### Framing

#### The standard is minimizing material violence.

#### Prefer:

#### [1] Pleasure and pain are intrinsic value and disvalue

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.

#### [2] Actor Spec— States must use util. Any other standard dooms the moral theory

**Goodin 90.** Robert Goodin 90, [professor of philosophy at the Australian National University college of arts and social sciences], “The Utilitarian Response,” pgs 141-142 //RS

My larger argument turns on the proposition that there is something special about the situation of public officials that makes utilitarianism more probable for them than private individuals. Before proceeding with the large argument, I must therefore say what it is that makes it so special about public officials and their situations that make it both more necessary and more desirable for them to adopt a more credible form of utilitarianism. Consider, first, the argument from necessity. Public officials are obliged to make their choices under uncertainty, and uncertainty of a very special sort at that. All choices – public and private alike – are made under some degree of uncertainty, of course. But in the nature of things, private individuals will usually have more complete information on the peculiarities of their own circumstances and on the ramifications that alternative possible choices might have for them. Public officials, in contrast, are relatively poorly informed as to the effects that their choices will have on individuals, one by one. What they typically do know are generalities: averages and aggregates. They know what will happen most often to most people as a result of their various possible choices, but that is all. That is enough to allow public policy-makers to use the utilitarian calculus – assuming they want to use it at all – to choose general rules or conduct.

#### [3] Extinction First –

#### [a] Forecloses future improvement – we can never improve society because our impact is irreversible

#### [b] Turns suffering – mass death causes suffering because people can’t get access to resources and basic necessities

#### [c] Moral uncertainty – if we’re unsure about which interpretation of the world is true – we ought to preserve the world to keep debating about it

### Plan

#### Plan: The appropriation of outer space by private entities is unjust.

#### The plan is enforced both internationally with UNCOPUOS and domestically through enforcement and liability regimes – solves best

* UNCOPUS is given power over private entities – 3 separate branches formed
* UNCOPUS = United Nations Committee on the Peaceful Uses of Outer Space
* Cost allocation is proportional to countries’ space impact
* Domestic policies are passed uniformly
* Enforced with a variety of sanctions
* States with more defined space policies can diplomatically pressure others for uniformity

Jennifer **El-Fakir 20** [Juris Doctor Candidate, Columbia Law School. Thank you to Professor Lori F. Damrosch for her guidance and to Alexander C. Bavis, Austin D. Kuhn, Afia M. Kwakwa, and the rest of the Columbia Journal of Transnational Law team for their continual support. "Problems with Enforcing International Space Law on Private Actors — Columbia Journal of Transnational Law," Columbia Journal of Transnational Law (June 2, 2020), https://static1.squarespace.com/static/5daf8b1ab45413657badbc03/t/5ed6c19ec930145149b92f2f/1591132576033/%28i%29+Isnardi+%2858-2%29.pdf]//anop

A. **Empower UNCOPUOS or a New International Enforcement Body with Increased Authority over Private Actors The space industry will likely benefit from a centralized enforcement authority that has actual regulatory, adjudicative, and arbitral powers**.196 In fact, Article XI of the Moon Agreement arguably calls for such an organization to create and enforce laws related to commercial activity.197 Additionally, several countries have already advocated for a permanent specialized United Nations agency to oversee outer space activities, which some have deemed the “World Space Organization” (“WSO”).198 However, UNCOPUOS has yet to seriously consider a new overseeing body.199 **Nonetheless, UNCOPUOS and the international space law community should** either (1) create a separate U.N. body that enforces international space law on public and private actors, or (2) **enhance the authority of UNCOPUOS to do the same. One particular structure that the WSO can follow is that which is already established by other U.N. specialized agencies: it may hold an Assembly, a Council, and a Secretariat.**200 The **Assembly may create policy, adopt amendments to international agreements, and ratify regulations and standards for commercial space activities. The Council may serve as an executive body that promotes cooperation among member states and international organizations.201 Commercial space interests may be adequately represented on this Council by allowing representation for all space-faring state members**.202 Also, representation from state members that are not the primary producers of commercial space activity, but serve as geographic hotspots for launching space activities, should be adequately represented on this board as well.203 Finally, the Secretariat may facilitate administrative support for WSO’s undertakings.204 **Additionally, the WSO should incorporate a dispute resolution organ that can hold accountable the actions of private actors through their respective member states**. It should have the maximum enforcement capacity, such as by **requiring that all state members adhere to the tribunal’s rulings. It should grant itself jurisdiction over private actors and allow these actors to bring a claim before the judicial organ as well, so long as the member states recognize the competence of the tribunal to consider the matter. Allowing cases concerning individual and private actors has already been established by many international courts and tribunals, such as the Permanent Court of Arbitration and various international human rights courts**.205 As commercial space activity only continues to grow, the WSO should provide an adequate means for adjudicating claims resulting from these activities. Problems will undoubtedly arise from creating the WSO. Developing countries or states without a strong presence in outer space may contend that this framework will be inconsistent with the object and purpose of the Outer Space Treaty, which declares that outer space is to be the “province of all mankind.”206 Therefore, assurances must be made that developing countries or non-space faring nations will benefit from this organization.207 For instance, the organization may help facilitate commercial space activities that would benefit these countries by providing greater technology and services. Technological advances in satellite imagery may help these countries mitigate environmental damage and warn them of impending natural disasters.208 **Another issue to address is how to establish an equitable cost allocation plan for this new organization. One idea is to allocate contributions based on the amount of tonnage launched per year by U.N. Member States**.209 Another idea is to emulate the cost allocation structure already established by the U.N. General Budget.210 **Regardless of the cost allocation structure provided, it should equitably reflect the contributions that space-faring nations make and ensure that they front the bulk of the costs**.211 As an alternative to going through the process of creating a new legal entity, UNCOPUOS could use its own established regulatory framework and expand its own powers to create a similar regulatory framework as described above. This seems like an intuitive step for a U.N. Committee that is already among the largest committees of the United Nations212 and is currently the “only intergovernmental platform for fostering global governance of outer space activities.”213 However, problems associated with expanding UNCOPUOS’s role would undoubtedly arise. In particular, there is actually no natural progression in transforming a U.N. General Assembly committee into an enforcement body since the General Assembly does not have enforcement authority under the U.N. Charter. The U.N. Charter may need to be amended to provide the General Assembly with such enforcement authority if expanding UNCOPUOS’s role were to actually be realized. Nonetheless, these barriers to greater enforcement are surmountable, assuming that the member states can defy the complex political tensions that exist within the U.N.214 **Creating the WSO or increasing UNCOPUOS’s powers will provide a forum for member states and private actors alike to facilitate space programs and should be reconsidered by UNCOPUOS.** B. **Promote Firmer and More Uniform Standards Among Domestic Laws To some extent, all five international space treaties rely on states to implement their own domestic laws to fulfill the treaties’ obligations. The strength of enforcement lies strongly with the strength of domestic space law to enforce itself upon private actors. National space law should particularly focus on (1) creating firmer and more uniform standards for the national registration requirements of space objects and (2) broadening avenues of recourse when private space activity causes harm.** However, individual states may lack the incentive to increase regulation, as it may reduce space activity launching from that particular state.215 Time will tell whether these space-faring nations will overcome this collective action problem by placing the need for the safe use of outer space before individual state interests. While the Outer Space Treaty and the Registration Convention imparted an obligation on States Parties to implement registration requirements for space objects within their domestic law, they failed to “identify the contours of any particular licensing regime.”216 This has caused an unevenness in registration requirements that have led to confusion and the failure to report space objects in outer space, as described infra. **Additionally, this lack of conformity in national law has allowed private actors to travel to more lenient states to launch their objects into space, also as described infra. For states to authorize space activities and provide greater supervision over them, all space-faring nations should establish a uniform licensing and regulatory regime with adequate enforcement measures within them.217 To create uniformity among domestic registration requirements for space objects, the International Law Association (“ILA”) issued a model law for national space legislation**.218 Notably, ILA’s model national law suggests that all national registrations should include certain information, such as the registration number of the space object, date and location of the launch, orbital parameters, and the function of the space object.219 ILA’s model national law also lists extensive requirements for authorizing the space activity, including that the space activity be compatible with public safety standards, foreign policy, national security, and other standards.220 This would prevent the situation created by Swarm, where it took advantage of India’s lenient safety standards to launch its hard-to-detect satellites.221 **Creating uniform standards for registration, including safety standards, would mitigate the risk of private actors forum shopping for the most lenient states from which to launch their space objects. States should also implement stronger enforcement mechanisms to motivate compliance with their respective national space laws and to harmonize their laws with other states. States’ enforcement mechanism schemes vary from sanctions such as license suspension or revocation, to fines and imprisonment. As for license suspension and revocation, the reasons for license suspension or revocation vary significantly.** For instance, in the United Kingdom, the Netherlands, South Korea, China, and many other major space-faring nations, a license may be revoked if the licensee conducts actions that endanger national security.222 Meanwhile, South Korea’s additional rule, that a license may be suspended if a launch has been delayed for greater than one year without cause, is not as widely adopted.223 South Korea also imposes heavy fines (up to ₩50 million , or approximately U.S. $44,387) and long sentences (up to five years in prison) for an individual who launches without a license. In contrast, France does not impose any sentence for launching a space object without authorization, but does impose a fine of up to €200,000 (or approximately U.S. $257,000).224 **Some states (such as India and Switzerland)225 have failed to enact any legislation concerning compliance to any safety and registration standards. In these cases, perhaps states with comprehensive compliance schemes (such as the United States and Australia)226 may diplomatically pressure less regulated states to impose basic safety and registration regulations. At a minimum, all states should institute a regulatory agency that holds the jurisdiction to license space activities and enforce licensing and safety protocols.227 In addition to standardizing registration requirements and compliance mechanisms, more states should provide adequate liability mechanisms for private actors when the private actors’ space activity causes harm.** Currently, the Liability Convention puts total fault on a State Party for all harm caused by objects launched from that state. **To hold private actors accountable for their actions, and to mitigate the risks of a “tremendous public payout” for private actions in space,228 governments should implement comprehensive domestic regulations of “safety and financial responsibility for private activities in space.”**229 Some states have already done so, but this liability framework is not universal.230 All states should place liability on the operator of the spacecraft, as is suggested by ILA’s model national law.231 In relation to imposing liability on the operator of the spacecraft, all states should require a certain level of insurance and indemnification to allow victims to be adequately compensated. While imposing insurance and indemnification standards may seem like a natural progression in imposing liability standards, this requirement is currently missing from many state’s domestic space law.232 In crafting insurance and indemnification laws on private space-faring actors, however, states should be careful not to create such a high liability risk to these actors that it would threaten the development of space innovation in this relatively nascent era of space commercialization.233 Thus, liability arising out of space activities should be limited.234 **While domestic laws are not “the perfect solution” for fixing gaps in enforcement, “they are easier to enact and more enforceable than any comparable international space law.”235 Increasing the strength of national space law as well as the uniformity among different states’ national space legal regimes would undoubtedly result in greater enforcement upon private actors. Additionally, increased domestic regulation may in turn inspire the further development of customary and conventional international space law.**236

### 1AC – Debris

#### Privatization of technology uniquely cause exponential development and debris.

Bernat 20 – Pawel, 2020, Military University of Aviation, [“ORBITAL SATELLITE CONSTELLATIONS AND THE GROWING THREAT OF KESSLER SYNDROME IN THE LOWER EARTH ORBIT,” SAFETY ENGINEERING OF ANTHROPOGENIC OBJECTS, Volume 4, PDF] Justin

The second decade of the 21st century has brought a dynamic and somewhat surprising development of the space industry. Since 1972 – the Apollo 17 crew mission to the Moon, the humankind has not left the safe environment of Earth’s orbit, and for years the global space sector has been progressing in slow but steady pace run by a few largest space agencies like American NASA, European ESA, Japanese JAXA, and Chinese CNSA. The most significant achievement of the “old ways” of managing outer space exploration is the International Space Stations (ISS) that has facilitated more than 20 years of continuous crewed operations. The situation started to change at the turn of the century when new generations of private entrepreneurs began to invest in and develop space technologies like rocket boosters, spaceships, and what most important for the subject of the paper – satellites and their constellations. This new shift is known among the space industry as “Space 2.0”, and its emergence is dated around 2000-2002 when the companies like SpaceX, Blue Origin, and Virgin Galactic were established. (Pyle, 2019). The real change, however, came in 2012 when the first SpaceX commercial mission was successfully launched to the ISS (NASA, 2012). Since then, the participation of the private sector in the space industry has skyrocketed, especially in the United States. Today, SpaceX is the only entity that provides reusable rockets (first stage and fairings) that is capable of vertical launch and landing. Their current flagship rocket – Falcon 9 has carried out 23 successful missions in 2020 (SpaceX, 2020) and another four are planned for December of that year (Weitering, 2020). Moreover, thanks to Crew Dragon spaceship developed by the company, Americans have regained this year the capacity of sending astronauts from their own soil after nine years of buying the seats on Russian Soyuz capsule. SpaceX is now in the process of building a communication satellites constellation that will be addressed and analyzed in the paper. Nowadays, in the space industry, we witness a very productive cybernetic feedback look between the development of space technologies, the democratization of those technologies, and a substantial reduction of prices. The latter is even more significant if we compare the cost of launching cargo into orbit now and 20 years ago – Falcon 9 is over ten times cheaper than Space Shuttle (Jones, 2018). This, of course, directly translates into the mass and number of objects that we are able to put in the orbit viably. Once the constellations consisting of thousands of satellites were unthinkable, but in the current environment, they become a reality. Space 2.0 also has brought new threats and challenges in the sphere of national and international security. The increase in launch capacity, among other factors, has led to progressive militarization and weaponization of space and new arms race (Bernat, 2019), which has also contributed to the growing numbers of orbiting objects. The goal of the paper is to present the argumentation that the threat posed by the cascading collisions in the Earth’s orbit (Kessler syndrome) is becoming more severe due to the construction of orbital satellite constellations; the threat that presents a real danger for people during their EVAs and orbital infrastructure, which may bare immediate consequences for safety and security systems on Earth. In order to provide the theoretical context for the above claim, the following issues will be presented and discussed: (1) space debris, (2) the Kessler syndrome, (3) orbital debris models, (4) the legal issues related to space debris and mitigation actions against their proliferation, and (5) the planned and being currently developed orbital satellite constellations and how they contribute to the growing threat of the Kessler syndrome.

#### Privatization increases space debris to an unsafe level but ending missions stops it.

Bernat 20 – Pawel, 2020, Military University of Aviation, [“ORBITAL SATELLITE CONSTELLATIONS AND THE GROWING THREAT OF KESSLER SYNDROME IN THE LOWER EARTH ORBIT,” SAFETY ENGINEERING OF ANTHROPOGENIC OBJECTS, Volume 4, PDF] Justin

5. Orbital satellite constellations and the growing threat of the Kessler syndrome Space 2.0 – the new era of space exploration that we witness now in the 21st century means, in words of Buzz Aldrin, “moving human enterprise into space” (Pyle, 2019, p. xiv). The process of commercialization of outer space has already begun and is not limited to private companies providing technologies and services for national or international space agencies, as it was in the past. On the contrary, private companies from the space sector have now matured to carry out their own independent projects. As for 2020, SpaceX is a company that serves as the best example – it launches satellites to the orbit, both for state and private contractors, it successfully realized two crew missions to the International Space Station, and is in the process of constructing Starlink satellite constellation that will provide high-speed internet access across the planet. Each satellite weighs around 260 kg, is equipped with an ion propulsion system, autonomous collision avoidance system, and orbits Earth at approximately 540-560 km altitude (Starlink, 2020). At the beginning of November 2020, more than 860 Starlink satellites were orbiting the Earth (Jewett, 2020). Immediate plans include launching 12,000 satellites, but they assume a potential later extension to 42,000 (Henry, 2019a). Of course, SpaceX has employed, at least declaratively, all necessary measures to keep the space clean – the satellites are equipped with the deorbiting system, and in the event of inoperability of the propulsion system (Starlink, 2020). The orbital collisions are, however, inevitable. As it was shown before, the possibility of collisions grows with the number of orbital objects. Bastida Virgili with the team compared (2016, p. 154-155) orbital debris environment development without and with a large hypothetical constellation consisting of merely 1080 satellites, distributed across 20 orbital planes at 1,100 km altitude (Fig. 5).

Chart, line chart

Description automatically generated

It has to be noted that although SpaceX’s Starlink is the only constellation that is being built in orbit, it is not the only one planned. There are at least a few initiatives aiming at the same goal – to construct internet infrastructure at the Earth’s orbit. The planned Kuiper Systems LLC, which is a subsidiary of Amazon and intends to place 3,236 broadband satellites in the LEO, is one of Starlink’s biggest competitors (Henry, 2019b). Now, there is even a rivalry between the two companies because Kuiper’s lowest orbital shell is planned to be 590 km, with a tolerance of 9 km either above or below (Cao, 2020), which is the altitude of Starlink satellites. Moreover, the race for space in orbit is now at the beginning. The outer space is vast. It increasingly becomes more cluttered with both operational satellites and space debris. The threat of collisions increases and no institution or body has enough power to license, coordinate and regulate what is sent to the orbit. The UNOOSA has not such power. National states decide what the companies from the space industry can launch to space. In the United States, which is most advanced in the area of private constellations, it is the Federal Aviation Administration (FAA) that issues the appropriate approvals. The race to put broadband internet satellites bears similarities to the gold rush – there are no rules, at the global level, apart from first-come, first-served.

#### Models are rigorous and robust.

---To clarify this is the methodology for above chart.

Virgili et al. 16 – Bastida, J.C. Dolado, H.G. Lewis, J. Radtke, H. Krag, B. Revelin, C. Cazaux b , C. Colombo, R. Crowther, M. Metz, 4/26/16, [“Risk to space sustainability from large constellations of satellites,” Act Astranautica, <https://sci-hub.se/10.1016/j.actaastro.2016.03.034>.] Justin

1.3. Simulation approach and result analysis A Monte Carlo (MC) approach was used to simulate the evolution of the object population over a period of 200 years under different post-mission disposal requirements, with four different tools (MEDEE – Modelling the Evolution of Debris on Earth's Environment [9], LUCA – Long Term Utility for Collision Analysis [10], DAMAGE – Debris Analysis and Monitoring Architecture to the Geosynchronous Environment [11] and DELTA – Debris Environment Long Term Analysis [12]). For analysis purposes, the effective number of objects was used where the contribution to the population by each object was weighted by the proportion of the orbital period spent in LEO. In a first step, four different evolutionary models performed an analysis of two reference scenarios. One scenario considered only the evolution of the background population and non-constellation traffic. The second scenario augmented the first with the addition of the representative constellation, with the requirement that 90% of the constellation satellites achieved post-mission disposal to orbits with remaining lifetimes of 25 years. The manoeuvres performed at the mission end to meet the disposal requirement are assumed to be impulsive (i.e. instantaneous) and result in an eccentric orbit with the apogee near the original (constellation) altitude and the perigee at an altitude such that the effects of atmospheric drag would cause the orbit to decay within 25 years. Two of the models considered an apogee remaining at the operational constellation altitude, while the other two reduced the apogee by 50 km. The purpose of these scenarios is to provide a cross-comparison of the models in terms of their predictions of the total object population, which take into account the effects of the constellation. As the distribution of the MC results for the models is of the same nature and the results are independent, a bootstrapping [20] approach is used to derive the mean, the standard deviation and the confidence levels at 95% of the combined results of all the MC runs from the four models (cf. Fig. 1), although not all the models performed the same number of MC runs (see Table 1). The main source of variation inside a particular model's MC runs included the randomness in collision activity, while the different models used their own solar activity forecast.

#### Unchecked Commercial Appropriation causes Space Conflicts.

Perez 21 Veronica Delgado-Perez. 12/14/21. Argument | The Commercialization of Space Risks Launching a Militarized Space Race. <https://www.theintlscholar.com/periodical/12/14/2020/analysis-commercialization-space-risk-international-law-military-space-race> [Veronica Delgado-Perez is a Staff Writer at The International Scholar.] // CVHS SR

Fundamentals of the Final Frontier It is a geopolitical imperative to determine what, if any, commercial activities and use of extraterrestrial resources are permitted within the confines of international law. Without clear-cut agreements on what activity is recognized by international law, the world will undoubtedly see states push the boundaries ever further in an attempt to gain the edge over geopolitical competitors — even more-so in an era of renewed great power competition. Yet to date, there exists no comprehensive treaty or legal reference to commercial activity in space. However, this should come as no surprise. It has only been since the turn of the century that technology and markets have progressed to the point where commercial space exploration and exploitation has become possible. Only recently have experts and analysts of geopolitics and international law begun to seriously examine questions surrounding the legal framework that would govern extraterrestrial resource-mining and other commercial activities. In the last decade, the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) dealt with commercial aspects in outer space. In one of their last reports, the Committee expressed that the era of the commercial utilization of outer space’s resources is intrinsically linked to the escalation of international competition over resources, which could threaten international peace and security. By encouraging the international community to engage in outer space’s activities for the benefit of humankind as a whole, “some delegations” have expressed that states should avoid the promotion of laws and regulations related to the commercialization of outer space, arguing that it should be considered the heritage of all humanity. In that regard, states must then ensure that domestic law on the use of outer space complies with international space law, which means that states should respect the principles outlined in the Outer Space Treaty and ensure that national regulations do not contravene international provisions. Even though the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (which entered into force in 1967), refers to the exploration and use of outer space, it does not address questions of a commercial nature, which compromises the ability of states and international actors to address new challenges to extraterrestrial activities. In several provisions, the treaty highlights that these activities may be carried out for peaceful purposes and the benefit of all people, reaffirming that outer space is not subject to national appropriation. Were outer space not considered a global commons, that would imply that the resources and results of commercial exploration may fall within the jurisdiction of a country. It is thus incumbent upon Washington — and its commercial enterprises — to demonstrate how American commercial exploration of space benefits other countries and complies with international space law, or otherwise to adhere to the spirit of past treaties which emphasize the impartiality of outer space until such time as the law is clarified. International Law is Adrift in Space The potential benefits of commercial space exploration cannot be ignored. From an economic standpoint, the space industry would generate a significant economic boon for both states and private companies, due to the abundance and variety of resources — particularly scarce minerals that are difficult to extract on Earth. As one example of the vastness of resources held in outer space, one asteroid has the potential to contain more than the total supply of platinum extracted throughout the history of mankind. It may very well open the door to an advanced era of space navigation, building extraterrestrial infrastructure that facilitates the exploration and use of space’s resources, and extra-planetary human habitation. Inevitably, there are significant drawbacks to the commercialization of space exploration. These can vary, for instance, from the commercial dominance of space’s natural resources only by those states with the technical and financial capital to support space missions, to geopolitical competition over extraterrestrial resources that threatens world peace and security, to the potential for the monopolization of extraterrestrial resources by states and private companies. As was the case during the Cold War, the Soviet Union and the United States began a Space Race in which they struggled to achieve supremacy in space exploration and domination of science. Today, the number of space powers has increased thanks to continual advancements in flight, combustion, and fueling technologies. In the three decades since the end of the Cold War, technologically advanced countries like China, Japan, and France which previously had no space program have successfully navigated to the top tier of space-faring agencies and programs. In 2018, the U.S. allocated $41 billion to space programs, followed by China at $5.8 billion, and Russia at $3.1 billion. Collectively, the three major space powers control almost 65% of the global industry, showing space powers are monopolizing space and reinforcing the inequality gap between states that do not have sufficient economic and technological capacity to invest. With new actors on the game stage, conflicts of interest may arise. There is a risk that each actor adopts a kind of short-term Realist approach to space policy — one which is driven by self-interest in reaping the greatest benefits of extraterrestrial exploration and commercialization while controlling access to others. If unmitigated, states may choose to militarize outer space to gain a strategic edge over competitors and adversaries. This process has already begun. Under the Trump administration, the Pentagon established the U.S. Space Force as a new branch of the Armed Forces to protect the country and allied interests in space. Already, Delta 4 — one of the U.S. Space Force’s missions — conducts strategic and theater missile warnings, manages weapon systems, and provides information to missile defense forces. The measure shows that for the U.S., outer space is not only a domain of scientific exploration but has the potential to become increasingly securitized. With the impending expiration of the Strategic Arms Reduction Treaty (START) between the U.S. and Russia on February 5, 2021, a number of security dilemmas could arise. If the world’s two largest nuclear powers do not edge toward extending the treaty, Washington and Moscow risk returning to the era of unrestricted expansion of launch platforms and strategically-deployed nuclear warheads — potentially with the aid of military infrastructure in space. Although President-elect Biden has expressed his interest in negotiating an extension of New START, how Moscow and Washington might proceed remains an open question. Bilateral progress towards a new arms-control regime would require establishing limits on the number and range of long- and mid-range missiles, establishing measures to limit the expansion of traditional missile deployment to space, and banning the deployment of nuclear weapons and weapons of mass destruction in outer space. More than the risk of the securitization of space, state, and private actors could begin to claim exclusive legal rights over the resources they discover. Indeed, the U.S. Commercial Space Launch Competitiveness Act, which came into force in 2015, expressly recognizes the right of U.S. Citizens to possess, own, transport, use, and sell space resources. By this means, domestic law already acknowledges the legal claim to property by individuals, which is prohibited by international law. Under the Outer Space Treaty, states renounced any traditional form of acquisition of territories and agreed not to foray unilaterally into space to extend their national policies on Earth or to exercise any kind of sovereignty over celestial bodies or resources. The absence of a modern international treaty that addresses these issues should be received with grave concern, as there is significant potential for risk to become reality. Existing UN treaties lack the technological context and foresight to address legal questions regarding the potential for commercial exploration and exploitation of outer space or its resources. During the sixties and seventies, when international instruments like the Outer Space treaty were conceived, the principal aim of states was to support and expand the scale of the state’s national capacity for operation in space and the development of legal instruments to guide state’s international cooperation in the peaceful exploration of outer space. These instruments were never designed to respond to commercial questions over mining or tourism in space, private investment in space activities, or the emergence of non-state private enterprises operating in space. As a result, private enterprises operating in the vacuum of space also float in an unstable legal vacuum which threatens to implode in geopolitical competition. Beyond Stars and States In an increasingly commercial outer space in which there are no set limits to the exploitation of resources or claim to property, states and private companies will inevitably pursue the development of new extraterrestrial industries to suit their geoeconomic interests. If unchecked, the legal protection of outer space as a domain of exploration for the benefit of all humanity would functionally fail. To protect investments and profit from national space industries, states would likely resort to military force to protect and secure private assets. Over time, space would ultimately become a fourth border domain over which states claim, exercise, and defend sovereignty — including through the use of force. The challenge is thus to prevent the circumstances that could lead to space-borne conflict before it is made possible. Notwithstanding, commercial exploration and the use of natural resources need not lead to predation among actors involved in space. The potential rewards — both technological and environmental — that could come from investment in the harvesting of resources in space are immense. International law cannot afford to wait for the security dilemma posed by commercial activity in space to manifest before addressing it but must anticipate and proactively adopt measures to address future issues that govern extraterrestrial human activity. The only remedy for the lack of legal governance over commercial activity in space is the creation of new international laws through a comprehensive international treaty on commercial operations in space. The new treaty must expressly regulate commercial activities by states and private companies, enshrine an international liability and compensation regime covering damages caused with workable sanction provisions, and reinforce norms that restrict any militarization of outer space. The international community should focus its efforts on establishing a legal regime, with mandatory provisions (rather than non-binding resolutions, observations, commentaries, and conclusions) which generate both international responsibility and provide enforceable sanctions in the event of violations. The effort should be borne out by expanding the scope and strengthening the oversight powers of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), rather than creating a new organ with redundant bureaucracy. Beyond the tasks of encouraging space research programs, studying space activities, and addressing legal questions, COPUOS should be granted the necessary powers to perform control and oversight monitoring functions. Experience has taught the international community that cooperative arrangements between states and international organizations can prevent competition for resources from escalating to kinetic conflict. Through cooperation, there is a chance to preserve extraterrestrial resources for future generations, secure an equitable allocation of resources and benefits with a mind to each country’s specific needs, and prevent the expansion of geopolitical conflict to the domain of space. Space powers must recognize the value in partnering with other states to advance the development of space programs more efficiently. It should be clear now that all nations could reap the benefits of collective action, exploration, and commercialization of resources from beyond Earth’s atmosphere while preventing a drawn-out international conflict to the final frontier. The will of states not to jeopardize the fundamental basis of international law must be reflected in coordination and surveillance efforts to ensure that the advantages derived from space exploration allow humanity to continue evolving.

#### Space War cause Nuclear War.

Gallagher 15 “Antisatellite warfare without nuclear risk: A mirage” <http://thebulletin.org/space-weapons-and-risk-nuclear-exchanges8346> (interim director of the Center for International and Security Studies in Maryland, previous Executive Director of the Clinton Administration’s CTBT Treaty Committee, an arms control specialist at the State Dept., and a faculty member at Wesleyan)//Elmer

In recent decades, however, as space-based reconnaissance, communication, and targeting capabilities have become integral elements of modern military operations, strategists and policy makers have explored whether carrying out antisatellite attacks could confer major military advantages without increasing the risk of nuclear war. In theory, the answer might be yes. In practice, it is almost certainly no. Hyping threats. No country has ever deliberately and destructively attacked a satellite belonging to another country (though nations have sometimes interfered with satellites' radio transmissions). But the United States, Russia, and China have all tested advanced kinetic antisatellite weapons, and the United States has demonstrated that it can modify a missile-defense interceptor for use in antisatellite mode. Any nation that can launch nuclear weapons on medium-range ballistic missiles has the latent capability to attack satellites in low Earth orbit. Because the United States depends heavily on space for its terrestrial military superiority, some US strategists have predicted that potential adversaries will try to neutralize US advantages by attacking satellites. They have also recommended that the US military do everything it can to protect its own space assets while maintaining a capability to disable or destroy satellites that adversaries use for intelligence, communication, navigation, or targeting. Analysis of this sort often exaggerates both potential adversaries’ ability to destroy US space assets and the military advantages that either side would gain from antisatellite attacks. Nonetheless, some observers are once again advancing worst-case scenarios to support arguments for offensive counterspace capabilities. In some other countries, interest in space warfare may be increasing because of these arguments. If any nation, for whatever reason, launched an attack on a second nation's satellites, nuclear retaliation against terrestrial targets would be an irrational response. But powerful countries do sometimes respond irrationally when attacked. Moreover, disproportionate retaliation following a deliberate antisatellite attack is not the only way in which antisatellite weapons could contribute to nuclear war. It is not even the likeliest way. As was clearly understood by the countries that negotiated the Outer Space Treaty, crisis management would become more difficult, and the risk of inadvertent deterrence failure would increase, if satellites used for reconnaissance and communication were disabled or destroyed. But even if the norm against attacking another country’s satellites is never broken, developing and testing antisatellite weapons still increase the risk of nuclear war. If, for instance, US military leaders became seriously concerned that China or Russia were preparing an antisatellite attack, pressure could build for a pre-emptive attack against Chinese or Russian strategic forces. Should a satellite be struck by a piece of space debris during a crisis or a low-level terrestrial conflict, leaders might mistakenly assume that a space war had begun and retaliate before they knew what had actually happened. Such scenarios may seem improbable, but they are no more implausible than the scenarios that are used to justify the development and use of antisatellite weapons.

#### Three impacts:

#### [1] Space debris causes miscalculated war.

Peter Dockrill 16. Award-winning science & technology journalist. “Space Junk Accidents Could Trigger Armed Conflict, Study Finds.” <https://www.sciencealert.com/space-junk-accidents-could-trigger-armed-conflict-expert-warns>.

The increasingly crowded space in Earth's low orbit could set the stage for an international armed conflict, says a new study. Researchers from the Russian Academy of Sciences warn that accidents stemming from the steady rise in space junk floating around the planet could incite political rows and even warfare, with nations potentially mistaking debris-caused incidents as the results of intentional aggressive acts by others. In a paper published in Acta Astronautica, the team suggests that space debris in the form of spent rocket parts and other fragments of hardware hurtling at high speed pose a "special political danger" that could dangerously escalate tensions between nations. According to the study, destructive impacts caused by random space junk cannot easily be told apart from military attacks. "The owner of the impacted and destroyed satellite can hardly quickly determine the real cause of the accident," the authors write. The risks of such an event occurring are compounded by the sheer volume of debris now orbiting Earth. Recent figures from NASA indicate that there are more than 500,000 pieces of space junk currently being tracked in orbit, travelling at speeds up to 28,160 km/h (17,500 mph). The majority of those objects are small – around the size of a marble – but some 20,000 of them are bigger than a softball. In addition to these 500,000 or so fragments – which are big enough for scientists to know about them – NASA estimates that there are millions of undetectable pieces of debris in orbit that are too small to be monitored. But even extremely small fragments such as these pose a threat – in fact, they're considered a greater risk than trackable debris, as their invisible status means spacecraft and satellites can't do anything to avoid them until it's too late. As NASA observed in 2013: "Even tiny paint flecks can damage a spacecraft when travelling at these velocities. In fact a number of space shuttle windows have been replaced because of damage caused by material that was analysed and shown to be paint flecks… With so much orbital debris, there have been surprisingly few disastrous collisions." While we may have been lucky in the past, we can't rely on that to continue. The study by the Russian team cites the repeated sudden failures of defence satellites in past decades that were never explained. The researchers attribute two possible causes: either unrecorded collisions with space junk, or aggressive actions from adversaries. "This is a politically dangerous dilemma," the authors write.

#### Lack of satellites guarantees nuclear war.

Les Johnson 14. Baen science fiction author, popular science writer, and NASA technologist. “Living without satellites”. <https://www.baen.com/living_without_satellites>.

Satellite imagery is used by the military and our political leaders to maintain the peace. When your potential adversaries can’t hide what they’re doing, where their armies are moving and what they are doing with their civilian and military infrastructure, then the danger of surprise attack is diminished. In our nuclear age with instant death only minutes away by missile attack, the doctrine of Mutual Assured Destruction (MAD) only works if both sides know whether or not they are being attacked. The launch of missiles or a bomber fleet can easily be seen from space far in advance of either reaching their potential targets halfway around the globe. The danger of surprise attack is therefore small, making an accidental war far less likely. So what does all this mean? And what do we do about it? First of all, it means that the advocates of space development, exploration and commercialization have succeeded far beyond their initial expectations and dreams. The economies and security of countries in the developed world are now dependent on space satellites. We space advocates should celebrate our success and be terrified of it at the same time. Should we lose these fragile assets in space, our economy would experience a disruption like no other: ship, air and train travel would stop and only restart/operate in a much-reduced capacity for years (GPS loss). Many banking and retail transactions would cease (VSAT loss). Distribution of news and vital national information would be crippled (communications satellite loss). Lives would be put at risk and the productivity of our farming would dramatically decrease (weather satellite loss). The risk of war, including nuclear war, would increase (loss of spy satellites) and our military’s ability to react to crises would be significantly reduced (loss of military logistics and intelligence gathering satellites).

#### Any nuclear war causes extinction – ice age and famine.

Steven Starr 15 [Director of the University of Missouri’s Clinical Laboratory Science Program, as well as a senior scientist at the [Physicians for Social Responsibility](http://www.psr.org/). He has worked with the Swiss, Chilean, and Swedish governments in support of their efforts at the United Nations to eliminate thousands of high-alert, launch-ready U.S. and Russian nuclear weapons. “Nuclear War: An Unrecognized Mass Extinction Event Waiting To Happen.” Ratical. March 2015. <https://ratical.org/radiation/NuclearExtinction/StevenStarr022815.html>] TG

A war fought with 21st century strategic nuclear weapons would be more than just a great catastrophe in human history. If we allow it to happen, such a war would be a mass extinction event that [ends human history](https://ratical.org/radiation/NuclearExtinction/StarrNuclearWinterOct09.pdf). There is a profound difference between extinction and “an unprecedented disaster,” or even “the end of civilization,” because even after such an immense catastrophe, human life would go on. But extinction, by definition, is an event of utter finality, and a nuclear war that could cause human extinction should really be considered as the ultimate criminal act. It certainly would be the crime to end all crimes. The world’s leading climatologists now tell us that nuclear war threatens our continued existence as a species. Their studies predict that a large nuclear war, especially one fought with strategic nuclear weapons, would create [a post-war environment in which for many years it would be too cold and dark to even grow food](http://climate.envsci.rutgers.edu/pdf/RobockToonSAD.pdf). Their findings make it clear that not only humans, but most large animals and many other forms of complex life would likely vanish forever in a nuclear darkness of our own making. The environmental consequences of nuclear war would attack the ecological support systems of life at every level. Radioactive fallout, produced not only by nuclear bombs, but also by the destruction of nuclear power plants and their spent fuel pools, would poison the biosphere. Millions of tons of smoke would act to [destroy Earth’s protective ozone layer](https://www2.ucar.edu/atmosnews/just-published/3995/nuclear-war-and-ultraviolet-radiation) and block most sunlight from reaching Earth’s surface, creating Ice Age weather conditions that would last for decades. Yet the political and military leaders who control nuclear weapons strictly avoid any direct public discussion of the consequences of nuclear war. They do so by arguing that nuclear weapons are not intended to be used, but only to deter. Remarkably, the leaders of the Nuclear Weapon States have chosen to ignore the authoritative, long-standing scientific research done by the climatologists, research that predicts virtually any nuclear war, fought with even a fraction of the operational and deployed nuclear arsenals, will leave the Earth essentially uninhabitable.

#### [2] Earth observation satellites key to addressing climate change through Earth mapping

Alonso 18

[(Elisa Jiménez Alonso, communications consultant with Acclimatise, climate resilience organization) “Earth Observation of Increasing Importance for Climate Change Adaptation,” Acclimatise, May 2, 2018, <https://www.acclimatise.uk.com/2018/05/02/earth-observation-of-increasing-importance-for-climate-change-adaptation/>] TDI

Earth observation (EO) satellites are playing an increasingly important role in assessing climate change. By providing a constant and consistent stream of data about the state of the climate, EO is not just improving scientific outcomes but can also inform climate policy. Managing climate-related risks effectively requires accurate, robust, sustained, and wide-ranging climate information. Reliable observational climate data can help scientists test the accuracy of their models and improve the science of attributing certain events to climate change. Information based on projections from models and historic data can help decision makers plan and implement adaptation actions. Providing information in data-sparse regions Ground-based weather and climate monitoring systems only cover about 30% of the Earth’s surface. In many parts of the world such data is incomplete and patchy due to poorly maintained weather stations and a general lack of such facilities. EO satellites and rapidly improving satellite technology, especially data from open access programmes, offer a valuable source information for such data-sparse regions. This is especially important since countries and regions with a lack of climate data are often particularly vulnerable to climate change impacts. International efforts for systematic observation The importance of satellite-based observations is also recognised by the international community. Following the recommendations of the World Meteorological Organization’s (WMO) Global Climate Observing System (GCOS) programme, the UNFCCC strongly encourages countries that support space agencies with EO programmes to get involved in GCOS and support the programme’s implementation. The Paris Agreement highlights the need for and importance of effective and progressive responses to the threat of climate change based on the best available scientific knowledge. This implies that climate knowledge needs to be strengthened, which includes continuously improving systematic observations of the Earth’s climate. To meet the need of such systematic climate observations, GCOS developed the concept of the Essential Climate Variable, or ECV. According to WMO, an ECV “is a physical, chemical or biological variable or a group of linked variables that critically contributes to the characterization of Earth’ s climate.” In 2010, 50 ECVs which would help the work of the UNFCCC and IPCC were defined by GCOS. The ECVs, which can be seen below, were identified due to their relevance for characterising the climate system and its changes, the technical feasibility of observing or deriving them on a global scale, and their cost effectiveness. The 50 Essential Climate Variables as defined by GCOS. One effort supporting the systemic observation of the climate is the European Space Agency’s (ESA) Climate Change Initiative (CCI). The programme taps into its own and its member countries’ EO archives that have been established in the last three decades in order to provide a timely and adequate contribution to the ECV databases required by the UNFCCC. Robust evidence supporting climate risk management Earth observation satellites can observe the entire Earth on a daily basis (polar orbiting satellites) or continuously monitor the disk of Earth below them (geostationary satellites) maintaining a constant watch of the entire globe. Sensors can target any point on Earth even the most remote and inhospitable areas which helps monitor deforestation in vast tropical forests and the melting of the ice caps. Without insights offered by EO satellites there would not be enough evidence for decision makers to base their climate policies on, increasing the risk of maladaptation. Robust EO data is an invaluable resource for collecting climate information that can inform climate risk management and make it more effective

**Warming causes extinction**

**Klein 14**[(Naomi Klein, award-winning journalist, syndicated columnist, former Miliband Fellow at the London School of Economics, member of the board of directors of 350.org), *This Changes Everything: Capitalism vs. the Climate*, pp. 12-14]

In a 2012 report, the World Bank laid out the gamble implied by that target. “As global warming approaches and exceeds 2-degrees Celsius, there is a risk of triggering **nonlinear tipping elements**. Examples include the disintegration of the West Antarctic ice sheet leading to more rapid sea-level rise, or large-scale Amazon dieback drastically affecting ecosystems, rivers, agriculture, energy production, and livelihoods. This would further add to 21st-century global warming and impact entire continents.” In other words, once we allow temperatures to climb past a certain point, where the mercury stops is not in our control.¶ But the bigger problem—and the reason Copenhagen caused such great despair—is that because governments did not agree to binding targets, they are free to pretty much ignore their commitments. Which is precisely what is happening. Indeed, emissions are rising so rapidly that unless something radical changes within our economic structure, 2 degrees now looks like a utopian dream. And it’s not just environmentalists who are raising the alarm. The World Bank also warned when it released its report that “we’re on track to a 4-C warmer world [by century’s end] marked by **extreme heat waves**, **declining global food stocks**, **loss of ecosystems** and biodiversity, and **life-threatening sea level rise**.” And the report cautioned that, “there is also **no certainty that adaptation to a 4-C world is possible**.” Kevin Anderson, former director (now deputy director) of the Tyndall Centre for Climate Change, which has quickly established itself as one of the U.K’s premier climate research institutions, is even blunter; he says 4 degrees Celsius warming—7.2 degrees Fahrenheit—is “incompatible with an organized, equitable, and civilized global community.”¶ We don’t know exactly what a 4 degree Celsius world would look like, but even the best-case scenario is likely to be calamitous. Four degrees of warming could raise global sea levels by 1 or possibly even 2 meters by 2100 (and would lock in at least a few additional meters over future centuries). This would drown some island nations such as the Maldives and Tuvalu, and inundate many coastal areas from Ecuador and Brazil to the Netherlands to much of California and the northeastern United States as well as huge swaths of South and Southeast Asia. Major cities likely in jeopardy include Boston, New York, greater Los Angeles, Vancouver, London, Mumbai, Hong Kong, and Shanghai.¶ Meanwhile, brutal heat waves that can kill tens of thousands of people, even in wealthy countries, would become entirely unremarkable summer events on every continent but Antarctica. The heat would also cause staple crops to suffer **dramatic yield losses** across the globe (it is possible that Indian wheat and U.S. could plummet by as much as 60 percent), this at a time when demand will be surging due to population growth and a growing demand for meat. And since crops will be facing not just heat stress but also extreme events such as wide-ranging droughts, flooding, or pest outbreaks, the losses could easily turn out to be more severe than the models have predicted. When you add ruinous hurricanes, raging wildfires, fisheries collapses, widespread disruptions to water supplies, extinctions, and globe-trotting diseases to the mix, it indeed becomes difficult to imagine that a peaceful, ordered society could be sustained (that is, where such a thing exists in the first place).¶ And keep in mind that these are the optimistic scenarios in which warming is more or less stabilized at 4 degrees Celsius and does not trigger tipping points beyond which runaway warming would occur. Based on the latest modeling, it is becoming safer to assume that 4 degrees could bring about a number of extremely dangerous feedback loops—an Arctic that is regularly ice-free in September, for instance, or, according to one recent study, global vegetation that is too saturated to act as a reliable “sink”, leading to more carbon being emitted rather than stored. Once this happens, any hope of predicting impacts pretty much goes out the window. And this process may be starting sooner than anyone predicted. In May 2014, NASA and the University of California, Irvine scientists revealed that glacier melt in a section of West Antarctica roughly the size of France now “appears unstoppable.” This likely spells down for the entire West Antarctic ice sheet, which according to lead study author Eric Rignot “comes with a sea level rise between three and five metres. Such an event will displace millions of people worldwide.” The disintegration, however, could unfold over centuries and there is still time for emission reductions to slow down the process and prevent the worst. ¶ Much more frightening than any of this is the fact that plenty of mainstream analysts think that on our current emissions trajectory, we are headed for even more than 4 degrees of warming. In 2011, the usually staid International Energy Agency (IEA) issued a report predicting that we are actually on track for 6 degrees Celsius—10.8 degrees Fahrenheit—of warming. And as the IEA’s chief economist put it: “Everybody, even the school children, knows that this will have catastrophic implications for all of us.” (The evidence indicates that 6 degrees of warming is likely to set in motion several major tipping points—not only slower ones such as the aforementioned breakdown of the West Antarctic ice sheet, but possibly more abrupt ones, like massive releases of methane from Arctic permafrost.) The accounting giant PricewaterhouseCoopers as also published a report warning businesses that we are headed for “4-C , or even 6-C” of warming.¶ These various projections are the equivalent of every alarm in your house going off simultaneously. And then every alarm on your street going off as well, one by one by one. They mean, quite simply, that climate change has become an **existential crisis** for the human species. The only historical precedent for a crisis of this depth and scale was the Cold War fear that we were headed toward nuclear holocaust, which would have made much of the planet uninhabitable. But that was (and remains) a threat; a slim possibility, should geopolitics spiral out of control. The vast majority of nuclear scientists never told us that we were almost certainly going to put our civilization in peril if we kept going about our daily lives as usual, doing exactly what we were already going, which is what climate scientists have been telling us for years. ¶ As the Ohio State University climatologist Lonnie G. Thompson, a world-renowned specialist on glacier melt, explained in 2010, “Climatologists, like other scientists, tend to be a stolid group. We are not given to theatrical rantings about falling skies. Most of us are far more comfortable in our laboratories or gathering data in the field than we are giving interviews to journalists or speaking before Congressional committees. When then are climatologists speaking out about the dangers of global warming? The answer is that virtually all of us are now convinced that global warming poses a clear and present danger to civilization.”

#### [3] Satellites are an impact multiplier – specifically solves the grid.

Pellegrino & Stang 16. Massimo Pellegrino, Master’s Degree in Space Studies from ISU, with Gerald Stang, Senior Associate Analyst at the EUISS, holds BSc and MSc degrees in chemical engineering from the University of Saskatchewan and an MA in international affairs from the School of International and Public Affairs at Columbia University (“Space Security for Europe”, *EU Institute for Security Studies*, published July 2016, <https://www.iss.europa.eu/content/space-security-europe>, accessed 7-10-2019) bm

Modern societies are highly dependent on the continuous operation of critical infrastructure to ensure the provision of basic goods and services. They consist of assets, systems or parts thereof which are so vital, that their disruption would significantly impact the economy, national security, public health, safety, or social well-being. Examples of critical infrastructure include energy, water, food supply, communication, transportation, and waste processing systems. Space assets are so deeply embedded in developed economies that a day without fully functioning space capabilities would severely restrict or even endanger our lives.

Space systems are critical for running energy grids and telecommunication networks, border and maritime surveillance, crisis management and humanitarian operations, environmental and climate monitoring, verification of international treaties and arms control agreements, and the fight against organised crime and terrorism. Space assets also provide the technological backbone for other critical infrastructures. The synchronisation of power grids and telecommunication networks, for example, is heavily dependent on GNSS timing signals and any disruption would create a domino effect on other critical infrastructures (see Figure 5).

Satellites also play a central role in supporting defence systems and military operations. They are force multipliers that provide intelligence, surveillance, and reconnaissance (ISR) capabilities, as well as communication, navigation, positioning and timing signals. Armed forces do not only use their own space systems, but are also significant consumers of space services provided by private operators. In fact, about 90% of US military communications traffic passes through civilian satellites, many of which privately owned, rather than through dedicated systems designed to withstand attempted interruptions.1 The reliance of both civilian and military users on space systems therefore places them firmly in the area of critical infrastructure. Some critical space systems, such as the American GPS, are under foreign control, and the governments controlling those systems retain the authority to disrupt services, even for allies, in case of a national emergency. While the United States announced that it has no intention of ever intentionally degrading public GPS signals (also known as ‘Selective Availability’) and that the next generation of GPS satellites will not include this feature, other governments might still do so.2

These dependences engender new and growing vulnerabilities. Reliance on space is likely to increase further as space capabilities and services improve in diversity, quality and affordability. Close to 1,500 satellites with a launch mass of over 50 kg are expected to be launched over the next decade; an increase of 50% compared to 2005-2014. This estimate excludes both the expected proliferation of smaller satellites (such as CubeSats), but also the planned OneWeb and Steam mega-constellations for global internet broadband service. Advances in small satellite capabilities and in launch technology (e.g. SpaceX’s Falcon rocket family) have already lowered the cost of access to space. About 45% more CubeSats were launched in 2014 than in 2013 (130 vs. 91), accounting for 63% of all satellites launched3 . However, just as the reliance on space increases, so too do threats and vulnerabilities. Therefore, in order to realise the full potential of investments in space, critical space systems need to be adequately protected and the space environment properly managed.

#### Grid security is an impact filter and is an existential risk

Denkenberger 21 [David Denkenberger, Anders Sandberg, Ross John Tieman, and Joshua M. Pearce, \* assistant professor of mechanical engineering at University of Alaska Fairbanks, “Long-term cost-effectiveness of interventions for loss of electricity/industry compared to artificial general intelligence safety,” 2021, *European Journal of Futures Research*, Vol. 9, Issue 1, https://doi.org/10.1186/s40309-021-00178-z, EA]

Civilization relies on a network of highly interdependent critical infrastructure (CI) to provide basic necessities (water, food, shelter, basic goods), as well as complex items (computers, cars, space shuttles) and services (the internet, cloud computing, global supply chains), henceforth referred to as industry. Electricity and the electrical infrastructure that distributes it plays an important role within industry, providing a convenient means to distribute energy able to be converted into various forms of useful work. Electricity is one component of industry albeit a critical one. Industry provides the means to sustain advanced civilization structures and the citizens that inhabit them. These structures play a critical role in realizing various futures by allowing humanity to discover and utilize new resources, adapt to various environments, and resist natural stressors.

Though industry is capable of resisting small stressors, a sufficiently large event can precipitate cascading failure of CI systems, resulting in a collapse of industry. If one does not temporally discount the value of future people, the long-term future (thousands, millions, or even billions of years) could contain an astronomically large amount of value [18]. Events capable of curtailing the potential of civilization (existential risks, such as human extinction or an unrecoverable collapse) would prevent such futures from being achieved, implying reducing the likelihood of such events is of the utmost importance [100]. Reducing the prevalence of existential risks factors; events, systemic structures, or biases which increase the likelihood of extinction but do not cause extinction by themselves is also highly valuable. Complete collapse or degraded function of industry would drastically reduce humanity’s capacity to coordinate and deploy technology to prevent existential risks, representing an existential risk factor. Consequently, interventions preventing loss of industry, reducing the magnitude of impacts, or increasing speed of recovery could be extremely valuable.

Existential risk research is, by nature, future focused, requiring the investigation of events that have not yet occurred. Futures studies methodologies are often applied to uncover salient trends or events, and explore potential causal structures [54, 123]. Probabilistic modeling techniques can then be used to determine the likelihood of such events occurring, including adequate treatment of uncertainty [101]. The cost-effectiveness modeling approach outlined in this paper is an example of this, attempting to assess the marginal utility of losing industry interventions on improving the long-term future. This approach could guide future efforts to assess the relative cost-effectiveness of interventions for different risks, existential or otherwise. More practically, this research can inform prioritization efforts of industrialized countries by providing estimates of the cost of global industrial collapse, and the utility of resilience interventions. This is relevant to the European Union which has a highly industrialized economy, providing $2.3 Trillion USD of the $13.7 Trillion USD global total of value add manufacturing [122]. The EU has shifted toward a more proactive foresight approach about natural and man-made disasters, noting the importance of rare high-impact events, systemic risks, and converging trends requiring better data and forecasting to drive a more ambitious crisis management system [47]. Still, it is clear that most academic and institutional emphasis has been on “ordinary” rather than extreme disasters, and risks from industry to the public and environment rather than widespread failures of industrial services causing harm.

The integrated nature of the electric grid, which is based on centralized generation makes the entire system vulnerable to disruption.1 There are a number of anthropogenic and natural catastrophes that could result in regional-scale electrical grid failure, which would be expected to halt the majority of industries and machines in that area. A high-altitude electromagnetic pulse (HEMP) caused by a nuclear weapon could disable electricity over part of a continent [16, 48, 66, 93]. This could destroy the majority of electrical grid infrastructure, and as fossil fuel extraction and industry is reliant on electricity [49], industry would be disabled. Similarly, solar storms have destroyed electrical transformers connected to long transmission lines in the past [117]. The Carrington event in 1859 damaged telegraph lines, which was the only electrical infrastructure in existence at the time. It also caused Aurora Borealis that was visible in Cuba and Jamaica [70]. This could potentially disable electrical systems at high latitudes, which could represent 10% of electricity/industry globally. Though solar storms may last less than the 12 h that would be required to expose the entire earth with direct line of sight, the earth’s magnetic field lines redirect the storm to affect the opposite side of the earth [117].

Lastly, both physical [6, 8, 69, 89, 111] and cyber attacks [3, 63, 90, 96, 118, 128, 130] could also compromise electric grids. Physical attacks include traditional acts of terrorism such as bombing or sabotage [130] in addition to EMP attacks. Significant actors could scale up physical attacks, for example by using drones. A scenario could include terrorist groups hindering individual power plants [126], while a large adversary could undertake a similar operation physically to all plants and electrical grids in a region.

Unfortunately, the traditional power grid infrastructure is simply incapable of withstanding intentional physical attacks [91]. Damage to the electric grid resulting in physical attack could be long lasting, as most traditional power plants operate with large transformers that are difficult to move and source. Custom rebuilt transformers require time for replacement ranging from months and even up to years [91]. For example, a relatively mild 2013 sniper attack on California’s Pacific Gas and Electric (PG&E) substation, which injured no one directly, was able to disable 17 transformers supplying power to Silicon Valley. Repairs and improvements cost PG&E roughly $100 million and lasted about a month [10, 102]. A coordinated attack with relatively simple technology (e.g., guns) could cause a regional electricity disruption.

However, a high-tech attack could be even further widespread. The Pentagon reports spending roughly $100 million to repair cyber-related damages to the electric grid in 2009 [57]. There is also evidence that a computer virus caused an electrical outage in the Ukraine [56]. Unlike simplistic physical attacks, cyber attackers are capable of penetrating critical electric infrastructure from remote regions of the world, needing only communication pathways (e.g., the Internet or infected memory sticks) to install malware into the control systems of the electric power grid. For example, Stuxnet was a computer worm that destroyed Iranian centrifuges [73] to disable their nuclear industry. Many efforts are underway to harden the grid from such attacks [51, 63]. The U.S. Department of Homeland Security responded to ~ 200 cyber incidents in 2012 and 41% involved the electrical grid [103]. Nations routinely have made attempts to map current critical infrastructure for future navigation and control of the U.S. electrical system [57].

The electric grid in general is growing increasingly dependent upon the Internet and other network connections for data communication and monitoring systems [17, 112, 118, 127, 135]. Although this conveniently allows electrical suppliers management of systems, it increases the susceptibility of the grid to cyber-attack, through denial of webpage services to consumers, disruption to supervisory control and data acquisition (SCADA) operating systems, or sustained widespread power outages [3, 72, 118, 120]. Thus global or regional loss of the Internet could have similar implications.

A less obvious potential cause is a pandemic that disrupts global trade. Countries may ban trade for fear of the disease entering their country, but many countries are dependent on imports for the functioning of their industry. If the region over which electricity is disrupted had significant agricultural production, the catastrophe could be accompanied by a ~ 10% food production shortfall as well. It is uncertain whether countries outside the affected region would help the affected countries, do nothing, or conquer the affected countries. Larger versions of these catastrophes could disrupt electricity/industry globally. For instance, it is possible that multiple HEMPs could be detonated around the world, due to a world nuclear war [105] or due to terrorists gaining control of nuclear weapons. There is evidence that, in the last 2000 years, two solar storms occurred that were much stronger than the Carrington event [85]. Therefore, it is possible that an extreme solar storm could disable electricity and therefore industry globally. It is conceivable that a coordinated cyber or physical attack (or a combination) on many electric grids could also disrupt industry globally. Many of the techniques to harden the electric grid could help with this vulnerability as well as moving to more distributed generation and microgrids [23, 29, 75, 76, 103, 114]. An extreme pandemic could cause enough people to not show up to work such that industrial functioning could not be maintained. Though this could be mitigated by directing military personnel to fill vacant positions, if the pandemic were severe enough, it could be rational to retreat from high human contact industrial civilization in order to limit disease mortality. The global loss of electricity could even be self-inflicted as a way of stopping rogue artificial general intelligence (AGI) [124]. As the current high agricultural productivity depends on industry (e.g., for fertilizers), it has been assumed that there would be mass starvation in these scenarios [107].

Repairing these systems and re-establishing electrical infrastructure would be a goal of the long term and work should ideally start on it immediately after a catastrophe. However, human needs would need to be met immediately (and continually) and since there is only a few months of stored food, it would likely run out before industry is restored with the current state of preparedness. In some of the less challenging scenarios, it may be possible to continue running some machines on the fossil fuels that had previously been brought to the surface or from the use microgrids or shielded electrical systems. In addition, it may be feasible to run some machines on gasified wood [31]. However, in the worst-case scenario, all unshielded electronics would be destroyed.

#### [4] Kessler Syndrome destroys economies – tons of industries depend on satellites

AFP 17 [Agence France-Presse. "Space junk could destroy satellites, hurt economies," https://phys.org/news/2017-05-space-junk-satellites-economies.html, accessed 1-14-2022]//anop

The growing amount of fast-moving space debris orbiting the Earth could lead to catastrophic collisions with satellites, hurting economies, researchers warned Wednesday ahead of a summit to coordinate efforts to remove the junk. There are an estimated 170 million pieces of so-called "space junk"—left behind after missions that can be as big as spent rocket stages or as small as paint flakes—in orbit alongside some US$700 billion of space infrastructure. But only 22,000 are tracked, and with the fragments able to travel at speeds above 27,000kmh (16,777 mph), even tiny pieces could seriously damage or destroy satellites. "The space junk problem has been getting worse every year," Ben Greene, head of Australia's Space Environment Research Centre which is hosting the two-day conference of international space environment scientists in Canberra, told AFP. "We're losing three or four satellites a year now to space debris collision. We're very close, NASA estimates, of within five to 10 years of losing everything." Greene added in a statement that "a catastrophic avalanche of collisions which could quickly destroy all orbiting satellites is now possible", noting that more collisions were creating extra debris. With society heavily dependent on satellites for communication and navigation, and powering key industries such as transport, finance and energy, the growing cosmic junkyard could threaten economies. "The Australian economy is entirely dependent on space," Greene said. "We're a big country with few people and the only way we can service it, whether it's with surveillance, safety or search-and-rescue, is from space." The barriers to entry for building spacecraft were also falling, making it easier for firms to launch their own objects, said space debris expert Moriba Jah from the University of Texas, who is at the conference. "I believe that we are certainly on a path to what I call a tragedy of the commons," he told the Australian Broadcasting Corporation, adding that a major collision was "inevitable" without action to tackle the problem. "You've driven on the roads here when you have a lot of mist or fog, and you have to go really slow, and you just don't know what's really around you. That's the perfect analogy to space right now," Jah said. Greene said scientists were developing technologies set to be operational in 18 months to track all debris so spacecraft could move around them. Another idea in the works was Earth-based high-powered lasers that could be fired into space to "push the debris around a little bit", with the programme 75 percent ready, he added. An experimental Japanese mission to clear space junk using an electrodynamic 'tether' to slow down the orbiting rubbish and bring it into a lower orbit ended in failure in February.

**That causes global nuclear war.**

Merlini ’11 [Cesare, was a nonresident senior fellow at the Center on the United States and Europe and is chairman of the Board of Trustees of the Italian Institute for International Affairs (IAI) in Rome, “A Post-Secular World?”, 03-30-2011, Routledge, https://www.brookings.edu/wp-content/uploads/2016/06/04\_international\_relations\_merlini.pdf]PM

Two neatly opposed scenarios for the future of the world order illustrate the range of possibilities, albeit at the risk of oversimplification. The first scenario entails the premature crumbling of the post-Westphalian system. One or more of the acute tensions apparent today evolves into an open and traditional conflict between states, perhaps even involving the use of nuclear weapons. The crisis might be triggered by a collapse of the global economic and financial system, the vulnerability of which we have just experienced, and the prospect of a second Great Depression, with consequences for peace and democracy similar to those of the first. Whatever the trigger, the unlimited exercise of national sovereignty, exclusive self-interest and rejection of outside interference would likely be amplified, emptying, perhaps entirely, the half-full glass of multilateralism, including the UN and the European Union. Many of the more likely conflicts, such as between Israel and Iran or India and Pakistan, have potential religious dimensions. Short of war, tensions such as those related to immigration might become unbearable. Familiar issues of creed and identity could be exacerbated. One way or another, the secular rational approach would be sidestepped by a return to theocratic absolutes, competing or converging with secular absolutes such as unbridled nationalism.