle or lens to help identify which facets of space activities are particularly dangerous, and to prioritize the existing initiatives, as well as to offer other unilateral and collaborative actions that can help reduce the pathways to confrontation between nuclear powers.

Why space is a particular problem for crisis stability

For a number of reasons, space poses particular challenges in preventing a crisis from starting or from being managed well. Some of these are to do with the physical nature of space, such as the short timelines and difficulty of attribution inherent in space operations. Some are due to the way space is used, such as the entanglement of strategic and tactical missions and the prevalence of dual-use technologies. Some are due to the history of space, such the absence of a shared understanding of appropriate behaviors and consequences, and a dearth of stabilizing personal and institutional relationships. While some of these have terrestrial equivalents, taken together, they present a special challenge.

The vulnerability of satellites and first strike incentives

Satellites are inherently fragile and difficult to protect; in the language of strategic planners, space is an ―offense-dominant‖ regime. This can lead to a number of pressures to strike first that don‘t exist for other, better-protected domains. Satellites travel on predictable orbits, and many pass repeatedly over all of the earth‘s nations. Low-earth orbiting satellites are reachable by missiles much less capable than those needed to launch satellites into orbit, as well as by directed energy which can interfere with sensors or with communications channels. Because launch mass is at a premium, satellite armor is impractical. Maneuvers on orbit need costly amounts of fuel, which has to be brought along on launch, limiting satellites‘ ability to move away from threats. And so, these very valuable satellites are also inherently vulnerable and may present as attractive targets.

Thus, an actor with substantial dependence on space has an incentive to strike first if hostilities look probable, to ensure these valuable assets are not lost. Even if both (or all) sides in a conflict prefer not to engage in war, this weakness may provide an incentive to approach it closely anyway.

A RAND Corporation monograph commissioned by the Air Force15 described the issue this way:

First-strike stability is a concept that Glenn Kent and David Thaler developed in 1989 to examine the structural dynamics of mutual deterrence between two or more nuclear states.16 It is similar to crisis stability, which Charles Glaser described as ―a measure of the countries‘ incentives not to preempt in a crisis, that is, not to attack first in order to beat the attack of the enemy,‖17 except that it does not delve into the psychological factors present in specific crises. Rather, first strike stability focuses on each side‘s force posture and the balance of capabilities and vulnerabilities that could make a crisis unstable should a confrontation occur.

For example, in the case of the United States, the fact that conventional weapons are so heavily dependent on vulnerable satellites may create incentives for the US to strike first terrestrially in the lead up to a confrontation, before its space-derived advantages are eroded by anti-satellite attacks.18 Indeed, any actor for which satellites or space-based weapons are an important part of its military posture, whether for support missions or on-orbit weapons, will feel ―use it or lose it‖ pressure because of the inherent vulnerability of satellites.

Short timelines and difficulty of attribution

The compressed timelines characteristic of crises combine with these ―use it or lose it‖ pressures to shrink timelines. This dynamic couples dangerously with the inherent difficulty of determining the causes of satellite degradation, whether malicious or from natural causes, in a timely way.

Space is a difficult environment in which to operate. Satellites orbit amidst increasing amounts of debris. A collision with a debris object the size of a marble could be catastrophic for a satellite, but objects of that size cannot be reliably tracked. So a failure due to a collision with a small piece of untracked debris may be left open to other interpretations. Satellite electronics are also subject to high levels of damaging radiation. Because of their remoteness, satellites as a rule cannot be repaired or maintained. While on-board diagnostics and space surveillance can help the user understand what went wrong, it is difficult to have a complete picture on short timescales. Satellite failure on-orbit is a regular occurrence19 (indeed, many satellites are kept in service long past their intended lifetimes).

In the past, when fewer actors had access to satellite-disrupting technologies, satellite failures were usually ascribed to ―natural‖ causes. But increasingly, even during times of peace operators may assume malicious intent. More to the point, in a crisis when the costs of inaction may be perceived to be costly, there is an incentive to choose the worst-case interpretation of events even if the information is incomplete or inconclusive.

Entanglement of strategic and tactical missions

During the Cold War, nuclear and conventional arms were well separated, and escalation pathways were relatively clear. While space-based assets performed critical strategic missions, including early warning of ballistic missile launch and secure communications in a crisis, there was a relatively clear sense that these targets were off limits, as attacks could undermine nuclear deterrence. In the Strategic Arms Limitation Treaty, the US and Soviet Union pledged not to interfere with each other‘s ―national technical means‖ of verifying compliance with the agreement, yet another recognition that attacking strategically important satellites could be destabilizing.20 There was also restraint in building the hardware that could hold these assets at risk.

However, where the lines between strategic satellite missions and other missions are blurred, these norms can be weakened. For example, the satellites that provide early warning of ballistic missile launch are associated with nuclear deterrent posture, but also are critical sensors for missile defenses. Strategic surveillance and missile warning satellites also support efforts to locate and destroy mobile conventional missile launchers. Interfering with an early warning sensor satellite might be intended to dissuade an adversary from using nuclear weapons first by degrading their missile defenses and thus hindering their first-strike posture. However, for a state that uses early warning satellites to enable a ―hair trigger‖ or launch-on-attack posture, the interference with such a satellite might instead be interpreted as a precursor to a nuclear attack. It may accelerate the use of nuclear weapons rather than inhibit it.

Misperception and dual-use technologies

Some space technologies and activities can be used both for relatively benign purposes but also for hostile ones. It may be difficult for an actor to understand the intent behind the development, testing, use, and stockpiling of these technologies, and see threats where there are none. (Or miss a threat until it is too late.) This may start a cycle of action and reaction based on misperception.

For example, relatively low-mass satellites can now maneuver autonomously and closely approach other satellites without their cooperation; this may be for peaceful purposes such as satellite maintenance or the building of complex space structures, or for more controversial reasons such as intelligence-gathering or anti-satellite attacks.

Ground-based lasers can be used to dazzle the sensors of an adversary‘s remote sensing satellites, and with sufficient power, they may damage those sensors. The power needed to dazzle a satellite is low, achievable with commercially available lasers coupled to a mirror which can track the satellite. Laser ranging networks use low-powered lasers to track satellites and to monitor precisely the Earth‘s shape and gravitational field, and use similar technologies. 21 Higher-powered lasers coupled with satellite-tracking optics have fewer legitimate uses.

Because midcourse missile defense systems are intended to destroy long-range ballistic missile warheads, which travel at speeds and altitudes comparable to those of satellites, such defense systems also have inherent ASAT capabilities. In fact, while the technologies being developed for long-range missile defenses might not prove very effective against ballistic missiles—for example, because of the countermeasure problems associated with midcourse missile defense— they could be far more effective against satellites. This capacity is not just theoretical. In 2007, China demonstrated a direct-ascent anti-satellite capability which could be used both in an ASAT and missile defense role, and in 2009, the United States used a ship-based missile defense interceptor to destroy a satellite, as well. US plans indicated a projected inventory of missile defense interceptors with capability to reach all low earth orbiting satellites in the dozens in the 2020s, and in the hundreds by 2030.22

Discrimination

The consequences of interfering with a satellite may be vastly different depending on who is affected and how, and whether the satellite represents a legitimate military objective.

However, it will not always be clear who the owners and operators of a satellite are, and users of a satellite‘s services may be numerous and not public. Registration of satellites is incomplete23 and current ownership is not necessarily updated in a readily available repository. The identification of a satellite as military or civilian may be deliberately obscured. Or its value as a military asset may change over time; for example, the share of capacity of a commercial satellite used by military customers may wax and wane. A potential adversary‘s satellite may have different or additional missions that are more vital to that adversary than an outsider may perceive. An ASAT attack that creates persistent debris could result in significant collateral damage to a wide range of other actors; unlike terrestrial attacks, these consequences are not limited geographically, and could harm other users unpredictably.

In 2015, the Pentagon‘s annual wargame, or simulated conflict, involving space assets focused on a future regional conflict. The official report out24 warned that it was hard to keep the conflict contained geographically when using anti-satellite weapons:

As the wargame unfolded, a regional crisis quickly escalated, partly because of the interconnectedness of a multi-domain fight involving a capable adversary. The wargame participants emphasized the challenges in containing horizontal escalation once space control capabilities are employed to achieve limited national objectives.

Lack of shared understanding of consequences/proportionality

States have fairly similar understandings of the implications of military actions on the ground, in the air, and at sea, built over decades of experience. The United States and the Soviet Union/Russia have built some shared understanding of each other‘s strategic thinking on nuclear weapons, though this is less true for other states with nuclear weapons. But in the context of nuclear weapons, there is an arguable understanding about the crisis escalation based on the type of weapon (strategic or tactical) and the target (counterforce—against other nuclear targets, or countervalue—against civilian targets).

Because of a lack of experience in hostilities that target space-based capabilities, it is not entirely clear what the proper response to a space activity is and where the escalation thresholds or ―red lines‖ lie. Exacerbating this is the asymmetry in space investments; not all actors will assign the same value to a given target or same escalatory nature to different weapons.

For example, the United States is the country most heavily dependent on military space assets. Its proportionally higher commitment to expeditionary forces make this likely to be true well into the future. So while the United States seeks to create a deterrence framework, punishment-based deterrence would not likely target its adversary‘s space assets. But then there is difficulty finding target on the ground that would be credible but also not unpredictably escalate a crisis. If an American military satellite were attacked but without attendant human casualties (‗satellites have no mothers‘), retaliation on an adversary‘s ground-based target is likely to escalate the conflict, perhaps justifying the adversary‘s subsequent claim to self-defense, even if the initial satellite attack didn‘t support such a claim.

Little experience in engaging substantively in these issues

Related to this issue is that there is relatively little experience among the major space actors in handling a crisis with the others. The United States and the Soviet Union, then Russia, have had a long history of strategic discussions and negotiations. This built up a shared understanding of each other‘s point of view, developed relationships between those conducting those discussions, and created bureaucracies and expertise to support those discussions. This experience and these relationships are important to interpreting events and to resolving disputes before they turn into a crisis, and to managing one once it begins. There is nothing like this level of engagement around space issues between these two states, and much less between the US and China.

One of the participants in a 2010 US space war game, a diplomatic veteran, imagined25 how things would play out if one or more militarily important US satellites failed amidst a crisis with an adversary known to have sophisticated offensive cyber and space capabilities:

The good news is that there has never been a destructive conflict waged in either the space or cyber domains. The bad news is that no one around the situation room table can cite any history from previous wars, or common bilateral understandings with the adversary, relating to space and cyber conflict as a guide to what the incoming reports mean, and what may or may not happen next.

This is the big difference between the space-cyber domains, and the nuclear domain. There is, in this future scenario, no credible basis for anyone around the president to attribute restraint to the adversary, no track record from which to interpret the actions by the adversary. There is no crisis management history: the president has no bilateral understandings or guidelines from past diplomatic discussions, and no operational protocols from previous incidents where space and cyber moves and counter-moves created precedents. Perhaps the adversary intended to make a point with one series of limited attacks, and hoped for talks with Washington and a compromise; but for all the president knows, sitting in the situation room, the hostile actions taken against America‘s space assets and information systems are nothing less than early stages of an all-out assault on US interests.

#### Dual use tech make minor accidents likely to escalate to nuclear war

Hitchens ’17 – Senior Research Scholar at the Center for International and Security Studies at Maryland and Director of the United Nations Institute for Disarmament Research

Theresa Hitchens, “Space Weapon Technology and Policy” (NUCLEAR WEAPONS AND RELATED SECURITY ISSUES, Washington, DC, USA, 2017), 030006, <https://doi.org/10.1063/1.5009221>

Abstract. The military use of space, including in support of nuclear weapons infrastructure, has greatly increased over the past 30 years. In the current era, rising geopolitical tensions between the United States and Russia and China have led to assumptions in all three major space powers that warfighting in space now is inevitable, and possible because of rapid technological advancements. New capabilities for disrupting and destroying satellites include radio-frequency jamming, the use of lasers, maneuverable space objects and more capable direct-ascent anti-satellite weapons. This situation, however, threatens international security and stability among nuclear powers. There is a continuing and necessary role for diplomacy, especially the establishment of normative rules of behavior, to reduce risks of misperceptions and crisis escalation, including up to the use of nuclear weapons. U.S. policy and strategy should seek a balance between traditional military approaches to protecting its space assets and diplomatic tools to create a more secure space environment.

I. INTRODUCTION

Outer space is recognized by all nations as “the province of mankind” not subject to national boundaries or appropriation via both treaty – especially the 1967 Outer Space Treaty1 – and by the practice of nation states. Since the dawn of the space age, the use of satellites has become integral to the global economy, including providing communications, weather services, mapping, precision timing and navigation services for shipping, secure crossborder banking, and Internet connectivity. Every state has both an interest in making use of space, and reason to deal with its use by other states, because the activities in space by one actor have the potential to impact all others, for good or for bad. In addressing international and national security, and nuclear security in particular, the space environment has played a role of great importance from almost the beginning of the nuclear age. The first satellites launched by the Soviet Union and the United States were oriented toward seeking information on what was transpiring in areas controlled by the other, and to verify bilateral arms control agreements. While in short order space systems also were integrated to the offensive uses of long-range delivery systems by providing photographic information about potential targets, strategic space systems were during the Cold War widely viewed as stabilizing the Superpower nuclear competition.

The use of space for military purposes has continued into the present era, with increasing capabilities to take advantage of large segments of the electromagnetic spectrum for acquiring intelligence, communicating globally, and generally supporting ways of using nuclear weapons both for deterrence, and, should deterrence fail, use of those weapons against an adversary. Most of the nuclear weapon possessing states operate satellites for these purposes. Perhaps as importantly, space systems over the last two decades have become integral to the tactical warfighting ability of many modern states – a situation that has complicated the status of space systems as strategically stabilizing. Indeed, the growing use of space by many countries to achieve victory on the battlefield has increased both the vulnerability of militaries to attacks on their space systems and has, at the same time, increased their value as potential targets in a war.

Over the past 50 years, the Soviet Union, the United States, and China have carried out experiments in or aimed at the outer space environment – mostly the area close to the atmosphere in Low Earth Orbit (LEO) – that show the capability to destroy a satellite, or to disrupt its functions. The specter of space warfare for many years has, among other negative consequences, raised concerns that a state’s nuclear retaliatory capability could be compromised. This concern also applies more generally, of course, to an ability to disrupt communications functions for other military, or civilian, purposes.

In the 1980s, there was a period when the United States, and perhaps others, explored whether systems based in space could be used to destroy an adversary’s intercontinental ballistic missiles, or their payloads. The so-called Star Wars program under the Reagan Administration envisioned the deployment of a system of satellites that would seek to destroy the missiles/warheads launched at the United States. One technology explored envisioned detonating a nuclear explosive to generate a beam of x-rays that would put out of commission the adversary’s warhead. Thus far, such technologies have not succeeded in playing a role in the nuclear-weapon situation globally. However, the U.S. descendant of the Star Wars program – currently limited to conventionally equipped, ground- and sea-based missile defense interceptors with limited capability against a full-blown nuclear attack – continues to stress nuclear deterrence and stability between the United States and Russia, as well as China, which maintains a much smaller nuclear arsenal than the Cold War adversaries. However, recent missile experiments by China have demonstrated the vulnerability of the geosynchronous equatorial orbit (GEO), where many hundreds of satellites are “parked” carrying out communications and other functions, including nuclear weapons support systems and spy satellites.

II. INCREASED THREATS INVOLVING OUTER SPACE

Since the first satellites were launched in the 1950s by the Soviet Union and then the United States, the Russian Federation, the United States, China, India, Japan, and other states have, without much coordination, launched so many satellites into space into various orbits and at various altitudes that there is currently a strong risk of both congestion and competition. There is no global regime for regulating outer space activities. The Outer Space Treaty of 1967, to which all the launching states, and most others, are party2 mandates that outer space be used solely for peaceful purposes, and prohibits the stationing of nuclear or other weapons of mass destruction in that environment. (The Treaty does not prohibit the transit of nuclear weapons, e.g. as a payload on a submarine-launched ballistic missile, through outer space; furthermore under common law practice, defensive military activities are tolerated as compliant with “peaceful purposes.”) The Outer Space Treaty, however, makes it clear that states are responsible for their own space activities, and compliance with international law. And while there are a number of other spacerelated treaties, UN principles and voluntary agreements managed by various UN and multilateral bodies, a nation’s activities in space are largely regulated by that nation alone. There is no international legal requirement for any one state to coordinate its satellite launches or maneuvers with others.

Environmental Threats: Crowding and Debris

Some 1,500 operational satellites are now in orbit, owned by more than 80 states or other entities. These states and entities have varying levels both of proficiency and of knowledge of the established laws and rules affecting space. In the radio frequency band of the electromagnetic spectrum, interference is rising, especially in the GEO regime. Some of this interference is deliberate, undertaken for political purposes, despite the fact that deliberate interference is one of the few legally binding restraints in the international space arena3 . The evolution in satellite technology has led to the wider use of smaller satellites, including so-called “Cubesats,” that can be deployed in constellations, especially in LEO. The number of operational satellites is expected to rise to many thousands within the decade. LEO, in particular, is becoming incredibly crowded with satellites, making tracking of on-orbit objects extremely difficult. Furthermore, many small satellites have no ability to maneuver to avoid collisions with other satellites and space debris.

The half-century of using space has resulted, from the breakup of satellites and other activities, in a considerable amount of on-orbit debris – including satellites no longer in use, parts of satellites that have broken up, launcher stages, nuts and bolts, and debris from the deliberate destruction of satellites. The United States and others track some 23,000 orbiting pieces with a diameter of greater than 10 cm. This debris is especially dangerous if a satellite or transiting vehicle collides with a piece, since the closing velocity of such a collision on-orbit is very high – some 7.5 kilometers per second (faster than a bullet) in LEO. Worse yet, even very small debris, most of which cannot be detected much less tracked, can destroy an operational satellite; it is estimated that some 500,000 to one million pieces of debris smaller than 10 centimeters exist on orbit.

It is widely agreed that new international measures to better coordinate space activities are required to ensure that the space environment is sustained. In 2007, the United Nations Committee for the Peaceful Uses of Outer Space (COPUOS) in Vienna, Austria, agreed on a set of guidelines for the mitigation of space debris, which are slowly being implemented by many space-faring states. It may be that such measures will eventually require removal of debris from orbit, as the decay of debris from space into the atmosphere where it burns up (or falls on Earth) is a very long-term prospect, taking as much as 25 years in LEO. Sadly, the lifetime of debris in GEO, like diamonds, is practically forever. COPUOS currently is working on a set of recommended best practices to ensure the “long-term sustainability of space.” COPUOS has a 2018 deadline to finish this work; however, there is already discussion of follow-on effort that may include international guidelines for debris removal.

Increasing Military Tensions in Space

In the geopolitical sphere, compared with the period following the breakup of the Soviet Union, the current decade is witnessing increased tensions between the United States and Russia, and between the United States and China. The geopolitical situation in space has been further eroded by the proliferation of experimentation with and/or deployment of dual-use technologies with “counterspace,” i.e. satellite attack, capabilities. As noted above, China, Russia and the United States all have tested (or in some cases deployed) such technologies in both LEO and GEO. The United States continues to have an advantage in military space capabilities, but its edge is eroding as China and Russia dedicate more resources.

Most technologies involved in sustaining systems in orbit are dual-use, but certain specific activities are raising suspicions about potential intended weapons use. The capability to maneuver satellites is particularly relevant. Russia placed a satellite called Luch/Olymp in GEO that maneuvered or drifted over a considerable range, and at several points in 2015 came extremely close to commercial satellites owned by Intelsat.4 Intelsat called the move “irresponsible,” but their request for information from Russia went unanswered. The maneuvers further prompted concern at the U.S. Defense Department about the satellite’s mission, which has not been revealed by Moscow. The United States also has carried out programs in GEO that could have potential weapons capabilities. For example, the PAN, an acronym for Palladium at Night, is a classified program apparently dealing with communications platforms, and perhaps providing other capabilities.5 The Geosynchronous Space Situational Awareness Program (GSSAP) is a U.S. military satellite constellation that also maneuvers in orbit, designed, according to the Pentagon, with the objective of inspecting other satellites orbiting in GEO. Such activities are known as Rendezvous and Proximity Operations (RPO), and have a number of benign applications such as satellite refueling, inspection and repair. Russia is carrying out other such experiments in LEO, as are China, the United States, Japan and Sweden. The commercial applications of maneuvering satellites are also increasing.

Among the number of more directly identifiable counterspace technologies now available, the most widespread are ground-based radio-frequency jammers, which can be used to disrupt satellite communications and operations. In addition, there are efforts to develop lasers for disrupting or degrading systems based in space. Russia, China and the United States have also carried out projects involving terrestrially based missiles carrying anti-satellite payloads. The United States as early as the 1980s launched missiles from an F-15 fighter jet with this objective. A 2007 Chinese test, involving the destruction of a non-functional Chinese weather satellite in LEO, released a considerable quantity of debris. The United States subsequently launched a missile from an Aegis cruiser that was advertised to have the objective of destroying a satellite in a decaying orbit, but this did not prevent speculation that the mission also had the objective of demonstrating a similar capability to that of China. Over decades, the U.S. missile defense program has also heavily relied on the space environment, for early warning, for communications, and as a place for engaging and destroying hostile systems. Noted above is the Reagan Administration’s “Star Wars” program, pursued with the idea of creating a “shield” against intercontinental ballistic missiles.

The harder-line rhetoric that has been employed in recent years also has had an inevitable impact of raising tensions. The United States has pivoted from an approach of “strategic restraint” to one emphasizing “warfighting.”6 In particular, the budgets for providing resiliency in space systems and counterspace capabilities have been increasing. At the same time, Russian accusations that U.S. activities have a hostile objective, and its responses to U.S. representations, have become shriller. Russia has called the anti-ballistic missile system SM-3 2A an anti-satellite weapon, while touting its own objectives for acquiring anti-satellite capabilities. In 2013, China tested a missile, the Dong Ning-2, which appears capable of reaching satellites in GEO. Chinese military space activities lack transparency, but it seems clear that such activities include the objective of being able to exercise counterspace actions. Most troubling, there has been a lack of serious dialogue among these Big Three states.

#### Inability to gauge intent makes it inevitable

Bohumil Dobos and Jakub Prazak 19, Bohumil Dobos is a scholar at the Institute of Political Studies, Faculty of Social Sciences, Charles University in Prague, Czech Republic, and a coordinator of the Geopolitical Studies Research Centre, Prazak holds a bachelor degree in Political Science and International Relations at the Faculty of Social Sciences. He also spent a semester abroad at the Tallinn University in Estonia. His areas of interest are astropolitics and space security, “To Clear or to Eliminate? Active Debris Removal Systems as Antisatellite Weapons”, <https://www.sciencedirect.com/science/article/pii/S0265964618300961> //Pinheiro

As noted above, the currently proposed ADR systems are based on a basic logic stating that a maneuverable asset would get to a vicinity of a large piece of orbital debris and by using specific technology would capture and deorbit it. Given the limited maneuverability of space assets, even functional satellites would probably be unable to escape such an attempt. This means that there is a certain possibility that the operator of the technology might be tempted to misuse it throughout periods of crisis. There are, nonetheless, three main obstacles to effective utilization of the ADR systems as ASAT weapons. The first is legal. Although the international law might be vague, an active and purposeful disruption of the operational satellite would constitute an act of aggression. Second, for an effective disruption of the complex satellite systems, a large presence of ADR satellites would be needed. As noted earlier, it is planned that the ADR systems should deorbit several pieces of debris per year. For example, the GPS constellation consists of 24 satellites with available spares. This means that to make the ADR system an effective weapon system, it would need to establish a much larger constellation than needed by the orbital debris removal proponents. Also, the movement of the vehicle would be rather slow and limited because of the limited amount of fuel it can carry. Any target would thus get plenty of warning time before any potential attack. Third, the misused ADR system might become a target of the land-based ASAT systems that all the major space powers except for Europe operate. As the ASAT systems are efficiently capable of striking objects in LEO, and theoretically even higher orbits, there would be a potential risk of conflict escalation.

The utility of the ADR system as an ASAT weapon rests upon its dual-use capacity. While the land-based ASAT weapons are purely military devices, the ADR systems will face an issue similar to the other examples of the dual-use space technology—the importance of intent. The ADR technology can be utilized as an ASAT system with its limitations as noted earlier. Despite the apparent limitations of the utility of these systems as weapons in a regular point of view, the ADR system can be utilized as a part of space hybrid operations. ADR methods often require advanced rendezvous and proximity operations that can be misused for offensive actions that are, nevertheless, difficult to track down and expose and remain below the threshold of military response.

Any ADR system will, however, be in a spotlight of the space powers, and other means of conducting such operations would probably remain more useful. It, however, presents a key technology necessary for ensuring the sustainability of the space endeavors. The key is thus not to limit the technological progress in the area but to ensure that none of the space actors will see its development as a threat. This calls for either a coordinated effort among the spacefaring nations or the development of the debris removal as a commercial service. Here we return to the issue of intent. While technologically speaking, an ADR system designed to be a non-military object would hold only limited potential as a weapon, the unclear nature of the intent could change the calculations of the spacefaring nations. If the system is being developed by a single country, there exists a potential that all the major space powers will attempt to develop the technology, and in that case, the technology will cross the threshold for effective weaponization.

#### Risk of miscalculation in space is higher than ever and guarantees existential escalation –

Adams ’18 – Former Staff Writer at Digital Trends, journalist

Dallon. “Weaponized Satellites and the Cold War in Space,” Digital Trends, May 1, 2018, <https://www.digitaltrends.com/cool-tech/weaponized-satellites-and-the-cold-war-in-space/>.

High stakes

On October 27, 1962, a nuclear-armed Soviet submarine had been spotted patrolling near the U.S. blockade line around Cuba, kicking off the Cuban Missile Crisis. In an attempt to bring the submarine to the surface, a U.S. destroyer began dropping non-lethal depth charges.

The captain of the submarine mistakenly believed these charges were an attack and ordered his crew to arm the nuclear-tipped torpedo for launch. If this launch occurred, the U.S. would have presumably retaliated with a barrage of nukes launched at predetermined locations across the USSR.

Per Soviet protocols, all three of the Russian submarine’s commanding officers needed to agree unanimously on the decision to launch the warhead. The second in command, Vasili Arkhipov, refused to consent to a launch. The commanding officers eventually brought the submarine to the surface and returned to Russia without incident.

In essence, one man’s last-minute decision prevented what could easily have been the beginning of World War III.

This is perhaps as close the world has ever come to a doomsday scenario, and it’s chilling to think a moment of indeterminacy would have meant instant annihilation for millions. But unfortunately, the potential for a grave accident due to misinterpretation is dreadfully ripe in the space-age Cold War we’re currently entrenched in.

“In regards to indeterminacy of an attack: Bingo! Attribution is tremendously difficult,” says Samson. “If a satellite stops working in orbit, it’s not always apparent why. It could be because of faulty parts, solar flares, or deliberate interference.”

Let’s say, for instance, a U.S. intelligence satellite is taken out by a solar flare or fleck of debris while a Chinese or Russian satellite with suspected ASAT potential floats haphazardly nearby. The U.S. would have every reason to believe this was a possible preemptive strike to diminish U.S. GPS capacity before a larger attack. Would defense officials wait calmly with such crucial satellite assets potentially in the crosshairs? Probably not.

While there is currently tremendous potential for a military battle to begin in space, the ensuing war would extend to earth soon thereafter. This unnerving warning was echoed by General John Hyten, head of the U.S. Air Force Space Command. “If war does extend into space someday — and I hope it never does — the first response is not going to be in space,” he warned.

All things considered, it could easily be argued that the risk of an existential threat on this pale blue dot has never been higher. It’s incredible that a nuclear weapon hasn’t been used on civilians in more than 70 years, but most military experts would agree it is a matter of when, not if.

Without meaningful legislation to prevent such a disaster, life on this planet could disappear as quickly as a blip on a radar screen, with only the artificial halo of orbiting trash left to tell the tale.

#### Perceived first-strike advantages make aggressive military postures extremely destabilizing – causes nuclear war

Schütz ’19 – ASSOCIATE FELLOW, PROGRAM SECURITY, DEFENSE, AND ARMAMENTS at the DGAP/German Council on Foreign Relations

Torben Schütz, “Technology and Strategy: The Changing Security Environment in Space Demands New Diplomatic and Military Answers,” DGAP kompakt, 14, <https://www.ssoar.info/ssoar/bitstream/handle/document/63288/ssoar-2019-schutz-Technology_and_Strategy_the_Changing.pdf?sequence=1&isAllowed=y&lnkname=ssoar-2019-schutz-Technology_and_Strategy_the_Changing.pdf>

Anti-Satellite Capabilities and their Strategic Implications

The specific characteristics of space assets determine strategic calculations about space: Such assets are vulnerable; strikes against them are difficult to deter; the information they provide has an ambiguous impact on crisis stability, and they favor smaller actors. All these characteristics can have detrimental impacts on the strategic and crisis stability among states.

The Vulnerability of Space Assets Decreases Crisis Stability

Both, the vulnerability and the importance of space assets for military operations incentivize first-strike strategies that are designed to destroy an adversaries’ space assets at the onset of a conflict and, thereby, decrease his other military capabilities. The actors know about the vulnerability of their space assets and are, therefore, particularly vigilant. This vigilance decreases crisis stability, which describes the balance of incentives for the involved actors to either de-escalate or further escalate a crisis.

Intricate Deterrence due to the Problems of Attribution and Time Compression

Deterrence is difficult to achieve for space assets, as they are so fragile that none would survive a well-coordinated first strike against them. They are classic “use-it-or-lose-it” assets, and this aspect further decreases crisis stability. Only a massive deployment of ground-based ASAT capabilities, that would enable a retaliatory strike so that both actors would lose their space assets, might counter-balance this to a certain degree, as it allows for a so-called deterrence by punishment.

However, even a (misinterpreted) threat to space assets could start a chain reaction and quickly escalate an incident in space to a wider war. Successful deterrence, therefore, requires situational awareness, attribution capabilities and resilient assets. Especially the latter two are notoriously difficult to achieve in space. While it might be easy to attribute a kinetic attack executed with a missile, the same is not true for ASAT attacks by other satellites, and, especially, not for cyberattacks and electronic warfare measures. Without clear attribution, however, it is difficult to deter any adversary, since he could speculate that an attack cannot be traced back to him – making deterrence and retaliation more difficult. Although cross-domain deterrence, i.e. threatening an actor through potential retaliation attacks on or by other-than-space assets, is always possible, it also amplifies the problems involved in traditional deterrence: A response has to be timely and proportionate, and it should not further expand of the conflict.

Furthermore, most timeframes for a potential escalation in space are measured in minutes, or even less for directed-energy and certain space-based ASAT weapons. As a result, both, decision-making processes and the humans deciding on military activities in space (e.g. a counterattack), are subject to very significant time compression. This also decreases crisis stability since it might further encourage an aggressive first-strike behavior prompted by the desire not to lose valuable assets.

The Ambiguous Influence of Information on Stability

The primary mission of most space assets is collecting and distributing information, and, as a result of this, crisis stability can be impacted in ambiguous ways. Information from space assets is key to four core security activities, which make it likely that a conflict in space and the loss of space assets will immediately spill over into other domains:

First, information is vital for the conduct of conventional military operations. Over the past three decades, Western and especially US armed forces have become dependent on information provided by space assets. Absence of space assets and their information would revert warfare to pre-space information conditions, and thereby make the movement of forces and communication among them more difficult. A more complicated movement and sustainment of forces, again, would make conventional and expeditionary operations alike more demanding.

Second, military early warning and intelligence are crucial for nuclear forces and second-strike capabilities. They helped to stabilize the strategic balance during the Cold War. As a result, attacks against space assets performing such early-warning and intelligence tasks were considered too dangerous. It was presumed that such an attack would lead an adversary to assume the worst-casescenario, i.e. an all-out nuclear attack, and then favor an equally destructive response. At least for Russia and the US, this is still valid today.

Third, an outage of intelligence space assets would decrease the quality of intelligence, surveillance, and reconnaissance, and, as a result, prompt a higher alert for conventional forces, since troop movements or military build-ups by an adversary could more easily go unnoticed.

Finally, space assets are used for the technical verification of compliance with international non-proliferation, arms control and disarmament regimes as well as embargos. Losing any space assets needed for these matters would also decrease a state’s ability to check whether other agreement parties are, in fact, compliant. This uncertainty would increase the chance for misinterpretation and miscalculations, thereby undermine trust between countries, and decrease crisis stability.

More information can, thus, help adversaries to defuse tensions. From this viewpoint, more information, and the provision of the space assets required to garner such information must be regarded as conducive to stability. With easier access to space and more space-faring states, strategic stability might therefore increase.

However, space assets can also decrease crisis stability as they are prone to technical glitches. This was, for instance, obvious during the Cold War, when early-warning satellites misinterpreted light reflected from clouds as missile launches. Such misinterpretations nearly led to nuclear exchanges on multiple occasions.

#### Scenario 2 is arms racing.

#### Misperception independently leads to a space arms race

Martin 20 [Anne-Sophie Martin, Ph.D. is the Co-Founder and Chief International Space Legal Officer at Berkelyn. “Legal Approach on the Dual-Use Nature of On-Orbit Servicing Programs.” On-Orbit Servicing: Next Generation of Space Activities. *Studies in Space Policy*. Vol. 26. 2020. https://libgen.li/edition.php?id=138687279]

On-orbit servicing (OOS) and Rendezvous and Proximity (RPO) missions are becoming a reality.1 They represent the next generation of space activities2 with the purpose to approach and to operate space assets in orbit. Recently, the private company Northrop Grumman successfully launched an OOS mission.3 Other companies such as Airbus Defence and Space,4 MDA Corporation5 are developing this technology. Moreover, space insurance companies are implementing new underwriting process based on these novel business plans.6 The European Space Agency is also enhancing this new technology with Clean Space. 7 The mission has various purposes, and in particular space debris removal.8 It will allow to refueling satellites, repairing and moving them to new orbits. These missions depict a new paradigm in space activities. Indeed, on one hand there is a requirement to prevent collision in orbit; on the other hand, in case of OOS/RPO, the issue is to dock two space assets, which raise some legal issues,9 in particular to what extent these technologies can be viewed as peaceful. Furthermore, if at first sight OOS are not military space activities; nevertheless, the basic abilities of these systems are of dual use nature, enabling also military capabilities. Consequently, this technology has the capacity to being used to harm other space asset. 1 Legal Approach on the Dual-Use Nature of On-Orbit … 3 Since the beginning of space age, States have used outer space for military activities and strategic operations.10 Moreover, dual-use technologies have always been a feature of space technologies and missions such as in case of remote sensing, telecommunications and navigation.11 It is necessary to recall that the legal regime of outer space is based on the principle of peaceful uses. However, there is a certain ambiguity on the meaning of “peaceful purpose”.12 The concept of “peaceful purposes”, also contained in the preamble to the Outer Space Treaty (OST),13 has been interpreted by scholars as “non-aggressive purposes”.14 Although some States and commentators have suggested “peaceful purposes” to indicate “non-military purposes”, this interpretation does not correspond with the practice of States to deploy military and dual-use satellites in orbit around the Earth.15 The common idea is that “peaceful use” means “non-aggressive use”.16 By contrast, space activities can be conducted for peaceful purposes while also contributing to security and defense interests. The issue remains of fundamental importance due to the growing development of military activities, dual-use satellites and new threats in space. The military use of outer space is now consolidated both by consistent and numerous interpretations about the words used in Article IV, and by States practices.17 The military uses of outer space, with a growing dual-use technology tendency, are now widespread amongst numerous space-faring nations. Dual-use nature of space technologies means that they can be used for civil and military purposes, as well as they are funded by civil and military entities (ex: national space agency and ministry of defense).18 States have always used satellites for military purposes, given their important strategic role to guarantee national security, or to support military or humanitarian operations on Earth. Indeed, warfare is henceforth unthinkable without the support of space capacities.19 Furthermore, the fact this technology is civil or commercial in nature does not lessen its strategic value.20 Even if commercially developed, they have the potential to expand security concerns and could possibly pave the way to an arms race in outer space.21

#### Specifically, arms races are true for South Asia because of the security trilemma.

Khan & Khan 19 (Zulfqar Khan is a Senior Analyst of the Pakistan Ministry of Defence; Visiting Fellow at the Islamabad Policy Research Institute; former Visiting Faculty of Department of Defence & Strategic Studies at Quaid-e-Azam University, Islamabad; and presently Visiting Faculty of the National Defence University in Islamabad. He has over twenty-five years experience in the field of research and analysis in different institutions, universities in the field of nuclear, defence, security, and conflict and diplomatic affairs. Ahmad Khan is a Ph.D. scholar and a Visiting Fellow at the ISSI. He is also a visiting faculty member at the department of Strategic Studies, National Defence University, Islamabad. A graduate of the Center for High Energy Physics, University of Punjab in Computational Physics, he has earlier served as a Research Associate at ISSRA, National Defence University and Pakistan Institute of Peace Studies. His areas of interest are strategic studies, defence policy, space arms race and regional politics. He has published in the Washington Quarterly, Astropolitics, Journal of Conflict and Peace, Policy Perspective and Journal of Social Sciences and Humanities. “Space Security Trilemma in South Asia,” *Astropolitics*, vol. 17, no. 1, pp. 4-22, 2019, <https://doi.org/10.1080/14777622.2019.1578931>) dwc 19

Conclusions In the twenty-first century, states aspire to accumulate power and influence over economic, political, and technological areas, as well as military power and space power. All of this is considered synonymous with the symbols of power and prestige for technologically advanced states. The desire to gather power is akin to technological advancement. However, technological advancement can- not be achieved without exploration of space for peaceful, strategic, and military uses to achieve states’ national security goals. Space has strategic connotations for both spacefaring and non-sparefaring states because space- related capability has emerged as a potent medium of progress and power.//// The uses of the global commons of space for various conflicting objectives are emerging as a potential cause of future conflicts. In addition, space politics at the global level among the major spacefaring states impacts inter- national and regional security environments, particularly in South Asia. The ongoing space competition between the United States and China has created a space security trilemma for Pakistan and India. This is primarily due to international and regional geostrategic transformations that are rooted in the Indo-U.S. space and strategic partnerships. This, in turn, impacts the security dynamics of South Asia, and negatively affects Pakistan, which is at a power disadvantage in comparison to India.//// The utilization of space power for states’ national defense has become an integral part of the national security strategy for India and Pakistan. In this regard, India is also focusing on expanding the orbit of its space program for national defense and power projection goals. This will prompt Pakistan to follow suit. The primary factor behind India’s growing space progress is partly due to its perceived fear of China’s expanding space program, and the latter’s growing militarization and weaponization capabilities. On the other hand, China’s primary concern is U.S. space weaponization capabilities.//// The concerns, vulnerabilities, and challenges in space trigger and magnify the security trilemma for these South Asian rivals, interconnecting China, India, and Pakistan in the context of an international security complex. This causes geopolitical dynamics and predicaments, such as China versus the United States, India versus China, and Pakistan versus India. Moreover, India has accelerated its space cooperation with the United States and other countries that will complement its BMD systems, which, from a Pakistani perspective, is a potent security threat and a destabilizing development that undermines the strategic stability of South Asia. Such developments place Pakistan under the sway of India’s increasing military and space dominance in the region. In sum, the space and technological programs of the United States, China, and India magnify the security trilemma between the regional states in South Asia.

#### South Asian space arms races go nuclear.

Ahmed and Arif 17 [RAJA QAISER AHMED is a Lecturer in the School of Politics and International Relations, Quaid I Azam University, Islamabad, Pakistan. MISBAH ARIF is a Visiting Lecturer in the Department of Defence and Diplomatic Studies at Fatima Jinnah Women University, Rawalpindi, Pakistan “Space Militarization in South Asia.” Sept./Oct. 2017. *University of California Press*. Vol. 57, No. 5. https://www.jstor.org/stable/pdf/26367781.pdf?refreqid=excelsior%3A001eb08009660f71b56e33d348ff862d&ab\_segments=&origin=]

Such developments would have serious repercussions for the strategic stability of South Asia and especially Pakistan. A new arms race is inevitable in the region and will compel other states to adopt a similar course of action. It is time for Pakistan to consider Indian advancement a serious threat. The older radar-based technologies are suitable for conventional and air forces, but space-based detection, navigation, communication, and monitoring give a state the upper hand and are very useful for effective command and control. Given the changing nature of warfare, where asymmetric attacks and informational advantages are of vital interest for a state, the importance of a space program is increasing day by day. Effective use of space satellite services will give India the upper hand over an adversary or competitor. A space program multiplies conventional forces by providing accurate information for analysis and assessment of threats. This is alarming for Pakistan. The Indian military will be capable of conducting operations in a more informed and sophisticated manner. India’s being capable of strong and effective space programs based on ASAT technology will enlarge its influence at the regional and international levels. Information domination will help India plan in a better way. The space program will give India accurate information about enemy missile silos and the movement of troops.45 India will be able to monitor troop movement in Pakistan and can base its plans on early, accurate information. Putting weapons in space will destabilize the already vulnerable international nonproliferation regime. The US is now focusing on India to develop its nuclear and space programs to counter China, but from US cooperation with India, Pakistan may face serious national security threats. Commercial use of Indian space assets and the sharing of technology throughout the region could help regional confidence and current interdependence initiatives, such as the South Asia Free Trade Agreement and the proposed Iran– Pakistan gas pipeline. CONCLUSION AND RECOMMENDATIONS The strategic environment of South Asia is complex, ambiguous, volatile, and unpredictable. South Asia is an important region geostrategically and geopolitically. The stability and security of the region are dependent on Indo–Pakistani relations, which have been strained for many years. The conventional asymmetry led to Pakistan’s reliance on nuclear weapons and a first-use policy. The nuclear deterrence between the two has been successful: no major war has occurred since nuclearization (aside from the Kargil standoff). Through its nuclear posture Islamabad has been able to achieve objectives like dissuading the enemy from considering aggression, deterring potential enemies, reducing dependence on allies, and military independence.46 Pakistan has been trying to preserve the credibility of its minimum nuclear deterrent since 1998. Pakistan’s proposed Strategic Restraint Regime would ban anti-ballistic missiles and submarine launched missiles in the region.47 But India rejected the proposal, wanting to balance the growing Chinese military muscle and engaging Pakistan in an expensive arms race. India’s space weapons program will solidify its defense and increase its options. It will also have serious repercussions for Indo–Pakistani relations and strategic stability in South Asia. It will heighten the asymmetry between the declared rivals, India and Pakistan. Further advancement and deployment of Agni V will give New Delhi second-strike capability. This will obviously have a negative effect on Pakistan’s security. Pakistan’s space program is only in its initial phases. India is very far ahead, and its rapid advancement in the field of space is alarming for Pakistan. To preserve its space assets, India has showed interest in building satellite killer devices, lasers, and military satellites to support Indian forces. Space weapons are unpredictable and fragile. It will be disastrous for mankind if these weapons are placed in outer space. To attain space dominance by developing such dangerous weapons would not be a rational approach. It is therefore recommended that alternative options be considered. India’s space weapons would have direct implications for Pakistan in particular. Indian activities in space will force Pakistan to make changes in its nuclear posture, imperiling stability and security. Indian space weaponization will force Pakistan to take measures to strengthen its defense forces. India’s having information about silos and the movement of troops, along with the ability to hit them, will require precautionary measures from Pakistan. Technological developments in the Indian space program could be a great threat to Pakistan, so the Pakistani government must now pay full attention to its space satellite program, to counter the Indian hegemonic space threat, and not always rely on the US and China. Pakistan receives technology from the US and China and does not possess indigenous technology production. Pakistan’s F-16s were provided by the US, and Pakistan’s space program is largely contingent on China’s help. Plans should be made to speed the development of Pakistan’s space program. India has always impelled Pakistan to take defensive security measures, as it did in 1998, when Pakistan had to test nuclear weapons in the aftermath of India’s nuclear tests. Pakistan doesn’t have its own launch vehicles or a launch pad for space vehicles. Pakistan needs to have its own launch vehicle and a geographically suitable place to build a launch pad. It is time for Pakistan to have an indigenous space program, not reliant on anyone else. Given the changing geostrategic environment, Pakistan must focus on internal balancing. India is working on expanding its conventional and nonconventional military might, as is evident in its rising defense budget allocations. Pakistan needs to pay special attention to this trend. Pakistan needs to work on a more robust nuclear triad with the development of nuclear submarines. Pakistan has made a significant development in this regard, with the successful test of its Nasr solid-fueled multi-tube tactical ballistic missile. Pakistan should go for nuclear submarines, which are hard to detect and can remain underwater for long periods. It must devise ways to overcome the economic challenge, to meet these increasing defense demands. And Pakistan can take this issue to the United Nations with the collaboration of other states, as its adversarial relations with India endanger the security of all states. The prevailing strategic environment will force Pakistan to take measures to counter the threats to its security. The measures will trigger an arms race in outer space and will create further instability in an already vulnerable South Asia. Efforts should be made at the global level to curb the proliferation of weapons in space, which is a global common and should be prevented from becoming a battleground. India’s space program is growing at a very brisk pace. The main regional issues of South Asia pivot around India–Pakistan rivalry. Space weaponization in South Asia will have dire implications for strategic stability. India’s quest for space weaponization is motivated by aspiration for supremacy and regional hegemony. India also wants to balance its capabilities with those of China to counter China’s growing influence in South Asia. Closer analysis of the issue suggests that given the historical relations between India and Pakistan, India’s quest for space weaponization will threaten the security of the region.

#### Space norms set redlines that allow international signaling and clarify criteria for retaliation during crises.

Schaffer 17 (Audrey Schaffer is Director, Space Strategy and Plans in the Office of the Secretary of Defense. “The Role of Space Norms in Protection and Defense,” *Joint Force Quarterly*, 10/1/17, National Defense University Press, <https://ndupress.ndu.edu/Publications/Article/1325996/the-role-of-space-norms-in-protection-and-defense/>) dwc 19

Role of Space Norms in Protection and Defense ////Norms are not a panacea for constraining aggressive, hostile, provocative, or otherwise deliberately irresponsible behavior in outer space. Norms may be enough to dissuade a rational actor from routinely engaging in irresponsible acts, but they will not prevent a committed aggressor from deliberately disrupting or denying space services it deems detrimental to its interests. Norms, however, can play a critical role in detecting and responding to potential threats. Norms enable early detection of potentially hostile actions or intentions in space. If a satellite exhibits behaviors contrary to operational norms, this is a clear flag to monitor its activities more closely. In times of peace, such activities are likely to be nothing more than an anomaly, which may deserve increased monitoring to preserve spaceflight safety or to mitigate harmful electromagnetic interference. In periods of heightened tensions, norms can form the basis of criteria for early indications and warning of potentially aggressive actions. //// To have maximum value in identifying “abnormal” behavior, norms should be widely accepted, such as through voluntary guidelines or international standards. Short of explicit international acceptance, national or allied declaratory policies can communicate those behaviors considered to be a demonstration of hostile intent, shaping tacit understanding of acceptable and unacceptable behaviors. If these agreements and/or communications are clear, and norms are generally observed in times of peace, then we can assume in times of crisis that behavior contrary to norms is most likely a deliberate choice. These assumptions will be a critical input to crisis decisionmaking and, by extension, may have a significant effect on crisis stability. Both an under-reaction and over-reaction to anomalous behaviors could have serious and unintended consequences for international peace and security. //// To the extent that the international community can observe what is happening in space, norms will shape world opinion about these behaviors, branding them as simply irresponsible or something more egregious such as potentially unlawful. This will require, at a minimum, compelling evidence based on space situational awareness information from a trusted source. Confirmation from multiple, independent, international, and/or commercial sources of space situational awareness will have a positive and reinforcing effect on detecting bad behavior in outer space. //// Nations may condemn those who choose to engage in behavior contrary to norms. Condemnation, however, is a double-edged sword; a nation cannot take others to task for violating international norms and simultaneously seek to operate with impunity. At first glance, military space operators may bristle at the implication that norms may constrain their freedom of action in space. Militaries, though, already accept legally binding constraints in all domains. For example, fundamental to the conduct of modern warfare is international humanitarian law (also known as the Law of War or the Law of Armed Conflict),2 which seeks to limit the effects of conflict, especially on noncombatants. Militaries around the world translate international humanitarian law into rules of engagement that guide servicemembers. //// A future space norms regime could be fashioned similarly to other regimes that govern activities in shared spaces and allow for differences in the application of rules to government or military actors and private actors. For example, Article 3 of the Convention on International Civil Aviation provides that the Convention does not apply to “state” aircraft, though such aircraft are required to exercise due regard for the safety of navigation of civil aviation.3 Article 48 of the Constitution of the International Telecommunication Union likewise provides freedom for military radio installations, but requires them, so far as possible, to observe provisions to prevent harmful interference.4 As in these other domains, safety and sustainability focused space norms, while remaining good and responsible practice no matter the situation, need not be strictly adhered to by militaries at all times. //// Even if militaries are not expressly required to follow norms, they nonetheless should be prepared to make more deliberate behavioral choices because of how actions inconsistent with norms will be interpreted. This not only requires a strategic and holistic perspective on national security space behaviors, especially in periods of crisis, but also creates opportunities for deliberate signaling. Just as increasing airborne reconnaissance or forward-deploying aircraft carriers can demonstrate interest and stake, so too can maneuvering satellites demonstrate readiness and resolve. Ensuring that the desired signals are received requires significant communication and/or agreement on norms of behavior well in advance of a crisis. //// Norms also provide clarity to acquirers, operators, and decisionmakers. Similar to how the Department of Defense (DOD) reviews all new weapons systems to ensure they can be operated in accordance with international law, acquirers and operators could look to space norms for guidance on what capabilities and actions would be permissible and under what circumstances. This ensures resources are not expended on systems that political leaders will not employ and provides guidance for operational planners on how to protect and defend space systems in a manner that will be deemed acceptable in different situations. //// Norms—or rather the violation thereof—also enable the creation of thresholds, triggers, and rules of engagement that allow militaries to employ passive or active measures to protect threatened space systems. Norms, ironically, may enhance freedom of action when it is needed most. Because norms support the development of criteria for judging hostile acts or hostile intent in space, they enable actions to be taken in self-defense.

#### Plan: The appropriation of outer space by private entities for on-orbit servicing and active debris removal is unjust.

Alver et. al 19 [James Alver, Acquisition Program Manager at U.S. Air Force Space and Missile Systems Center. Andrew Garza, NASA Program Manager, Tillman Scholar. Christopher May, Aerospace Engineer at The Aerospace Corporation. “An Analysis of the Potential Misuse of Active Debris Removal, On-Orbit Servicing, and Rendezvous & Proximity Operations Technologies.” May 6, 2019. https://swfound.org/media/206800/misuse\_commercial\_adr\_oos\_jul2019.pdf]

There are a number of different avenues through which norms can be built. Many of the more productive venues to pursue in the short term are unilateral mechanisms, developed within a single country or implemented within the RPO industry. Domestic norms can begin within the industry, with groups like CONFERS leading the charge. Working with RPO operators, satellite customers, insurers, and government stakeholders, the SWF can work to grow the CONFERS partnership to ensure buy-in, and use its role within the organization to help develop mutually agreeable, verifiable standards of behavior for these activities. Initially, as standards mature, it may be possible for them to be policed internally. Insurance policies could require adherence to norms, and satellite operators would likely select insured providers in order to protect their assets. Self-policing is not always ideal, but when industry knowledge in an emerging field evolves faster than the typically glacial pace of the regulatory process it may be necessary. As the RPO industry matures, norm-building may move to more legally-binding systems. Government regulatory agencies could adopt established standards and industry best practices into the regulatory code, creating a more thorough enforcement environment than might exist in a self-policed setting. It is important, however, that regulators take care to follow standards set by the industry or work closely with stakeholders when designing binding requirements. Well-designed regulations can enhance the safety and security of the space environment, while poorly-designed ones have the potential to stifle the industry and inhibit innovation that might improve safety and security in the future. Behavioral norms for RPO activities established within the United States could inspire governments or industry groups within other countries to adopt similar norms. Multinational insurers may require or strongly incentivize adherence to norms, or foreign companies might adopt them voluntarily in order to appear more trustworthy or responsible to potential clients. Conversely, there is a danger that overly restrictive binding regulations could encourage RPO operators to place themselves under the jurisdiction of countries with more relaxed standards. This phenomenon is comparable to “flags of convenience” on terrestrial seas, where ship owners will register their vessels with countries that have lower fees or weaker labor and environmental requirements in order to save costs. This phenomenon means that, perversely, attempts by countries to enforce stronger standards at sea often lead to lower overall adherence to those standards in the world market.28 A similar dynamic in space would be extremely detrimental to security and sustainability, and it must be prevented by maintaining buy-in from RPO operators when developing any binding regulations. Achieving universal acceptance of behavioral 28 Gregory, “Flags of Convenience: The Development of Opent Registries in the Global Maritime Business and Implications for Modern Seafarers.” requirements would also avoid the danger of flags of convenience, but truly global consensus appears illusive.

#### Bottom up approaches are key --- industry norms create binding CIL

Tziouras 20 [John Tziouras, Doctor of Law on Space Law at Faculty of Law, Aristotle University of Thessaloniki (A.U.TH.), and former scholar of A.U.TH.'s Research Committee. “On-Orbit Servicing: Security and Legal Aspects.” On-Orbit Servicing: Next Generation of Space Activities. Studies in Space Policy. Vol. 26. 2020. https://libgen.li/edition.php?id=138687279]

In the age of privatization of space activities new non-governmental actors made their presence opening up, or at least planning to open up, new markets in the new Space Industry. This emerging trend of private enterprises is characterized by creative “out-of-the-box” thinking, leading to revolutionary ideas and concepts. While State “space secrets” are still well-kept, the new Space Industry wants to be what the older traditional space industry is not: a non-bureaucratic and entirely cost-effective and not top-down governmental way of doing things. In an era of coexistence, traditional space industry and New Space Industry turn out to have a symbiotic relationship.47 The same symbiotic relationship that exists between international space law and national space legislation. In this so-called “fourth phase” of space law (Lato Sensu) as von der Dunk explains, the changing role of law-making follows the new trend. So, today, “space law should not be taken to refer only to those global treaties, resolutions and other legal or soft-law developments which principally originated from the bosom of COPUOS, or more precisely from the cooperation between most of the major spacefaring states.”48 In this case, bottom-up lawmaking,49 as an alternative to the traditional top-down law making, do not feature state policymakers but rather the very practitioners-both public and private. This process has a great advantage concerning the previous experience that practitioners usually have. As a result, a more detailed, carefully drafting process begins which over time leads to the initially non-binding rules becoming law. In the light of the above mentioned, space nowadays, is a privileged area for bottom-up lawmaking for a couple of reasons: First, UN space law was adopted at the time when states were the only actors in this field when space activities were carried out mainly for strategic purposes.50 Today national legislation, state best practices or organization driven efforts (i.e. DARPA51 about OOS), start framing a new legal landscape for commercial activities. Secondly, traditional arms control approaches, on Conference on Disarmament (CD), are still in a stalemate preventing any development in that field.While very useful tools were developed on international UN Committee forums/fora on the Peaceful Uses of Outer Space (COPUOS), the contribution of non-state actors, including institutions (i.e. European Space Policy Institute, Secure World Foundation), should be upgraded. A possible way to develop regulatory mechanisms or legal instruments, capable of regulating OOS activities, is to involve all the relevant stakeholders—especially non-governmental actors—in an alternative, bottom-up, lawmaking approach based initially on informal, practice-based rules which lead to more formal legal instruments at national or international level. There are analogous success stories in the realm of international trade law. Janet Koven Levit, in a very useful article mentioned that bottom-up lawmaking generates a specific, technical regulatory system. As she pointed out, “transnational legal processes typically begin with a treaty or some other legal instrument that triggers a trickle-down process whereby domestic legal systems absorb international law. In contrast, bottom-up lawmaking features soft rules ascending to legal status.”52 Such processes start with a relatively small, homogenous lawmaking group which creates substantive rules, which are essentially organic norms emanating from the practices of the respective practitioners. While Levit studies the success of bottomup lawmaking practice in the case of several international trade legal treaties, there seem to be various analogies with OOS. In that sense, non-state actors, such as those mentioned above, as well as OOS practitioners (even from the public sector) could initiate a process, pursued outside the existing multilateral fora, bypassing at least stalemates on PAROS. Also, given the divergent purpose relative to ADR, OOS bottom-up lawmaking process initiative could be studied autonomously, as this is mainly this book’s aim. While there is a recently beautiful work on ADR, OOS should be studied under its own theoretical, strategic, legal and political context.

### 1AC - Framing

#### The standard is maximizing expected wellbeing. Prefer ---

#### Extinction outweighs.

--- must preserve infinite lives and generations.

--- question of intergenerational equity.

--- existential threats are underestimated: global public good, intergenerational, unprecedented, scope neglect.

GPP 17 (Global Priorities Project, Future of Humanity Institute at the University of Oxford, Ministry for Foreign Affairs of Finland, “Existential Risk: Diplomacy and Governance,” Global Priorities Project, 2017, https://www.fhi.ox.ac.uk/wp-content/uploads/Existential-Risks-2017-01-23.pdf, Accessed 7/22/2017, Kent Denver-jKIM)

* 1. THE ETHICS OF EXISTENTIAL RISK In his book Reasons and Persons, Oxford philosopher Derek Parfit advanced an influential argument about the importance of avoiding extinction: I believe that if we destroy mankind, as we now can, this outcome will be much worse than most people think. Compare three outcomes: (1) Peace. (2) A nuclear war that kills 99% of the world’s existing population. (3) A nuclear war that kills 100%. (2) would be worse than (1), and (3) would be worse than (2). Which is the greater of these two differences? Most people believe that the greater difference is between (1) and (2). I believe that the difference between (2) and (3) is very much greater. ... The Earth will remain habitable for at least another billion years. Civilization began only a few thousand years ago. If we do not destroy mankind, these few thousand years may be only a tiny fraction of the whole of civilized human history. The difference between (2) and (3) may thus be the difference between this tiny fraction and all of the rest of this history. If we compare this possible history to a day, what has occurred so far is only a fraction of a second.65 In this argument, it seems that Parfit is assuming that the survivors of a nuclear war that kills 99% of the population would eventually be able to recover civilisation without long-term effect. As we have seen, this may not be a safe assumption – but for the purposes of this thought experiment, the point stands. What makes existential catastrophes especially bad is that they would “destroy the future,” as another Oxford philosopher, Nick Bostrom, puts it.66 This future could potentially be extremely long and full of flourishing, and would therefore have extremely large value. In standard risk analysis, when working out how to respond to risk, we work out the expected value of risk reduction, by weighing the probability that an action will prevent an adverse event against the severity of the event. Because the value of preventing existential catastrophe is so vast, even a tiny probability of prevention has huge expected value.67 Of course, there is persisting reasonable disagreement about ethics and there are a number of ways one might resist this conclusion.68 Therefore, it would be unjustified to be overconfident in Parfit and Bostrom’s argument. In some areas, government policy does give significant weight to future generations. For example, in assessing the risks of nuclear waste storage, governments have considered timeframes of thousands, hundreds of thousands, and even a million years.69 Justifications for this policy usually appeal to principles of intergenerational equity according to which future generations ought to get as much protection as current generations.70 Similarly, widely accepted norms of sustainable development require development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs.71 However, when it comes to existential risk, it would seem that we fail to live up to principles of intergenerational equity. Existential catastrophe would not only give future generations less than the current generations; it would give them nothing. Indeed, reducing existential risk plausibly has a quite low cost for us in comparison with the huge expected value it has for future generations. In spite of this, relatively little is done to reduce existential risk. Unless we give up on norms of intergenerational equity, they give us a strong case for significantly increasing our efforts to reduce existential risks. 1.3. WHY EXISTENTIAL RISKS MAY BE SYSTEMATICALLY UNDERINVESTED IN, AND THE ROLE OF THE INTERNATIONAL COMMUNITY In spite of the importance of existential risk reduction, it probably receives less attention than is warranted. As a result, concerted international cooperation is required if we are to receive adequate protection from existential risks. 1.3.1. Why existential risks are likely to be underinvested in There are several reasons why existential risk reduction is likely to be underinvested in. Firstly, it is a global public good. Economic theory predicts that such goods tend to be underprovided. The benefits of existential risk reduction are widely and indivisibly dispersed around the globe from the countries responsible for taking action. Consequently, a country which reduces existential risk gains only a small portion of the benefits but bears the full brunt of the costs. Countries thus have strong incentives to free ride, receiving the benefits of risk reduction without contributing. As a result, too few do what is in the common interest. Secondly, as already suggested above, existential risk reduction is an intergenerational public good: most of the benefits are enjoyed by future generations who have no say in the political process. For these goods, the problem is temporal free riding: the current generation enjoys the benefits of inaction while future generations bear the costs. Thirdly, many existential risks, such as machine superintelligence, engineered pandemics, and solar geoengineering, pose an unprecedented and uncertain future threat. Consequently, it is hard to develop a satisfactory governance regime for them: there are few existing governance instruments which can be applied to these risks, and it is unclear what shape new instruments should take. In this way, our position with regard to these emerging risks is comparable to the one we faced when nuclear weapons first became available. Cognitive biases also lead people to underestimate existential risks. Since there have not been any catastrophes of this magnitude, these risks are not salient to politicians and the public.72 This is an example of the misapplication of the availability heuristic, a mental shortcut which assumes that something is important only if it can be readily recalled. Another cognitive bias affecting perceptions of existential risk is scope neglect. In a seminal 1992 study, three groups were asked how much they would be willing to pay to save 2,000, 20,000 or 200,000 birds from drowning in uncovered oil ponds. The groups answered $80, $78, and $88, respectively.73 In this case, the size of the benefits had little effect on the scale of the preferred response. People become numbed to the effect of saving lives when the numbers get too large. 74 Scope neglect is a particularly acute problem for existential risk because the numbers at stake are so large. Due to scope neglect, decision-makers are prone to treat existential risks in a similar way to problems which are less severe by many orders of magnitude. A wide range of other cognitive biases are likely to affect the evaluation of existential risks.75

#### The introspective connection between pain and pleasure and phenomenal conceptions of intrinsic value and disvalue is irrefutable – 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.

#### Revisionary intuitionism is true and proves util

Yudkowsky 08 [Eliezer Yudkowsky (research fellow of the Machine Intelligence Research Institute; he also writes Harry Potter fan fiction). “The ‘Intuitions’ Behind ‘Utilitarianism.’” 28 January 2008. LessWrong. http://lesswrong.com/lw/n9/the\_intuitions\_behind\_utilitarianism/]

I haven’t said much about metaethics – the nature of morality – because that has a forward dependency on a discussion of the Mind Projection Fallacy that I haven’t gotten to yet. I used to be very confused about metaethics. After my confusion finally cleared up, I did a postmortem on my previous thoughts. I found that my object-level moral reasoning had been valuable and my **meta-level moral reasoning had been** worse than **useless**. And this appears to be a general syndrome – **people do much better when discussing whether torture is** good or **bad than**when they discuss **the meaning of “good” and “bad”. Thus, I deem it prudent to keep moral discussions on the object level** wherever I possibly can. Occasionally people object to any discussion of morality on the grounds that morality doesn’t exist, and in lieu of jumping over the forward dependency to explain that “exist” is not the right term to use here, I generally say, “But what do you do anyway?” and take the discussion back down to the object level. Paul Gowder, though, has pointed out that both the idea of choosing a googolplex dust specks in a googolplex eyes over 50 years of torture for one person, and the idea of “utilitarianism”, depend on “intuition”. He says I’ve argued that the two are not compatible, but charges me with failing to argue for the utilitarian intuitions that I appeal to. Now “intuition” is not how I would describe the computations that underlie human morality and distinguish us, as moralists, from an ideal philosopher of perfect emptiness and/or a rock. But I am okay with using the word “intuition” as a term of art, bearing in mind that “intuition” in this sense is not to be contrasted to reason, but is, rather, the cognitive building block out of which both long verbal arguments and fast perceptual arguments are constructed. **I see** the project of **morality as a project of renormalizing intuition.** We have intuitions about things that seem desirable or undesirable, intuitions about actions that are right or wrong, intuitions about how to resolve conflicting intuitions, intuitions about how to systematize specific intuitions into general principles. **Delete all** the **intuitions, and** you aren’t left with an ideal philosopher of perfect emptiness, **you’re left with a rock. Keep all your** specific **intuitions and** refuse to build upon the reflective ones, and you aren’t left with an ideal philosopher of perfect spontaneity and genuineness, **you’re left with a** grunting **caveperson** running in circles, due to cyclical preferences and similar inconsistencies. “Intuition”, as a term of art, is not a curse word when it comes to morality – there is nothing else to argue from. **Even modus ponens is an “intuition”** in this sense – **it**‘s **just** that modus ponens **still seems like a good idea after being** formalized, **reflected on**, extrapolated out to see if it has sensible consequences, etcetera. So that is “intuition”. However, Gowder did not say what he meant by “utilitarianism”. Does utilitarianism say… That right actions are strictly determined by good consequences? That praiseworthy actions depend on justifiable expectations of good consequences? That probabilities of consequences should normatively be discounted by their probability, so that a 50% probability of something bad should weigh exactly half as much in our tradeoffs? That virtuous actions always correspond to maximizing expected utility under some utility function? That two harmful events are worse than one? That two independent occurrences of a harm (not to the same person, not interacting with each other) are exactly twice as bad as one? That for any two harms A and B, with A much worse than B, there exists some tiny probability such that gambling on this probability of A is preferable to a certainty of B? If you say that I advocate something, or that my argument depends on something, and that it is wrong, do please specify what this thingy is… anyway, I accept 3, 5, 6, and 7, but not 4; I am not sure about the phrasing of 1; and 2 is true, I guess, but phrased in a rather solipsistic and selfish fashion: you should not worry about being praiseworthy. Now, what are the “intuitions” upon which my “utilitarianism” depends? This is a deepish sort of topic, but I’ll take a quick stab at it. First of all, it’s not just that someone presented me with a list of statements like those above, and I decided which ones sounded “intuitive”. Among other things, **if you try to violate** “**util**itarianism”, **you run into paradoxes, contradictions**, circular preferences, **and other** things that aren’t **symptoms of** moral wrongness so much as **moral incoherence**. After you think about moral problems for a while, and also find new truths about the world, and even discover disturbing facts about how you yourself work, you often end up with different moral opinions than when you started out. This does not quite define moral progress, but it is how we experience moral progress. As part of my experienced moral progress, I’ve drawn a conceptual separation between questions of type Where should we go? and questions of type How should we get there? (Could that be what Gowder means by saying I’m “utilitarian”?) The question of where a road goes – where it leads – you can answer by traveling the road and finding out. If you have a false belief about where the road leads, this falsity can be destroyed by the truth in a very direct and straightforward manner. When it comes to wanting to go to a particular place, this want is not entirely immune from the destructive powers of truth. You could go there and find that you regret it afterward (which does not define moral error, but is how we experience moral error). But, even so, wanting to be in a particular place seems worth distinguishing from wanting to take a particular road to a particular place. Our intuitions about where to go are arguable enough, but our intuitions about how to get there are frankly messed up. **After** the two hundred and eighty-seventh **research** study **showing that people will chop their own feet off if you frame the problem the wrong way, you start to distrust first impressions. When you’ve read** enough **research on scope insensitivity** – people will pay only 28% more to protect all 57 wilderness areas in Ontario than one area, **people will pay the same amount to save 50,000 lives as 5,000** lives… that sort of thing… Well, the worst case of scope insensitivity I’ve ever heard of was described here by Slovic: Other recent research shows similar results. Two Israeli psychologists asked people to contribute to a costly life-saving treatment. They could offer that contribution to a group of eight sick children, or to an individual child selected from the group. The target amount needed to save the child (or children) was the same in both cases. Contributions to individual group members far outweighed the contributions to the entire group. There’s other research along similar lines, but I’m just presenting one example, ’cause, y’know, eight examples would probably have less impact. If you know the general experimental paradigm, then the reason for the above behavior is pretty obvious – focusing your attention on a single child creates more emotional arousal than trying to distribute attention around eight children simultaneously. So people are willing to pay more to help one child than to help eight. Now, **you could** look at this intuition, and **think it was** revealing **some** kind of incredibly **deep moral truth** which shows that one child’s good fortune is somehow devalued by the other children’s good fortune. But what about the billions of other children in the world? Why isn’t it a bad idea to help this one child, when that causes the value of all the other children to go down? How can it be significantly better to have 1,329,342,410 happy children than 1,329,342,409, but then somewhat worse to have seven more at 1,329,342,417? **Or you could** look at that and **say: “The intuition is wrong: the brain can’t** successfully **multiply** by eight and get a larger quantity than it started with. **But it ought to**, normatively speaking.” And once you realize that the brain can’t multiply by eight, then the other cases of scope neglect stop seeming to reveal some fundamental truth about 50,000 lives being worth just the same effort as 5,000 lives, or whatever. You don’t get the impression you’re looking at the revelation of a deep moral truth about nonagglomerative utilities. It’s just that the brain doesn’t goddamn multiply. Quantities get thrown out the window. If you have $100 to spend, and you spend $20 each on each of 5 efforts to save 5,000 lives, you will do worse than if you spend $100 on a single effort to save 50,000 lives. Likewise if such choices are made by 10 different people, rather than the same person. As soon as you start believing that it is better to save 50,000 lives than 25,000 lives, that simple preference of final destinations has implications for the choice of paths, when you consider five different events that save 5,000 lives. (It is a general principle that Bayesians see no difference between the long-run answer and the short-run answer; you never get two different answers from computing the same question two different ways. But the long run is a helpful intuition pump, so I am talking about it anyway.) The aggregative valuation strategy of “shut up and multiply” arises from the simple preference to have more of something – to save as many lives as possible – when you have to describe general principles for choosing more than once, acting more than once, planning at more than one time. Aggregation also arises from claiming that the local choice to save one life doesn’t depend on how many lives already exist, far away on the other side of the planet, or far away on the other side of the universe. Three lives are one and one and one. No matter how many billions are doing better, or doing worse. 3 = 1 + 1 + 1, no matter what other quantities you add to both sides of the equation. And if you add another life you get 4 = 1 + 1 + 1 + 1. That’s aggregation. **When you’ve read** enough heuristics and **biases research, and**enough **coherence** and uniqueness **proofs for** Bayesian probabilities and **expected utility**, and you’ve seen the “Dutch book” and “money pump” effects that penalize trying to handle uncertain outcomes any other way, then **you don’t see** the **preference reversals** in the Allais Paradox **as** revealing some incredibly **deep moral truth** about the intrinsic value of certainty. **It** just **goes to show that the brain doesn’t** goddamn **multiply.** The primitive, perceptual intuitions that make a choice “feel good” don’t handle probabilistic pathways through time very skillfully, especially when the probabilities have been expressed symbolically rather than experienced as a frequency. So you reflect, devise more trustworthy logics, and think it through in words. When you see people insisting that no amount of money whatsoever is worth a single human life, and then driving an extra mile to save $10; or when you see people insisting that no amount of money is worth a decrement of health, and then choosing the cheapest health insurance available; then you don’t think that their protestations reveal some deep truth about incommensurable utilities. Part of it, clearly, is that **primitive intuitions don’t**successfully **diminish the emotional impact of** symbols standing for **small quantities** – anything you talk about seems like “an amount worth considering”. And part of it has to do with preferring unconditional social rules to conditional social rules. Conditional rules seem weaker, seem more subject to manipulation. If there’s any loophole that lets the government legally commit torture, then the government will drive a truck through that loophole. So it seems like there should be an unconditional social injunction against preferring money to life, and no “but” following it. Not even “but a thousand dollars isn’t worth a 0.0000000001% probability of saving a life”. Though the latter choice, of course, is revealed every time we sneeze without calling a doctor. The rhetoric of sacredness gets bonus points for seeming to express an unlimited commitment, an unconditional refusal that signals trustworthiness and refusal to compromise. So you conclude that moral rhetoric espouses qualitative distinctions, because espousing a quantitative tradeoff would sound like you were plotting to defect. On such occasions, people vigorously want to throw quantities out the window, and they get upset if you try to bring quantities back in, because quantities sound like conditions that would weaken the rule. But you don’t conclude that there are actually two tiers of utility with lexical ordering. You don’t conclude that there is actually an infinitely sharp moral gradient, some atom that moves a Planck distance (in our continuous physical universe) and sends a utility from 0 to infinity. You don’t conclude that utilities must be expressed using hyper-real numbers. Because the lower tier would simply vanish in any equation. It would never be worth the tiniest effort to recalculate for it. All decisions would be determined by the upper tier, and all thought spent thinking about the upper tier only, if the upper tier genuinely had lexical priority. As Peter Norvig once pointed out, if Asimov’s robots had strict priority for the First Law of Robotics (“A robot shall not harm a human being, nor through inaction allow a human being to come to harm”) then no robot’s behavior would ever show any sign of the other two Laws; there would always be some tiny First Law factor that would be sufficient to determine the decision. Whatever value is worth thinking about at all, must be worth trading off against all other values worth thinking about, because thought itself is a limited resource that must be traded off. When you reveal a value, you reveal a utility. I don’t say that morality should always be simple. I’ve already said that the meaning of music is more than happiness alone, more than just a pleasure center lighting up. I would rather see music composed by people than by nonsentient machine learning algorithms, so that someone should have the joy of composition; I care about the journey, as well as the destination. And I am ready to hear if you tell me that the value of music is deeper, and involves more complications, than I realize – that the valuation of this one event is more complex than I know. But that’s for one event. When it comes to multiplying by quantities and probabilities, complication is to be avoided – at least if you care more about the destination than the journey. **When you’ve reflected** on enough intuitions, **and corrected enough absurdities, you** start to **see a common denominator**, a meta-principle at work, **which one might phrase as “Shut up and multiply.”** Where music is concerned, I care about the journey. When lives are at stake, I shut up and multiply. It is more important that lives be saved, than that we conform to any particular ritual in saving them. And the optimal path to that destination is governed by laws that are simple, because they are math. **And that’s why I’m a utilitarian** – at least when I am doing something that is overwhelmingly more important than my own feelings about it – which is most of the time, because there are not many utilitarians, and many things left undone.