

Lunar Heritage 1AC vs. You

1AC: Plan

Plan - Private entities ought not appropriate lunar heritage sites

Harrington 19, Andrea J. "Preserving Humanity's Heritage in Space: Fifty Years after Apollo 11 and beyond." J. Air L. & Com. 84 (2019): 299. (Associate Professor and Director of the Schriever Space Scholars at USAF Air Command and Staff College)//Elmer

The **issue of humanity's cultural heritage in space has arisen** as one of many unanswered questions in space law, with **no international agreements specifically addressing it.** With the beginning of the space age fifty-six years ago and a series of remarkable achievements in space exploration behind us, **it is necessary to determine what should be done regarding the "artifacts" of this exploration.** **NASA has promulgated their recommendations** for spacefaring entities with the goal of protecting the lunar artifacts left behind by the Apollo missions.⁸ These **recommendations establish "keep-out zones"** of up to a four kilometer diameter with the aim of protecting the artifacts, particularly from dangerous, fastmoving particles that arise as a result of craft landings.⁹ Experience has shown that even artifacts that are sheltered by craters can be significantly sandblasted and pitted as a result of the moving particles.¹⁰ **These recommendations, supposedly drafted in conformity with the Outer Space Treaty, however, are completely nonbinding.**¹¹ Legislation that has passed the U.S. Senate and is under consideration by the House of Representatives as of July 2019 would make these recommendations binding on U.S. entities seeking to land on the Moon.¹² Accidental damage from unrelated missions, however, is only one of many threats to space artifacts. **With the impending return to the Moon, it is likely that individuals and corporations will be looking to turn a profit from space heritage,** without concern for the protection of such heritage. **Tourists may disrupt sites** with careless expeditions and **landing sites may be desecrated so that the items can be sold.** A Russian Lunakhod lunar rover has already been sold at auction to a private party, though it has not yet been moved from its original position on the Moon.¹³ **While national heritage legislation can protect** space artifacts **from citizens of their own countries,** there is currently **no effective means** in the present space law regime by **which a country can protect its heritage from other countries.**¹⁴ Both California and New Mexico have added Tranquility Base to their list of protected heritage sites.¹⁵ However, this solution, and those proposed in the bill put forth to the U.S. House of Representatives, only serve to restrict the activities of a small subset of the potential visitors to the Moon. **Though the Senate bill calls for the President to initiate negotiations for a binding international agreement, there is still a long road from this bill to a potential agreement.**¹⁶ **A solution is needed to prevent the damage, destruction, loss, or private appropriation of our cultural heritage in space.**

1AC: Lunar Heritage Adv

The Advantage is Lunar Heritage:

Global Moon Rush by private actors is coming now.

Sample 19 Ian Sample 7-19-2019 “Apollo 11 site should be granted heritage status, says space agency boss”

<https://www.theguardian.com/science/2019/jul/19/apollo-11-site-heritage-status-space-agency-moon> (PhD at Queens Mary College)//Elmer

But **protecting lunar heritage may not be straightforward**. On Earth, the United Nations Educational, Scientific and Cultural Organisation (Unesco) decides what deserves world heritage status from nominations sent by countries that claim ownership of the sites. Different rules apply in space. The UN's outer space treaty, a keystone of space law, states that all countries are free to explore and use space, but warns it “is not subject to national appropriation by claim of sovereignty”. In other words, space is for all and owned by none. Wörner is not put off and sees no need for troublesome regulations. “My hope is that humanity is smart enough not to go back to this type of earthly protection. Just protect it. That's enough. Just protect it and have everybody agree,” he said. A no-go zone of 50 metres around Tranquility base should do the job, he added. Martin Rees, the Cambridge cosmologist and astronomer royal, said there was a case for designating the sites so future generations and explorers were aware of their importance. “If there are any artefacts there, they shouldn't be purloined,” he said. “Probably orbiting spacecraft will provide routine CCTV-style coverage which would prevent this from being done clandestinely.” Beyond the dust-covered hardware that stands motionless on the moon, Lord Rees suspects future activity could drive calls for broader lunar protection. The Apollo 17 astronaut and geologist Harrison Schmidt has advocated strip mining the moon for helium-3, a potential source of energy. The proposal, which Rees suggests has raised eyebrows in the community, could potentially provoke a backlash. “There might be pressure to preserve the more attractive moonscapes against such despoilation, and to try to enforce regulations as in the Antarctic,” he said. Fifty years on from Apollo 11, the moon is still a place to make statements. In January, the Chinese space agency became the first to land a probe on the far side. On Monday, India hopes to launch a robotic probe, the delayed Chandrayaan-2 lander that is bound for the uncharted lunar south pole. Far more is on the cards. Major space agencies, including ESA and Nasa, plan a “lunar gateway”, described by Wörner as a “bus stop to the moon and beyond”. His vision is for a “moon village”, but rather than a sprawl of domes, shops and a cosy pub, it is more an agreement between nations and industry to cooperate on lunar projects. **The private sector is eager to be involved. Between now**

and 2024, at least five companies aim to launch lunar landers. In May, **Nasa selected three companies to design, build and operate spacecraft that will ferry scientific experiments and technology packages to the moon. The coming flurry of activity may make protection more urgent.**

Michelle Hanlon, a space lawyer at the University of Mississippi, co-founded the non-profit organisation For all Moonkind to protect, preserve and memorialise human heritage on the moon. While she conceded that not all of the sites that bear evidence of human activity needed protection, she said many held invaluable scientific and archaeological data that we could not afford to lose. “These sites need to be protected from disruption if only for that reason,” she added. The protection should be far wider, and more formal, than Wörner calls for, Hanlon argues.

“It is astounding to me that we wouldn't protect the site of Luna 2, the very first object humans crashed on to another celestial body, and Luna 9, the very first object humans soft-landed on another celestial body,” she said. The Soviet Luna programme sent robotic craft to the moon between 1959 and 1976. **“The director general has a much more optimistic view of human nature than I do,”** Hanlon said. “I completely

agree that the **entities and nations headed back to the moon in the near future will take a commonsense approach and give due regard to the sites and artefacts.** However, that is the near future. **We have to be prepared for the company or nation that doesn't care. Or worse, that seeks to return to the moon primarily to pillage for artefacts that will undoubtedly sell for tremendous amounts of money here on Earth.”**

AND

Corporate development, tourism, and looting will destroy scientifically rich Tranquility base artifacts.

Fessl 19 Sophie Fessl 7-10-2019 “Should the Moon Landing Site Be a National Historic Landmark?”

<https://daily.jstor.org/should-the-moon-landing-site-be-a-national-historic-landmark/> (PhD King’s College London, BA Oxford)//Elmer

When Neil Armstrong set foot on the moon on July 20, 1969, the pictures sent to Earth captured a historical moment: It was the first time that any human set foot on another body in our solar system. Fifty years later, experts are debating how to preserve humankind’s first steps beyond Earth. Could a National Park on the moon be the solution to saving Armstrong’s bootprints for future archaeologists? Flags, rovers, laser-reflecting mirrors, footprint—these are just a few of the dozens of artifacts and features that bear witness to our exploration of the moon. Archaeologists argue that these objects are a record to trace the development of humans in space. “Surely, those footprints are as important as those left by hominids at Laetoli, Tanzania, in the story of human development,” the anthropologist P.J. Capelotti wrote in *Archaeology*. While the oldest then known examples of hominins walking on two feet were cemented in ash 3.6 million years ago, “those at Tranquility Base could be swept away with a casual brush of a space tourist’s hand.” *Fragile Traces* Just how fragile humankind’s lunar traces are was seen already during Apollo 12.

On November 19, 1969, Charles “Pete” Conrad and Alan Bean manually landed their lunar module in the moon’s Ocean of Storms, 200 meters from the unmanned probe Surveyor 3, which was left sitting on the moon’s surface two years earlier, in 1967.

The next day, Conrad and Bean hopped to Surveyor 3. As they approached the spacecraft, they were surprised: The spacecraft, originally bright white, had turned light brown. It was covered in a fine layer of moon dust, likely kicked up by their landing. Harsh ultraviolet light has likely bleached the U.S. flag bright white. Without Apollo 12 upsetting the moon dust, Surveyor 3 would likely have remained stark white. Unlike Earth, the moon has no wind that carries away the dust, no rain to corrode materials, and no plate tectonic activity to pull sites on the surface back into the moon. But the moon’s thin atmosphere also means that solar wind particles bombard the lunar surface, and harsh ultraviolet light has likely bleached the U.S. flag bright white. The astronauts’ first bootprints will likely be on the moon for a long time, and will almost certainly still be there when humans next visit—unless, by tragic coincidence, a meteorite hits them first. Had LunaCorp not abandoned the idea in the early 2000s, the company’s plan to send a robot to visit the most famous sites of moon exploration could have done a lot of damage. And with Jeff Bezos’ recent unveiling of a mock-up of the lunar lander Blue Moon, it is only a matter of time before corporate adventurers and space tourists reach the moon. Historians and archaeologists are keen to avoid lunar looting. Roger Launius, senior curator of space history at the National Air and Space Museum in Washington, D.C., warned: “What we don’t want to happen is what happened in Antarctica at Scott’s hut People took souvenirs, and nothing was done to try to preserve those until fairly late in the game.” On the other hand, there is a legitimate scientific interest in investigating how the equipment that’s on the moon was affected by a decades-long stay there.

Private entities are a unique threat---universal rules key.

Hertzfeld and Pace 13 (, H. and Pace, S., 2013. International Cooperation on Human Lunar Heritage. [online]

Cpb-us-e1.wpmucdn.com. Available at:

<<https://cpb-us-e1.wpmucdn.com/blogs.gwu.edu/dist/7/314/files/2018/10/Hertzfeld-and-Pace-International-Cooperation-on-Human-Lunar-Heritage-t984sx.pdf>> [Accessed 18 January 2022] Dr. Hertzfeld is an expert in the economic, legal, and policy issues of space and advanced technological development. Dr. Hertzfeld holds a B.A. from the University of Pennsylvania, an M.A. from Washington University, and a Ph.D. degree in economics from Temple University. He also holds a J.D. degree from the George Washington University and is a member of the Bar in Pennsylvania and the District of Columbia. Dr. Hertzfeld joined the Space Policy Institute in 1992. His research projects have included studies on

the privatization of the Space Shuttle, the economic benefits of NASA R&D expenditures, and the socioeconomic impacts of earth observation technologies. He teaches a course in Space Law and a course in microeconomics through the Economics Department at G.W. Dr. Hertzfeld has served as a Senior Economist and Policy Analyst at both NASA and the National Science Foundation, and has been a consultant to many U.S. and international organizations, including a recent project on space applications with the OECD. He is the co-editor of Space Economics (AIAA 1992). Selected other publications include a study of the issues for privatizing the Space Shuttle (2000), an analysis of the value of information from better weather forecasts, an analysis of sovereignty and property rights published in the Journal of International Law (University of Chicago, 2005), and an economic analysis of the space launch vehicle industry (2005). Dr. Hertzfeld has also edited and prepared a new edition of the Study Guide and Case Book for Managerial Economics (Sixth Edition, W.W. Norton & Co.). Dr. Scott N. Pace is the Deputy Assistant to the President and Executive Secretary of the National Space Council (NSpC). He joined the NSpC in August 2017. From 2008-2017, he was the Director of the Space Policy Institute and a Professor of the Practice of International Affairs at George Washington University's Elliott School of International Affairs. From 2005-2008, he served as the Associate Administrator for Program Analysis and Evaluation at NASA. Prior to NASA, he was the Assistant Director for Space and Aeronautics in the White House Office of Science and Technology Policy. From 1993-2000, he worked for the RAND Corporation's Science and Technology Policy Institute, and from 1990-1993, he served as the Deputy Director and Acting Director of the Office of Space Commerce, in the Office of the Deputy Secretary of the Department of Commerce. In 1980, he received a Bachelor of Science degree in Physics from Harvey Mudd College; in 1982, Masters degrees in Aeronautics & Astronautics and Technology & Policy from the Massachusetts Institute of Technology; and in 1989, a Doctorate in Policy Analysis from the RAND Graduate School.)-rahulpenu

International Cooperation on Human Lunar Heritage The U.S. Apollo Space Program was a premier technological accomplishment of the 20th century. Preserving the six historic landing sites of the manned Apollo missions, as well as the mementos and equipment still on the Moon from those and other U.S. (e.g., Ranger and Surveyor) and Soviet Union (e.g., Luna) missions is important. Some of the instruments on the lunar surface are still active, monitored, and provide valuable scientific information. But recent government and private-sector plans to explore and potentially use lunar resources for commercial activity raise questions about the use of the Moon and potential accidental or purposeful threats to the historic sites and scientific equipment there. Although some steps to protect these sites have been proposed, we suggest a better way, drawing on international, not U.S. unilateral, recognition for the sites. Less than 2 years before the first footsteps on the lunar surface on 20 July 1969 (see the image), the United Nations Outer Space Treaty (OST) was drafted, ratified, and came into force (1). Article II of the OST reinforced and formalized the international standard that outer space, the Moon, and other celestial bodies would not be subject to claims of sovereignty from any nation by any means, including appropriation. The OST prohibits ownership of territory or its appropriation by any state party to the treaty, which includes the United States, Russia, and 126 other nations. It does not prohibit the use of the Moon and its resources. In fact, the treaty emphasizes the importance of freedom of access to space for any nation and the importance of international cooperation in space exploration. These principles of the space treaties have enabled gains in science and technology and have contributed to international stability in space. New attention is being focused on the lunar surface. China has an active Moon exploration program and is considering sending astronauts (taikonauts) to the Moon. Private firms are contemplating robotic missions that could land in the vicinity of the historical sites of Apollo and other missions. Although we might assume the best of intentions for such missions, they could irreparably disturb the traces of the first human visits to another world. NASA has taken steps to protect the lunar landing sites and equipment and to initiate a process to create recognized norms of behavior. In July 2011, guidelines were issued for private companies competing in the Google Lunar X Prize that established detailed requirements for avoiding damage to U.S. government property on the Moon (2). H.R. 2617, The Apollo Lunar Landing Legacy Act, was introduced into the U.S. Congress on 8 July 2013 (3). In essence, it proposes to designate the Apollo landing sites and U.S. equipment on the Moon as a U.S. National Park with jurisdiction under the auspices of the U.S. Department of the Interior. Although the bill acknowledges treaty obligations of the United States, it would create, in effect, a unilateral U.S. action to control parts of the Moon. This would create a direct conflict with international law and could be viewed as a violation of U.S. commitments under the OST. It would be an ineffective way of protecting historical U.S. sites, and it fails to address interests of other states that have visited and will likely visit the Moon. It is legally flawed, unenforceable, and contradictory to our national space policy and our international relations in space (4). There is a better way for the United States to protect its historic artifacts and equipment on the Moon. The first step is to clearly distinguish between U.S. artifacts left on the Moon, such as flags and scientific equipment, and the territory they occupy. The second is to gain international, not unilateral, recognition for the sites upon which they rest. Aside from debris from crash landings (by Japan, India, China, and the European Space Agency), there are only two nations with "soft-landed" equipment

on the lunar surface: the United States and Russia. China has plans to soft-land Chang'e 3 on the Moon in December 2013. All three nations (and any others wishing to participate) have much to gain and little or nothing to lose from a multinational agreement based on mutual respect and mutual protection of each other's historical sites and equipment.

Legal Issues Although ownership of planets, the Moon, and celestial bodies is prohibited, ownership of equipment launched into space remains with the nation or entity that launched the equipment, wherever that equipment is in the solar system. Under the OST, that nation is both responsible and liable for any harmful acts that equipment may create in space. There are no prescribed limits on time or the amount of damage a nation may have to pay. The U.S. government therefore still owns equipment it placed on the Moon. Ownership has the associated right of protecting the equipment, subject to using necessary and proportional means for protection. But, because no nation can claim ownership of the territory on which equipment rests, there is an open issue of how to control the spots on the Moon underneath that equipment, because the site is integral to the historical significance. In H.R. 2617, establishment of Apollo sites as a unit of the U.S. National Park System could be interpreted as a declaration of territorial sovereignty on the Moon, even though ensuing paragraphs specify the Park's components as the "artifacts on the surface of the Moon" at those sites. This problem needs international legal clarification, achievable via a formal agreement among those nations that have the technological ability to directly access the Moon (5).

Section 6(a) raises another legal issue. The bill proposes that the Secretary of the Interior shall administer the park in accordance with laws generally applicable to U.S. National Parks. It also requires the Secretary to act in accordance with applicable international law and treaties. The U.S. National Park System Act states that the Parks are "managed for the benefit and inspiration of all the people of the United States" (6). The OST clearly emphasizes that the exploration and use of space by nations is to benefit all peoples. The laws and space policies of the United States have always emphasized peaceful uses of space and the benefits of space for humankind. It may not be possible to implement and execute provisions of this Bill without raising important and fundamental questions about these contradictions between the language of the treaty and the mandates of our National Park Service. A third legal issue is raised in section (6) (c)(2) that allows private donations and cooperative agreements to "provide visitors centers and administrative facilities within reasonable proximity to the Historical Park." This implies future private use of the Moon under rights granted by the U.S. government. Unilateral granting of lunar territorial rights to private individuals and implicit sovereign protection of that territory violates the OST. Finally, section 8 of the bill requires the Secretary of the Interior to submit the Apollo 11 lunar landing site to the United Nations Educational, Scientific, and Cultural Organization (UNESCO) for designation as a World Heritage Site. This violates Article II of the OST. All current World Heritage Sites are located on sovereign territory of nations. The only exception is a separate treaty that allows UNESCO to designate underwater sites (such as sunken ships) as protected cultural sites (7). These designations are very limited, and although the convention has been ratified by 43 nations, the United States, Russia, and China are not among them. Thus, any new treaty of this type specifically for outer space would have little chance of being ratified by the major space-faring nations. A Proposal to Protect Lunar Sites Although a new U.N. treaty for space artifacts of significant cultural and historic importance may be reasonable someday, this would start a very long process with unknown outcomes. Such a treaty could be delayed to a point beyond the time when nations and/or companies may be active on the Moon (8). Our suggested alternative is to create a bilateral agreement between the United States and Russia, offered as a multilateral agreement to other nations with artifacts on the Moon. This would be more legally expedient, politically sustainable, and would more likely meet and exceed the stated goals of the bill. It would also emphasize the important role of national laws to implement and enforce these international space agreements.

Any nation with assets on the lunar surface will endeavor to protect those assets. This creates a situation where those nations have a timely, current, and common interest incorporating important implications for peaceful uses of outer space; scientific research and the advancement of knowledge; and cultural and heritage value, either presently or in the foreseeable future. The United States, Russia, and China all engage in multilateral cooperative space programs. They share many economic and trade dependencies adding to the international importance of promoting cooperation in space and commerce. In spite of today's charged political environment, an agreement of the type we propose may still be possible to negotiate because it focuses on the culture of space, the use of space to benefit humankind, and the archaeological record of our civilization. It specifically would not touch sensitive issues of real property rights, export controls, human rights, or the weaponization of outer space. Cooperation on recognizing and protecting each other's interests in historical sites and on equipment and artifacts also

has no significant security, prestige, or technological impediments. It reinforces the basic principles of the existing space treaties, avoids declarations of sovereignty on the Moon, and encourages multilateral cooperation resulting in a more stable and predictable environment for private activities on the Moon. The best mechanism for implementing a new agreement would be direct negotiations at highest levels of government in the United States, Russia, and China, with priority to include Russian sites in a proposal that protects U.S. sites. It could be included in meetings of heads of state of those nations, either jointly or sequentially among the three nations. Such an agreement could be executed in a relatively short period of time, setting precedents for peaceful and coordinated research, exploration, and exploitation of the Moon (9). An international agreement on lunar artifacts among the United States, Russia, and China would be a far superior and long-lasting solution than the unilateral U.S. proclamation in H.R. 2617. Enforcement of the agreement would be through each nation's national laws, applying to those entities subject to the jurisdiction or control of the agreement members. Each nation's property would be protected and preserved. Other nations should be free to join the agreement, and particularly encouraged to do so if they have the ability to access the Moon.

An important result would be to develop a new level of trust among nations that could then lead to more comprehensive future cooperative agreements on space, science, exploration, commerce, and the use of the Moon and other celestial bodies.

Heritage Sites are critical for science research around Dust. OSTP 18

TING & PRESERVING APOLLO PROGRAM LUNAR LANDING SITES & ARTIFACTS” (The Office of Science and Technology Policy is a department of the United States government, part of the Executive Office of the President, established by United States Congress on May 11, 1976, with a broad mandate to advise the President on the effects of science and technology on domestic and international affairs.))//Elmer

<https://csps.aerospace.org/sites/default/files/2021-08/Protecting%20Lunar%20Sites%20OSTP%20report%20Mar18.pdf>

The Moon continues to hold great significance around the world. The successes of the Apollo missions still represent a profound human technological achievement almost 50 years later and continue to symbolize the pride of the only nation to send humans to an extraterrestrial body. The Apollo missions reflect the depth and scope of human imagination and the desire to push the boundaries of humankind's existence. The Apollo landing sites and the accomplishments of our early space explorers energized our Nation's technological prowess, inspired generations of students, and greatly contributed to the worldwide scientific understanding of the Moon and our Solar System. Additionally, other countries have placed hardware on the Moon which undoubtedly has similar historic, cultural, and scientific value to their country and to humanity. Three Apollo sites remain scientifically active and all the landing sites provide the opportunity to learn about the changes associated with long-term exposure of human-created systems in the harsh lunar environment. These sites offer rich opportunities for biological, physical, and material sciences. Future visits to the Moon's surface offer opportunities to study the effects of long-term exposure to the lunar environment on materials and articles, including food left behind, paint, nylon, rubber, and metals. Currently, very little data exist that describe what effect temperature extremes, lunar dust, micrometeoroids, solar radiation, etc. have on such man-made material, and no data exist for time frames approaching the five decades that have elapsed since the Apollo missions. While some of the hardware on the Moon was designed to remain operational for extended periods and successfully telemetered scientific data back to the Earth, much of what is there was designed only for use during the Apollo mission and then abandoned with no

expectation of further survivability. **How these artifacts** and their constituent materials have **survived** and been **altered** while on the lunar surface **is of great interest to engineers and scientists. The Apollo artifacts and the impact sites have the potential to provide unprecedented data** if lunar missions to gather and not corrupt the data are developed. These data **will be invaluable for helping to design future long-duration systems for operation on the lunar surface.** NASA has formally evaluated the possible effects of the lunar environment and identified potential science opportunities. For example, using Apollo 15 as a representative landing site, the crew left 189 individually cataloged items on the lunar surface, including the descent stage of the Lunar Module, the Lunar Roving Vehicle, the Apollo Lunar Surface Experiments Package, and a wide variety of miscellaneous items that were offloaded by the astronauts to save weight prior to departure. The locations of many of these items are well documented, and numerous photographs are available to establish their appearance and condition at the time they were left behind.

Moon Dust Research key to Moon Basing.

Smith 19 Belinda Smith 7-18-2019 "Who protects Apollo sites when no-one owns the Moon?" <https://www.abc.net.au/news/science/2019-07-19/apollo-11-moon-landing-heritage-preservation-on-outer-space-treaty/11055458> (Strategic Communications Advisor at Department of Education and Training at University of Victoria)//Elmer

It's not just about history Alongside heritage value, **the bits and pieces left on the Moon have enormous scientific significance.** Take **moon dust.** It's a real **problem for moon-bound equipment** because it's **made of fine, super sticky and highly abrasive grains, which have a habit of clogging instruments and spacesuits.** But as **Armstrong and Aldrin** trotted across the surface, **the footprints they left behind gave us valuable information into the properties of moon dust.** Flinders University space archaeologist Alice Gorman said. "The ridges on the boots were meant to measure how far they sank into the dust. "Then they used the light contrast between the ridges to measure the reflectance properties of the dust." A boot print in grey dust. **This iconic photo of Buzz Aldrin's footprint is also a science experiment. (Supplied: NASA) It's data like this that will help if we want a long-term base on the Moon – we need to know how our gear will stand up to lunar conditions.** Apart from the sticky, gritty dust, the lunar surface is also peppered with **meteorites and cosmic rays.** So, Dr Gorman said, **one of the very few reasons to revisit a moon site is to collect some of the equipment left behind and see how it fared. "What has happened to this material in 50 years of sitting on the lunar surface? This is going to be really interesting scientific information because it will help planning for future missions and get an understanding of long-term conditions."** And NASA has already done this. **The Apollo 12 mission,** which landed on the Moon four months after Apollo 11, collected parts from the 1967 Surveyor probe and brought them back to Earth. An astronaut standing next to a piece of equipment on the lunar surface Along with rocks and soil samples, Apollo 12 astronauts collected pieces of the Surveyor 3 probe for analysis back on Earth. (Supplied: NASA) Another reason to preserve the equipment left on the Moon is to prove we really went there, Professor Capelotti said. "There's a lot of people out there who still don't believe it happened. "The stuff on the Moon is a testament to what we did and when we did it."

Scenario 1 – Warming:

Lunar observatory solves warming adaptation.

Ding et al. 17 (, Y., Liu, G. and Guo, H., 2017. Moon-based Earth observation: scientific concept and potential applications. [online] Volume 11, 2018. Available at: <<https://www.tandfonline.com/doi/full/10.1080/17538947.2017.1356879>> [Accessed 22 January 2022] Yixing Ding - Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, Beijing, People's Republic of China Guang Liu - Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, Beijing, People's Republic

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4. Scientific goal of moon-based earth observation A basic question for moon-based Earth observation is, 'What to see?' According to the characteristics of moon-based Earth observation, the phenomena suitable for Moon-based Earth observation may have at least one of the following features:

long-lasting, related to Sun–Earth–Moon motion, requires stable baseline observation, large-scale and describes multiple parameters. In the following sections, we will present several observation objectives to discuss in detail. 4.1. Solid earth dynamics Solid Earth tides, continental plate movement and glacier isostatic adjustment (GIA) are three typical large-scale solid Earth

movements (Jiang et al. 2016), the measurement of which is a basic task of geodesy. For a uniform layered Earth, accurately predicting tidal movement can be done theoretically, but complex ocean tides and the inelasticity and heterogeneity of Earth's interior material make the solid tide of the real Earth difficult to research theoretically. For GIA studies, prior knowledge about ancient ice cover evolution and a large amount of observational data are needed. Plate tectonics theory is a quantitative description of Earth plate movement (Ni et al. 2016). It may well explain the movement of most oceanic plates, but still have some problems to explain the mechanism of strong continental earthquakes, large-scale continental deformation, as well as the movements of other oceanic plates (Bird 2003).

Accurately measuring solid Earth dynamics is beneficial to understanding solid Earth tides,

continental plate movement and GIA, and provides further support for geodynamics and seismology. Devices such as a

superconducting gravimeter and global navigation satellite system are currently used to measure small deformations of solid Earth, but these point-by-point methods are spatially limited to certain regions.

Spaceborne InSAR measures deformation continuously, but the swath is not wide enough for mapping large-scale solid Earth movement. The Moon is a vast and stable platform that can provide sufficiently long and stable baseline interferometry. Its movement is easier to predict and the time interval of repeat-pass interferometry could be reduced to one day (Fornaro et al. 2010). In addition, the

Moon is one of the main sources of tides on the Earth; so if we compare two measurements at different times, the lunar tide portion can be subtracted, leaving only the solar tide portion. After proper processing, it may help us learn more about the interior structure of Earth's crust. To measure the large-scale deformation, a Moon-based repeat-pass InSAR system needs to be carefully designed. Except for the general SAR parameters, the critical baseline is a key factor that impacts its performance. The critical baseline B_c leading to a complete spatial decorrelation is given by $B_c = B \sin \theta \tan \theta_i$ (7) In this equation, the incidence angle θ_i is related to the observational geometry, while B and θ are optional. When the bandwidth is 100 MHz and the incidence angle is 25° , the critical baselines are 14,000, 3300 and 1770 km at the L-band, C-band and X-band, respectively. In order to keep the correlation between two repeat passes, a practical baseline must be smaller than B_c . Therefore, from a practical point of view, the L-band is better than the C-band or X-band. Figure 4 shows the simulation results of one-day interval interferometry, but the side-looking constraints are not involved. In this case, the temporal decorrelation is highly

reduced. It is obvious that the interferometric area is larger in the L-band than in X-band. Meanwhile, when the declination of the Moon is near the extremes, the interferometric area becomes larger. When the declination of the Moon is near the equatorial plane, one-day interval repeat-pass interferometry is not feasible, but a half month or one month interval repeat-pass interferometry is available. The magnitude of the solid Earth motion is not large. For example, the typical solid Earth tide amplitude is dozens of centimetres in one day. A resolution of hundreds of metres or even coarser will be enough if the wave is stably scattered. 4.2.

Energy budget of earth Fundamentally, climate change depends on Earth's radiation balance. Observation of both the solar radiation and Earth's reflection and emission will depend on accurate

measurement with space technology. Since the late 1970s, the United States and Europe have launched a number of missions to measure solar and terrestrial radiation, such as NASA's Active Cavity Radiometer Irradiance Monitor Series programme (ACRIM1, 1980–1989; ACRIM2, 1991–2001; ACRIM3, 2000–present), Earth Radiation Budget Experiment (ERBE, 1984–1994), Clouds and Earth's Radiant Energy System (CERES, 1997–present), Solar Radiation and Climate Experiment (SORCE, 2003–present) and the French Megha-Tropiques satellite on the Scanner for Radiation Budget (ScaRaB, 2011–present). These missions have greatly improved our understanding of Earth's energy system. The Deep Space Climate Observatory

(DSCOVR), placed at the earth–Sun first Lagrangian point, has been designed to measure the outgoing radiation of the sunlit Earth disk with a constant look angle. But in the outgoing radiation, the reflected shortwave radiation is highly affected by albedo and atmospheric conditions, showing obvious anisotropy. Lack of sampling in space and time is vulnerable to uncertainties. The lunar observatory provides

large-scale observation with continuously changing angles enabling it to calibrate the data of satellites in different orbits at different times. Its most important property is that it can provide a very long-term time series from a single orbit platform. In a year, the time series covers all local times, all

seasons (different weather pattern) and all Earth phases for all underlying surfaces (Pallé and Goode 2009; Karalidi et al.

2012). The diversity of the surface-weatherphase combination is beneficial to improving the quality of

global energy budget data and to the **study of regional energy redistribution** and its **multi-layer coupling effects**. The **Moon-based data will** also **provide a direct connection between the data from space technology and the data from ground-based earthshine measurement series, which span almost one hundred years**. The system design can consult the DSCOVR satellite, a radiometer measuring irradiance of the Earth phase and an imaging camera taking images of the Earth phase for various Earth sciences purposes. In order to take into account the needs of observing the Earth's environmental elements, 1 km spatial resolution and 20–30 channels of the camera are suggested. 4.3. Earth's environmental elements **Vegetation** is an **important part of the global carbon pool** and a **key element of global carbon cycle**. Most vegetation is distributed in middle- and low-latitude regions. A **Moon-based optical camera can image global vegetation almost every day**. SAR maps not only the horizontal distribution of vegetation, but also extracts forest morphological structure through tomography. The **Moon provides multi-baseline accessibility** within a single pass to eliminate the tomographic temporal decorrelation, but the imaging temporal decorrelation within a long synthetic aperture time hampers the focusing of forest. Therefore, to **validate the feasibility of Moon-based 3D mapping of forest** more **imaging methods** for unstable scatterer, for example, the **time reversal imaging method** (Jin and Moura 2007), need to be tested and new methods are also expected. **Glaciers are sensitive variables of climate change**. The **monitoring of glacier area, surface velocity and mass balance plays an important role in understanding the status of glaciers and their response to global change**. Remote sensing techniques, such as **optical sensors SAR and altimeter data, provide regular observations of key glacial parameters**. A lunar platform would provide continuous three- or four-day temporal coverage per month at the polar regions, but the observation incidence angle would typically be larger than 40° (see Figure 5) due to the relatively small inclination angle of the lunar orbit. For the High Asia area, the average coverage is about 4 h per day with proper incidence angle. The challenges may be the cost of high-resolution mapping for the optical sensor, and the layover problem (Tilley and Bonwit 1989) in heavy gradient area for SAR. Moon-based altimetry faces the same problems as LiDAR mentioned before, and is not recommended. An **atmospheric observatory on the Moon** can be **used to evaluate the cloud fraction in an unambiguous manner, determine the composition in terms of the major trace gas and aerosols** (Hamill 2016), and **shed light on the relationship between lunar phases and cloudiness or precipitation**. Particularly, the **Moon offers a good place for occultation observation, which means observing the light or microwave changes emitted by stars or satellites** when they are obstructed by atmosphere around the Earth. The Global Ozone Monitoring by Occultation of Stars (GOMOS) instrument on board the Envisat satellite is a typical system using the stellar occultation measurement principle in monitoring ozone and other trace gases in Earth's stratosphere (Kyrola et al. 2004). Moon-based occultation was proposed in Link (1969), and was considered promising in Moon-based Earth atmosphere monitoring (Hamill 2007, 2016; Guo et al. 2014). **The advantage of Moon-based occultation is that a star descends several times slower through the atmosphere than when viewed from a LEO satellite**. This helps by **increasing the SNR and resolution to some extent**, but the practical performance also relies on the system design and the probability of finding an appropriate occultation geometry. 4.4. Earth-space environment Observing the environment of outer space surrounding Earth requires much larger FOV than only observing the solid Earth. The **Moon is an ideal place to monitor the interaction between the solar wind and the magnetosphere**. Moon-based observation combined with high near-polar Earth orbit or Molniya orbit observations can help us construct the three-dimensional structure of the magnetosphere by X-ray and EUV remote imaging. Images in all meridian planes of the whole plasma layer have already been captured by the EUV camera on the Chang'e 3 lander. Some initial results reflect the basic features of the plasmasphere, and also verified the accessibility of high-quality data of magnetosphere from the Moon (Feng et al. 2014). 5. Conclusion In this paper, we propose the **Moon as a platform for Earth observation with long-term, dynamic capabilities, mainly focusing on large-scale geoscience phenomena**. The characteristics of a lunar platform, the sensors and the scientific objectives of Moon-based Earth observation are discussed in detail. A lunar platform could observe Earth in quite a different way, and give a long-lasting disk view, a stable baseline and a unique perspective. The proposed sensors include some optical sensors and SAR. LiDAR, altimeters and scatterometers may not be functional on the lunar surface mainly because of the long viewing distance, and Moon-based radiometers may not be necessary if spaceborne radiometers are effective enough. Though the cost is not discussed in this paper, a Moon-based SAR would be extremely expensive and face too many specific technical difficulties to be implemented at the present time. On the contrary, passive optical sensors, such as spectrographs and panchromatic cameras, are much easier to realize. The scientific objectives of Moon-based Earth observation include measuring solid Earth dynamics and the global energy budget, and monitoring Earth's environment and the surrounding environment of outer space. Moon-based Earth observation will be effective in measuring solid Earth tides, detecting outgoing radiation, and monitoring the magnetosphere and some of Earth's environmental elements. Finally, we suggest that **numerical simulations** are indispensable to validate the proposals and to address specific problems.

Moon Base is the only option and outweighs Satellites.

Ding et al. 17 (, Y., Liu, G. and Guo, H., 2017. Moon-based Earth observation: scientific concept and potential applications. [online] Volume 11, 2018. Available at:

AT: SATs/GEO

<<https://www.tandfonline.com/doi/full/10.1080/17538947.2017.1356879>> [Accessed 22 January 2022] Yixing Ding - Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, Beijing, People's Republic of China
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There are several characteristics of Moon-based Earth observation as listed below. (1) **Longevity** The **life cycle of artificial satellites is generally several years, while the Moon has already existed** for billions of years, and will not go extinct in the foreseeable future. It is a longstanding, essentially permanent platform. **The revisit cycle is quite different from LEO satellite.** Except for the polar regions, the revisit period is one day, the same as Earth's rotation period. The revisit period in the same geometric condition is one month, the same as the moon's revolution period. The temporal sampling of the lunar platform is not systematically biased. It covers all local times in a month and all seasons in a year. **This will be very useful for long-term time series analysis in climate change research.** Furthermore, the lunar platform can also provide time series data to calibrate the remote sensing data from other platforms. (2)

Integrity The whole Earth disk facing the Moon, both the sunlit portion and dark portion, is always observable from the near side of the Moon, with a field angle of only about 2°. This allows an observer on the **Moon to view the whole Earth disk at any given time** and Earth's entire surface in a day, **both in dark and sunlit conditions.** (3) Stability Studies show that the lunar crust lacks plate

tectonics; so the quantity and degree of moonquake activities are much less than earthquakes (Jaumann et al. 2012). **Compared to satellite platforms, the Moon has vast spaces on which to install a set of sensors to form a long, stable baseline of large observational networks for precise measurement.** Moon also moves stably, which enables repeat-pass interferometry. (4) Uniqueness Moon exerts influences on precipitation,

ice nuclei **concentrations, diurnal pressure changes, hurricanes, cloudiness, thunderstorm and surface temperature** (Balling and Cerveny 1995). The tidal force of the Moon is also considered as a trigger of **earthquakes** (Cochran et al. 2004) and a resource generating internal waves (Simmons et al. 2004). For those Moon-related terrestrial phenomena, the lunar platform provides such a unique perspective that any place on the Earth can be continuously monitored at different Moon–Earth phase angles each day. **A Moon-based sensor can dynamically trace the whole process covering their occurrence, development and dissipation.** It will help the understanding of the relationship between the tidal phases and the evolution of the phenomena. 3. Sensors for moon-based earth observation For most of the history of lunar exploration, the United States, China and Japan have been taking a few pictures of Earth with cameras both on the lunar surface and in lunar orbit. This proved that it is possible to observe Earth utilizing Moon-based optical sensors. However, except for observing Earth's magnetosphere, these photos had no specific scientific objective. Few works about the sensors for Moon-based Earth observation have been published by previous missions. So, in this section we discuss the feasibility and the key parameters of various traditional remote sensors, including both the optical sensors and the microwave sensors. 3.1. **Optical sensors for moon-based earth observation** One important parameter of most remote sensing systems is the spatial resolution. The **detection range of Moon-based optical sensors is much further than spaceborne sensors.** The diffraction limited resolution of optical sensors r is given by $r = 1.22\lambda R/d$, (1) where λ is the wavelength, d the telescopic aperture and R the distance from the sensor to the target. In the visible band, the limiting resolution is 0.17–0.36 km, when d is 1 m. In short, if the telescopic aperture is 0.5 m, the spatial resolution can be less than 1 km in the visible band and several kilometres in the near-infrared and thermal infrared bands, which satisfies the needs of climatologic models and global mapping for oceans, clouds and land use (Ding, Guo and Liu 2014). LiDAR is an example of an active sensor. To place a LiDAR on the Moon, many technological challenges must be taken into consideration, such as the echo power, the size of the laser beam on earth's surface and the coverage performance. If the scattering solid angle of a homogeneous scatterer is p , the received power of this system falls within the square of the distance from LiDAR to scatterer R (Wagner et al. 2006): $P_r = P_t R^2 \sin^2 p$, (2) where the received power and transmitted power is

Pr and Pt, Dr the receiving aperture and r the reflectivity. The power needed for Moon-based LiDAR would be a hundred thousand times greater than that of satellite-based LiDAR, which is at the megawatt level. The footprint of the laser beam on Earth's surface is proportional to the laser divergence angle. Under a divergence of 0.1 m/rad, the beam of Moon-based LiDAR would be 36–40 km, two orders of magnitude larger than the beam width of spaceborne LiDAR. Such a large beam would stretch the length of the echo signal and complicate its waveform, and will lead to a difficulty to determine the exact echo position of the target in measuring the altitude of sea surface and the thickness of vegetation.

Adaptation solves Climate Change's worst effects – it's the Silver Bullet.

Rood and Gibbons 21 Richard B. Rood and Elizabeth Gibbons 9-11-2021 "After a summer of weather horrors, adapting to climate change is an imperative"

<https://archive.is/VKac8#selection-391.0-413.1> (Richard B. (Ricky) Rood is a professor of climate and space sciences and engineering at the University of Michigan. Elizabeth (Beth) Gibbons is executive director of the American Society of Adaptation Professionals.)//Elmer

This summer, the extraordinary heat in the Pacific Northwest, floods across the Northern Hemisphere and Hurricane Ida's swath across the country have awakened more people to the dangers of climate change. As professionals working on climate change, we receive many requests for comments and interviews. More telling, perhaps, have been panic-tinged personal letters from family and friends as well as colleagues working in the field awakening to the real-world consequences of our warming climate. Public messaging on climate change is dominated by the discussion of reducing carbon dioxide emissions to limit the warming and to stop the "worst effects" of climate change. This is the mitigation of global warming. Headlines range from declarations of climate despair to the measured voices of those who insist that there is still the time and wherewithal to limit warming to the goals aspired to by the United Nations. Amid this cacophony of mitigation panic and sought-after patience is another discussion that has been going on for more than a decade. Namely, that we are not likely to meet emission-reduction goals such as those of the Paris agreement. This is complemented by the fact that we live in a rapidly changing climate, rapid change will continue, and we are not going back to the climate of our childhoods. When we consider how we will address our climate future, it is worth considering our past behavior and choices. We have had the ability and the roadmap to make major strides in reducing carbon dioxide emissions and mitigating climate change for many years. In many cases, these mitigation tactics are "no regrets," with very quick monetary payback for expenditures — the insulation of houses and choosing fuel-efficient vehicles, for example. Yet we have not taken these steps at the scales that are required for effective intervention. Mitigation is one response, but adaptation can be framed as the other response. Adaptation is responding to the effects of warming or perhaps coping with the consequences of the warming Earth. With the public conversation focusing overwhelmingly on mitigation, adaptation has been a neglected topic. Compared with mitigation, adaptation is relatively easy. Effective mitigation requires changing human behavior, ingrained geopolitical and economic power structures, and built infrastructure on a global scale. It requires convincing people to invest for the common good of other people, often decades into the future. At its simplest, adaptation can be carried out by an individual. You can sell the house next to the ocean and move to northern Michigan. You can reinforce your roof and put your oceanside house on stilts. There is a concrete value proposition. Although adaptation can be carried out by individuals, it is better and certainly more equitable to plan on the larger scales of a community, a city or a region. As the geographical scale increases and more individuals, organizations and local governments are involved, it does get more difficult. However, the threats to life, property and the local environment often serve as motivation to challenge the barriers of cooperation and shared beneficial outcomes. For example, a region threatened by rising seas is motivated to come together to find solution strategies. Indeed such efforts are underway, for example, in the Southeast Florida climate compact, the Puget Sound climate collaborative, and efforts across Southeast Virginia's Hampton Roads region. When a region successfully implements adaptation plans, communities are likely to have wins when the next storm is not as destructive and costly. These wins help people cope with global warming and realize some ability to take control of what has been often stated as an existential threat. There

have been those calling for adaptation policy for many years. However, it has been difficult to get adaptation on the policy agenda. This is ascribed to many reasons, including the persistent, spurious argument that if we talk of adaptation, then we will decide that we do not need to mitigate our emissions. However, we are at the point that, **even if we were to meet all of the emission reduction goals of the United Nations' Paris agreement, adaptation will still be required**. In the end, the most important aspect of adaptation is fundamentally human. If individuals and communities can see **adaptation as a way of sustaining their well-being** in the face of rapidly changing weather, then it is a step of moving past the narrative that we must, between now and 2030, solve an existential threat to **our survival**. We can see successful adaptation strategies spreading, scaling, and bringing planetary warming into the mind-set and the behavior of more and more people. We must entrain dealing with the weather of a warming Earth into all that we do. **And that, we assert, will make the need for mitigation more real and urgent.**

Missing Data holds back Adaptation efforts.

Barrios et Al 18, Alonso, Guillermo Trincado, and René Garreaud. "Alternative approaches for estimating missing climate data: application to monthly precipitation records in South-Central Chile." *Forest Ecosystems* 5.1 (2018): 1-10. (Graduate School, Faculty of Forest Sciences and Natural Resources)

The effects of climate on natural resources have become highly relevant (Cannell et al. 1995). In forestry, there is an increasing interest to study the influence of climate on forest productivity (Álvarez et al. 2013), forest hydrology (Dai et al. 2011), soil water availability (Ge et al. 2013), and wood quality (Xu et al. 2013). **Nowadays, climate data are also required for parameterizing process-based simulators of tree growth** (Sands and Landsberg 2002) **and for studying forest water balance** (Huber and Trecaman 2002), **phenology processes** (Caveside et al. 2005) **and to carry out pest and disease research** (Ahumada et al. 2013). **To perform these studies, complete and homogenous climate data that covers a sufficiently long period of time is required** (Teegavarapu 2012; Khosravi et al. 2015). **Climate data often have missing information that limits their use** (Alfaro and Pacheco 2000). **Missing values in climate series affects parameter estimation** when applying regression and multivariate analysis techniques (Ramos-Calzado et al. 2008). In most cases, some techniques must be applied to estimate missing data. In forestry, there are few studies that have compared the accuracy of different approaches. Furthermore, factors that might affect their precision have not been studied in detail. The simplest approach for imputing missing values involves the data being filled-in. **The main limitation is that these approaches are suitable for small gaps and can only be applied to climate variables with a high degree of autocorrelation** (Khosravi et al. 2015), **which is not the case for annual mean temperatures or precipitation values**. A more common approach to complete missing data is to use information from neighboring meteorological stations (Vasiliev 1996), using techniques such as inverse distance weighting (IDW). Nonetheless, horizontal distance is not a measure of spatial autocorrelation (e.g., Ahrens 2006; Ramos-Calzado et al. 2008), especially when the region contains prominent topographic features or major water bodies. Indeed, two relatively close stations can feature substantial differences in their mean climate and climate variability if they are located at opposite sides of a mountain range. Spatial correlations could be quantified by calculating the correlation coefficient between time series obtained at different locations. Teegavarapu and Chandramouli (2005) found that replacing distances with correlation coefficients as weights improved estimation of missing precipitation data. The resulting method is known as a coefficient of correlation weighting (CCW), reported by Teegavarapu (2009).

Prevents extinction.

Sears 21 (, N., 2021. Great Powers, Polarity, and Existential Threats to Humanity: An Analysis of the Distribution of the Forces of Total Destruction in International Security. [online] ResearchGate. Available at:

<<https://www.researchgate.net/publication/350500094>> [Accessed 22 November 2021] Nathan Alexander Sears is a PhD Candidate in Political Science at The University of Toronto. Before beginning his PhD, he was a Professor of International Relations at the Universidad de Las Américas, Quito. His research focuses on international security and the existential threats to humanity posed by nuclear weapons, climate change, biotechnology, and artificial intelligence. His PhD dissertation is entitled, “International Politics in the Age of Existential Threats”)-re-cut rahulpenu

Climate Change Humanity faces existential risks from the large-scale destruction of Earth’s natural environment making the planet less hospitable for humankind (Wallace-Wells 2019). The decline of some of Earth’s natural systems may already exceed the “planetary boundaries” that represent a “safe operating space for humanity” (Rockstrom et al. 2009). Humanity has become one of the driving forces behind Earth’s climate system (Crutzen 2002). The major anthropogenic drivers of climate change are the burning of fossil fuels (e.g., coal, oil, and gas), combined with the degradation of Earth’s natural systems for absorbing carbon dioxide, such as deforestation for agriculture (e.g., livestock and monocultures) and resource extraction (e.g., mining and oil), and the warming of the oceans (Kump et al. 2003). While humanity has influenced Earth’s climate since at least the Industrial Revolution, the dramatic increase in greenhouse gas emissions since the mid-twentieth century—the “Great Acceleration” (Steffen et al. 2007; 2015; McNeill & Engelke 2016)—is responsible for contemporary climate change, which has reached approximately 1°C above preindustrial levels (IPCC 2018). Climate change could become an existential threat to humanity if the planet’s climate reaches a “Hothouse Earth” state (Ripple et al. 2020). What are the dangers? There are two mechanisms of climate change that threaten humankind. The direct threat is extreme heat. While human societies possesses some capacity for adaptation and resilience to climate change, the physiological response of humans to heat stress imposes physical limits—with a hard limit at roughly 35°C wet-bulb temperature (Sherwood et al. 2010). A rise in global average temperatures by 3–4°C would increase the risk of heat stress, while 7°C could render some regions uninhabitable, and 11–12°C would leave much of the planet too hot for human habitation (Sherwood et al. 2010). The indirect effects of climate change could include, inter alia, rising sea levels affecting coastal regions (e.g., Miami and Shanghai), or even swallowing entire countries (e.g., Bangladesh and the Maldives); extreme and unpredictable weather and natural disasters (e.g., hurricanes and forest fires); environmental pressures on water and food scarcity (e.g., droughts from less-dispersed rainfall, and lower wheat-yields at higher temperatures); the possible inception of new bacteria and viruses; and, of course, large-scale human migration (World Bank 2012; Wallace-Well 2019; Richards, Lupton & Allywood 2001). While it is difficult to determine the existential implications of extreme environmental conditions, there are historic precedents for the collapse of human societies under environmental pressures (Diamond 2005). Earth’s “big five” mass extinction events have been linked to dramatic shifts in Earth’s climate (Ward 2008; Payne & Clapham 2012; Kolbert 2014; Brannen 2017), and a Hothouse Earth climate would represent terra incognita for humanity. Thus, the assumption here is that a Hothouse Earth climate could pose an existential threat to the habitability of the planet for humanity (Steffen et al. 2018., 5). At what point could climate change cross the threshold of an existential threat to humankind? The complexity of Earth’s natural systems makes it extremely difficult to give a precise figure (Rockstrom et al. 2009;). However, much of the concern about climate change is over the danger of crossing “tipping points,” whereby positive feedback loops in Earth’s climate system could lead to potentially irreversible and self-reinforcing “runaway” climate change. For example, the melting of Arctic “permafrost” could produce additional warming, as glacial retreat reduces the refractory effect of the ice and releases huge quantities of methane currently trapped beneath it. A recent study suggests that a “planetary threshold” could exist at global average temperature of 2°C above preindustrial levels (Steffen et al. 2018; also IPCC 2018). Therefore, the analysis here takes the 2°C rise in global average temperatures as representing the lower-boundary of an existential threat to humanity, with higher

temperatures increasing the risk of runaway climate change leading to a Hothouse Earth. The Paris Agreement on Climate Change set the goal of limiting the increase in global average temperatures to “well below” 2°C and to pursue efforts to limit the increase to 1.5°C. If the Paris Agreement goals are met, then nations would likely keep climate change below the threshold of an existential threat to humanity. According to Climate Action Tracker (2020), however, current policies of states are expected to produce global average temperatures of 2.9°C above preindustrial levels by 2100 (range between +2.1 and +3.9°C), while if states succeed in meeting their pledges and targets, global average temperatures are still projected to increase by 2.6°C (range between +2.1 and +3.3°C). Thus, while the Paris Agreements sets a goal 6 that would reduce the existential risk of climate change, the actual policies of states could easily cross the threshold that would constitute an existential threat to humanity (CAT 2020).

Scenario 2 – Neutrinos:

Earth’s Atmosphere limits Neutrino Research – only a Moon base solves.

Crawford 12, I. A., et al. "Back to the Moon: The scientific rationale for resuming lunar surface exploration." Planetary and Space Science 74.1 (2012): 3-14. (Department of Earth and Planetary Sciences, Birkbeck College)//Elmer

A natural area to use the Moon as a platform for performing scientific experiments is astronomy (for summaries see, e.g., Burns et al., 1990; Livio, 2006; Crawford and Zarnecki, 2008; Jester and Falcke, 2009). Almost the entire electromagnetic spectrum is currently being used to study the universe from radio to high-energy gamma ray emission. Different frequencies typically relate to different physical processes, and consequently the universe looks markedly different in optical, infrared, or radio wavelengths. Hence, during the last century modern telescopes have diversified and evolved enormously, fundamentally changing our view of the universe and our place therein. Due to their ever increasing sensitivity, which allows one to peer deeper and deeper into the earliest phases of the cosmos, the requirements for telescope sites have become more and more extreme: one simply needs the best possible observing conditions. The most important factors here are light pollution (at the relevant frequencies) and distortions due to the atmosphere. Light pollution is generally caused by any form of civilization, thereby pushing observatories to more and more remote locations. Detrimental effects of the atmosphere include: • temporary effects such as clouds and water vapour, which temporarily absorb and disturb optical or high-frequency radio radiation, • turbulence in the ionosphere or troposphere, which distorts radio or optical wave fronts, thereby severely degrading the image quality, • air glow, which can overpower sensitive infrared observations, • total absorption of radiation, e.g., of very low-frequency radio, infrared, X-ray, and gamma-ray radiation. The best – and in many cases only – remedy is to observe from dry deserts, high mountains, or from space. Two of the most remote, but also most exquisite, astronomical sites on Earth are the Atacama desert and Antarctica. The former currently hosts some of the world’s largest telescopes, including ESO’s 8m-class Very Large Telescopes (VLT), the ALMA sub-mm-wave radio telescope, and in the future probably also the ~40 m diameter European Extremely Large Telescope (E-ELT; see <http://www.eso.org>). A century after its initial exploration, Antarctica now also hosts a number of somewhat smaller telescopes (e.g., the South Pole Telescope, Carlstrom et al., 2011) as well as the giant IceCube detector. IceCube is the world’s largest neutrino observatory, using the ice itself as detector material (e.g., Abbasi et al., 2011). The Moon would be a logical next step in the quest for the most suitable sites to be used for astronomy. An important secondary important factor in selecting a site, however, is the available infrastructure: How accessible is the site for people and material? How does one obtain power and how good is the data connection? Already for Antarctica this poses serious constraints, and it took a long time until this continent became useful for scientific exploitation. It is needless to say that the Moon is even more difficult to reach. Hence, like Antarctica, any significant exploitation of the Moon requires a developed infrastructure – something that would likely become available only in conjunction with human exploration of the Moon. Even then one has

to assess **how unique and useful the Moon is for astronomy in the first place. After all, the International Space Station (ISS), while having a well-developed infrastructure available, is not used for telescopes; its small, relatively unstable platform in low Earth orbit (LEO) is simply too poor a telescope site to be competitive.**

Hence, the vast majority of space-based telescopes have been associated with free-flying satellites. Of course, some of these satellites, most notably the Hubble Space Telescope (HST), benefited from the heavy lift capabilities of the Space Shuttle and the servicing possibilities the human space flight program offered (NRC, 2005). Indeed, it is interesting to note that the one human-serviced space telescope, HST, is in fact the most productive of all astronomy space missions even many years after its launch (see Tables 4 and 6 in Trimble and Ceja, 2008; HST produced 1063 papers in the time frame 2001-2003, compared to 724 for Chandra, the next most productive). So, the question to ask is: **Which type of telescopes**

would uniquely benefit from a lunar surface location? This question has been addressed in a couple of workshops and scientific roadmaps in recent years (Falcke et al., 2006; Livio, 2006; NRC, 2007; Crawford and Zarnecki, 2008; Worms et al., 2009). In the following section we try to synthesize these findings. 4.2 Which astronomy? There is a **wide consensus that a low-frequency radio telescope** (i.e. a **radio telescope operating at frequencies below 30-100 MHz, would be the highest priority** (e.g., Jester and Falcke, 2009; Burns et al., 2009). Radio waves at these frequencies are seriously distorted by the **Earth's ionosphere and completely absorbed or reflected at frequencies below 10-30 MHz.**

Hence, the low-frequency universe is the last uncharted part of the electromagnetic spectrum, and a lunar infrastructure would greatly benefit its exploration. Of particular relevance for science here is the investigation of the "dark ages" of the universe. This is the epoch several hundred million years after the big bang, but before the formation of the first stars and black holes, when the cosmos was mainly filled with dark matter and neutral hydrogen. **This epoch contains still pristine information of the state of the big bang and can essentially only be observed through radio emission from atomic hydrogen red-shifted to several tens of MHz. The best location to study this treasure trove of cosmology (Loeb and Zaldariaga 2004) would indeed be on the lunar far-side.**

The Moon is key for Neutrino Research – would be involved in any return to the Moon. Wilson 92, T. L. "Neutrino Astronomy of the Moon." Lunar and Planetary Science Conference. Vol. 23. 1992. <https://www.lpi.usra.edu/meetings/lpsc1992/pdf/1757.pdf> (Thomas L. Wilson, NASA Johnson Space Center/ISN1)//Elmer

The notion of conducting neutrino astronomy on the Moon has had a very brief history [1-91]. The case has even been presented [7] that **the ultimate future of neutrino astronomy in the 21st Century may be on the Moon.** A recent NASA workshop at Stanford University [6] clearly demonstrated that **the physics community supports a return to the Moon, provided its justification is a strong scientific initiative directed at taking advantage of the lower background ambient magnetic fields than on Earth and the absence of an appreciable atmosphere. Several significant issues in particle physics, such as searches for proton decay and measurement of the neutron's electric dipole moment, are background-limited on Earth.** Similarly, **the Earth's stratosphere is a source of considerable noise in neutrino astronomy on Earth [6,9]. The Moon, in contrast, ostensibly may offer a viable advantage in both of these cases if its backgrounds are appreciably lower as they appear to be. The proposal for a neutrino detector at a lunar base, then, represents an important shift in emphasis towards fundamental physics research in space, as a part of NASA's initiative to re-establish a permanent presence on the Moon.** Such a

detector would **bolster** not only **the science of neutrino** astronomy and its role in basic astrophysics as a neutrino telescope, but would also enhance our fundamental understanding of the **physics** of the Universe. It is conceivable that long-baseline neutrino oscillations experiments could be conducted between Earth-based accelerators [10,6] and a lunar base neutrino detector. **The first round of scientific experiment candidates for a lunar outpost, in fact, includes a lunar neutrino telescope** [11] although any such strategy is still under study. In this regard, neutrino and antineutrino spectra as might be seen on the Moon's surface have been published [6,1-31]. **The critical issue of prompt neutrino production by decay of charmed mesons has been studied [3,5], but the branching ratios have changed due to further refinement of Earth-based accelerator experiments and these analyses may require additional work.** The charm production issue is particularly important because it background-limits a lunar observatory. Furthermore, this occurs in the 1 MeV portion of the neutrino spectrum, right where grand unification in particle physics has been predicting proton decay. Another analysis [12] of Earth-based neutrino astronomy has attempted to illustrate the full spectrum as might be observed from the surface of the Earth, including the (presently undetectable) relic neutrinos left over from the Big Bang [13,14]. This spectrum is amended and presented here (Figure 1) to include the antineutrino luminosity of the Moon [6,15] produced by its natural radioactivity. Charm [15] is not presented, and it may have overriding significance. This view of the neutrino Universe from the surface of the Moon is important in the assessment and scientific justification for such a detector at a lunar base. The Earth has many advantages in neutrino astronomy because grand-scale neutrino detectors are already in use there, such as in the ongoing radiochemical studies [16] of solar neutrinos. **The Moon, on the other hand, clearly has advantages** illustrated in Figure 1 due to the **lack of** in situ **atmospheric neutrinos** [6,9] and the **absence of nuclear reactor antineutrino** fluxes which are beginning to complicate antineutrino astronomy's access on Earth to portions of supernovae spectra in astrophysics. The recent study of active galactic nuclei (AGN) neutrinos [17, 18] as another interesting astrophysical source are not presented.

Neutrino Research key to Nuclear Detection that deters Proliferation – key to determine military usages.

Lee 20 Thomas Lee "Can tiny, invisible particles help stop the spread of nuclear weapons?" <https://engineering.berkeley.edu/news/2020/03/can-tiny-invisible-particles-help-stop-the-spread-of-nuclear-weapons/> (Associate Adjunct Professor, Research Scientist Operations & IT Management.)//Elmer

The **key to preventing nuclear proliferation may depend on** a little bit of **ghost hunting**. Scientists have long been interested in **a device that can detect neutrinos**, ghost-like particles that have no electric charge and nearly no mass — and therefore can pass through matter. Now, **researchers are closer than ever to deploying technology that can spot** those elusive **subatomic particles and**, in doing so, **alert** international **authorities to the illicit production of plutonium**, a key fuel for nuclear bombs. **The technology may provide a “way to monitor the plutonium content in a nuclear reactor in real time that we just don’t have right now,”** said Bethany Goldblum (M.S.'05, Ph.D.'07 NE), a top researcher with UC Berkeley's Department of Nuclear Engineering. **Goldblum, the executive director of the Berkeley-based Nuclear Science and Security Consortium, co-wrote a study published this week in the Review of Modern Physics that examines the feasibility of neutrino detectors in nuclear nonproliferation efforts.** The study's co-authors include Adam Bernstein and Nathaniel Bowden from Lawrence Livermore National Laboratory, Patrick Huber from Virginia Tech, Igor Jovanovic from the University of Michigan and John Mattingly from North Carolina State University. **The study ultimately concludes that such technology deployed outside nuclear reactors could prove effective in ensuring that countries are not making weapons-related material under the guise of peaceful civilian energy production.** The report also advances the idea that **researchers could one day use the technology to discover or exclude the presence of reactors at distances**

of a few hundred kilometers. “Over several decades, physicists have conceived many ideas for using fission neutrinos in nuclear security,” the study says. “Some ideas remain in the realm of pen and paper, constrained by basic physical and practical considerations. For other concepts, demonstrated technology is catching up with real opportunities.” **The ghost particle Neutrinos are the most abundant particles in the universe, having been formed by large nuclear explosions like the Big Bang, supernovas and the fusion process that happens inside the sun. They travel near the speed of light, have little mass and carry no electric charge. Because of these attributes, neutrinos can pass through matter and are incredibly difficult to detect, which is why scientists often refer to them as “ghost particles.”** For example, if 10 trillion neutrinos struck the Earth, all but one would pass through the planet without having interacted with anything at all. In 1956, Clyde Cowen and Frederick Reins, two scientists at the Los Alamos National Laboratory in New Mexico, confirmed the neutrino’s existence, work that eventually earned the Nobel Prize in Physics. The duo placed two large water tanks near a nuclear reactor, which produces electron antineutrinos in huge quantities, as part of the fission process.

As it turns out, neutrinos can collide with protons in the water and produce a neutron and a positron through a process called inverse beta decay. When the positron moves through the water, it produces a flash of light that special sensors can detect. Up to this point, scientists were primarily interested in finding neutrinos because the particles might offer clues to the universe’s origin and the formation of stars and galaxies. But starting around the turn of the 21st century, the idea that neutrino detectors could be used in nuclear nonproliferation efforts started to gain real traction.

In 2000, Adam Bernstein, then a postdoctoral fellow at the Sandia National Laboratory in Livermore, California, **wrote a paper exploring the idea of using detectors filled with purified water to spot neutrinos produced from nuclear explosions.** In many ways, water is a great medium to detect neutrinos because it is easy to purify, cheap and is transparent to light produced by neutrinos colliding with water molecules. The key would be to build detectors big enough to hold enough water to see the neutrino signal above background radiation. **However, finding neutrinos in water is still pretty hard.** Bernstein found that adding small amounts of gadolinium — a rare earth metal with unusual nuclear properties — to the water could significantly boost the detector’s chances of spotting neutrinos. In gadolinium-doped water, neutrino interactions produce a much stronger signal than neutrinos in water alone. Bernstein eventually abandoned the idea to monitor explosions because the cost and size of such neutrino detectors would make the technology impractical, especially compared to existing, cheaper technologies like seismic detectors, he said. **Instead, Bernstein turned his attention to using the gadolinium-doped technology to catch neutrinos from nuclear reactors. “Since we’re still mostly using water, it is possible to build large detectors, up to 100 kilotons in size or more, to spot these reactor neutrinos,”** said Bernstein, now a staff physicist at the Lawrence Livermore National Laboratory (LLNL) and director of the lab’s Rare Event Detection group in the Nuclear and Chemical Sciences division. **“The neutrino signature would stand out much more readily above background radiation even in a big detector,”** he said. LLNL is the lead laboratory for a proposed United States/United Kingdom experiment, called WATCHMAN, to **demonstrate remote monitoring of nuclear reactors using a kiloton-scale antineutrino detector.** This experiment has already “exceeded my expectations,” Bernstein said. **“The idea that the nonproliferation community might one day be able to use this technology that until now has been the exclusive province of fundamental science is an exciting motivation for this work.”**

Halting the spread of nukes Since 1970, nearly 200 nations signed the landmark Treaty of the Non-Proliferation of Nuclear Weapons (NPT), which seeks to limit the spread of nuclear weapons. **Through a combination of remote monitoring and on-the-ground inspections, containment and surveillance, the International Atomic Energy Agency (IAEA) commands plenty of tools to figure out if countries are using nuclear energy for peaceful purposes, Goldblum said. But what happens if the line between civilian and military use of nuclear energy is not so clear?** For example, the United States has long accused Iran of

trying to make nuclear weapons, but Iran says it wants to develop nuclear capabilities for civilian power generation. The knowledge to construct a nuclear bomb is actually pretty well known. The hard part is getting enough materials — either enriched uranium or plutonium — to fuel the weapon. A country can reprocess the spent fuel from a civilian nuclear reactor and extract plutonium for a weapon. And a nuclear bomb only requires about 10 kilograms of plutonium. The so-called “dual-use” capabilities of nuclear reactors presents a significant challenge to the IAEA. “None of the countries now embarking on civil nuclear power programs say they are planning to acquire reprocessing capabilities,” according to a 2017 report by the Brookings Institute think tank. “But many of them are unwilling to forswear what they consider to be their ‘right’ eventually to have dual-use capabilities.” The neutrino detection technology could offer a solution. In addition to the large systems like WATCHMAN, scientists have constructed much smaller detectors that can be deployed close to reactor cores — provided operators allow such access. Optimizing reactor power levels to produce plutonium, a telltale sign that a country is trying to build a bomb, will change the rate and energy spectrum of antineutrinos that a device parked outside of the reactor can detect. And since these particles can pass through matter, the operator can’t shield the reactor’s release of antineutrinos the same way lead blocks X-rays. So if a country wants to operate a civilian nuclear power program, an antineutrino detector could provide an effective tool to continuously verify the reactor is only producing energy for peaceful purposes. For now, a detector must stay within tens of meters of the reactor to be effective. But in the future, could such technology spot antineutrinos from longer distances and even across borders? For distances 100 kilometers or beyond, the Review of Modern Physics study shows detectors would need to be 10 to 100 times bigger than WATCHMAN. But researchers hope WATCHMAN will demonstrate the basic technology and provide a platform for study of a range of possible enhancements to improve standoff and overall sensitivity. And in any case, the mere knowledge that such technology has become a reality could prove to be a powerful deterrent to nuclear proliferation in itself.

Proliferation risks unravelling now due to inability to determine peaceful and military nuclear development.

Dalton and Levite 22 Toby Dalton and Ariel Levite 1-13-2022 "The Nonproliferation Regime is Breaking" <https://archive.is/MQ4sC#selection-1881.0-1917.304> (TOBY DALTON is Senior Fellow and Co-Director of the Nuclear Policy Program at the Carnegie Endowment for International Peace. ARIEL (ELI) LEVITE is Senior Fellow in the Nuclear Policy Program and Cyber Policy Initiative at the Carnegie Endowment for International Peace.)//Elmer

The global system to prevent nuclear proliferation and promote disarmament is beginning to fray. Although the nonproliferation regime has held together for more than half a century, more countries are acquiring sensitive nuclear material and technology through illicit acquisition and preferential trade. In May 2021, for instance, the International Atomic Energy Agency (IAEA) reported that Iran had accumulated ten kilograms of highly enriched uranium and severely restricted access to its nuclear sites. And in October 2021, Australia, the United Kingdom, and the United States announced a new strategic partnership (AUKUS) that will make Australia the first ever nonnuclear state to

receive highly enriched fuel for nuclear-powered submarines. It is unlikely Australia would divert this uranium to make bombs, but it establishes a dangerous precedent. These two cases typify the growing challenges faced by the nonproliferation system. Historically, the framework set in place by the 1970 Nuclear Nonproliferation Treaty (NPT) relied on development limits and international monitoring of uranium enrichment and plutonium reprocessing to succeed. But the spread of these sensitive nuclear materials and technologies is substantially degrading both processes. **It is increasingly difficult to distinguish between nuclear programs designed for peaceful purposes and those that aim to yield bombs.**

The IAEA toolkit to detect concerning activity, flag it, and address it diplomatically risks obsolescence. **To restore the nonproliferation regime's role as a bulwark of global stability**, international nonproliferation institutions and states **need new ways to track** and tackle the development of **nuclear weapons**. This requires an innovative approach to monitoring and constraining dangerous activity. But given that more countries are acquiring or producing highly enriched uranium, material constraints alone are not enough. **Monitors will need fresh tools to credibly track additional indicators of potential bomb activity that are hard to pass off as peaceful in nature, such as weaponization: the development and manufacture of nuclear warheads for missiles or other delivery vehicles**. Monitoring this kind of activity, in particular, goes beyond the traditional focus of nuclear observers, but it may now offer the best, most reliable way to know whether states are trying to acquire nuclear weapons. Given the global rise in nuclear activity, the world should move quickly to create such a system. **When existing powers are less able to prevent uranium enrichment—and even hand over highly enriched material to other countries—it incentivizes competitors to double down** on their programs. **When new states develop bombs, it further encourages proliferation**. Especially in an era of growing geopolitical competition, the international community needs more indicative information on the spread of nuclear weapons so that diplomacy can head off destabilizing proliferation and arms races.

SHIELDING THE WORLD The NPT is the cornerstone of the nonproliferation order. It requires that nonnuclear states avoid acquiring weapons (Article II), allows all states access to nuclear technology for peaceful purposes (Article IV), and commits the signatories with nuclear weapons—China, France, Russia, the United Kingdom, and the United States—to eventually disarm (Article VI). In practice, this regime limits state possession of and the operation of technology used to produce the fissile materials needed for nuclear weapons: highly enriched uranium and plutonium. And it empowers the IAEA to stringently scrutinize nuclear research and energy programs, enforce nuclear safeguards, and detect clandestine production. Although its powers of enforcement are limited, the NPT has endured due to a combination of IAEA monitoring, strict nuclear trade regulations by multilateral institutions, and commitments by individual member states to abide by the rules. The United States has historically played an important role in leading and augmenting this regime, mostly with the Soviet Union and later with Russia. To uphold the NPT bargain, Washington cooperated with many partner countries through the Atoms for Peace program, sharing technology and materials to advance nuclear energy and research in states that swore off atomic weapons. U.S. agencies also operated programs to constrain the spread of enriched uranium and nuclear production technology, promote transparency in civilian nuclear material, and convert research reactors from high- to low-enriched fuel. By doing so, Washington further slowed the accumulation of fissile and sensitive technology. Other nuclear states supported or at least acceded to these efforts, tightly restricting the flow of key materials and technologies. The system isn't perfect. There are inherent tensions in the NPT bargain, which allows some states to hold weapons while banning others from acquiring them. The world has experienced periodic proliferation crises that exposed gaping holes in the regime, such as in 1991, when observers discovered that Iraq had a clandestine program for producing nuclear weapons. Sometimes, the NPT has failed to stop weapons development altogether, as happened in North Korea, which withdrew from the treaty when its program was exposed. And three nuclear-armed states—India, presumably Israel, and Pakistan—never joined the NPT. But remarkably, this package has generally held together for decades. Most countries that at one time had nuclear weapons aspirations walked them back, such as South Korea, Sweden, and Switzerland. South Africa voluntarily disarmed, dismantling the six nuclear bombs it had secretly built, and joined the NPT as a nonnuclear state. The world averted close calls, including one resulting from the demise of the Soviet Union, which could have easily yielded four nuclear states instead of one, and another in Iran, which was stopped en route in 2003. If anything, the norm against proliferation has grown stronger over time. Today, only six states without nuclear weapons have the indigenous capability to produce fissile materials—Argentina, Brazil, Germany, Iran, Japan, and the Netherlands—a testament to the efficacy of the regime. But there are multiple signs that this record may not continue. **DANGEROUS DECAY** Some of the recent problems with the nonproliferation system derive from the stalled progress toward nuclear disarmament by states with nuclear weapons. After Russia and the United States

dramatically slashed their Cold War nuclear arsenals by retiring obsolete systems, arms reductions have come to a standstill in both countries in the last decade. Now, they are modernizing their arsenals, as are China, India, Pakistan, and the United Kingdom. This has prompted many nonnuclear states to push forward a nominally complementary but practically competing UN Treaty on the Prohibition of Nuclear Weapons. (The treaty calls for a categorical ban on the possession of nuclear weapons by the signatories, and it has been rejected by all nuclear weapons states and their allies.) Other issues come from the behavior of nuclear states outside the system, most problematically North Korea. But the most worrisome problem is that the barrier between peaceful nuclear activity and weapons development is eroding. Most of the damaging erosion has been done by the weapons states themselves, via ad hoc arrangements to advance other strategic interests. Notably, the 2005 U.S.-Indian nuclear deal, endorsed in 2008 by the Nuclear Suppliers Group—one of the principal institutions that regulates nuclear sales—enabled the United States and others to trade technology with India alongside carve-outs that permitted unsafeguarded Indian nuclear activity for weapons development. Then, the NPT's 2010 Review Conference affirmed that states pursuing nuclear energy had an unconditional right to fully access nuclear technology, regardless of necessity. The 2015 Iran nuclear deal, the Joint Comprehensive Plan of Action, capped Iran's uranium enrichment program but walked back an earlier understanding (in the preliminary 2013 Joint Plan of Action) that Iranian enrichment activities would be limited to what Tehran needed for its peaceful program. Both the United States and Iran have since undermined the deal, leaving Iran, according to IAEA Director General Rafael Grossi, enriching uranium to concentrations that "only countries making bombs are reaching." There are other prominent carve-outs in the system. In 2010, China violated supplier rules by agreeing to construct additional nuclear power reactors in Pakistan, and in 2010 and 2017, Russia signed nuclear deals with Turkey and Egypt, respectively, without requiring (as far as is publicly known) that Ankara or Cairo forego developing fissile materials. Washington's efforts to promote a "gold standard" for nuclear trade, in which recipients renounce the ability to produce enriched plutonium and uranium, foundered after it was introduced, in 2009, due to opposition from most prospective clients, including Saudi Arabia, and the U.S. government's own desire to revitalize the domestic nuclear industry through power plant exports. Collectively, this decay in the NPT's rules has made it easier for nonnuclear states to obtain fissile materials, blurring the primary distinction between peaceful nuclear programs and military ones. Countries with weapons aspirations can now more easily hide their ambitions—and progress—in plain sight.

Nuclear Proliferation causes Nuclear War.

Kroenig 15 (Matthew Kroenig; Associate Professor and International Relations Field Chair in the Department of Government and School of Foreign Service at Georgetown University; 2015, "The History of Proliferation Optimism: Does It Have a Future?"; *Journal of Strategic Studies*, Volume 38, Issue 1-2)//Re-cut by Elmer

The spread of nuclear weapons poses at least six severe threats to international peace and security including: nuclear war, nuclear terrorism, global and regional instability, constrained US freedom of action, weakened alliances, and further nuclear proliferation. Each of these threats has received extensive treatment elsewhere and this review is not intended to replicate or even necessarily to improve upon these previous efforts. Rather the goals of this section are more modest: to usefully bring together and recap the many reasons why we should be pessimistic about the likely consequences of nuclear proliferation. Many of these threats will be illuminated with a discussion of a case of much contemporary concern: Iran's advanced nuclear program. Nuclear War The greatest threat posed by the spread of nuclear weapons is nuclear war. The more states in possession of nuclear weapons, the greater the probability that somewhere, someday, there will be a catastrophic nuclear war. To date, nuclear weapons have only been used in warfare once. In 1945, the United States used nuclear weapons on Hiroshima and Nagasaki, bringing World War II to a close. Many analysts point to the 65-plus-year tradition of nuclear non-use as evidence that nuclear weapons are unusable, but it would be naïve to think that nuclear weapons will never be used again simply because they have not been used for some time. After all, analysts in the 1990s argued that worldwide economic downturns like the Great Depression were a thing of the past, only to be surprised by the dot-com bubble bursting later in the decade and the Great Recession of the late 2000s.⁴⁸ This author, for one, would be surprised if nuclear

weapons are not used again sometime in his lifetime. Before reaching a state of MAD, new nuclear states go through a transition period in which they lack a secure-second strike capability. In this context, one or both states might believe that it has an incentive to use nuclear weapons first. For example, if Iran acquires nuclear weapons, neither Iran, nor its nuclear-armed rival, Israel, will have a secure, second-strike capability. Even though it is believed to have a large arsenal, given its small size and lack of strategic depth, Israel might not be confident that it could absorb a nuclear strike and respond with a devastating counterstrike. Similarly, Iran might eventually be able to build a large and survivable nuclear arsenal, but, when it first crosses the nuclear threshold, Tehran will have a small and vulnerable nuclear force. In these pre-MAD situations, there are at least three ways that nuclear war could occur. First, the state with the nuclear advantage might believe it has a splendid first strike capability. In a crisis, Israel might, therefore, decide to launch a preventive nuclear strike to disarm Iran's nuclear capabilities. Indeed, this incentive might be further increased by Israel's aggressive strategic culture that emphasizes preemptive action. Second, the state with a small and vulnerable nuclear arsenal, in this case Iran, might feel use them or lose them pressures. That is, in a crisis, Iran might decide to strike first rather than risk having its entire nuclear arsenal destroyed. Third, as Thomas Schelling has argued, nuclear war could result due to the reciprocal fear of surprise attack.⁴⁹ If there are advantages to striking first, one state might start a nuclear war in the belief that war is inevitable and that it would be better to go first than to go second. Fortunately, there is no historic evidence of this dynamic occurring in a nuclear context, but it is still possible. In an Israeli-Iranian crisis, for example, Israel and Iran might both prefer to avoid a nuclear war, but decide to strike first rather than suffer a devastating first attack from an opponent. Even in a world of MAD, however, when both sides have secure, second-strike capabilities, there is still a risk of nuclear war. Rational deterrence theory assumes nuclear-armed states are governed by rational leaders who would not intentionally launch a suicidal nuclear war. This assumption appears to have applied to past and current nuclear powers, but there is no guarantee that it will continue to hold in the future. Iran's theocratic government, despite its inflammatory rhetoric, has followed a fairly pragmatic foreign policy since 1979, but it contains leaders who hold millenarian religious worldviews and could one day ascend to power. We cannot rule out the possibility that, as nuclear weapons continue to spread, some leader somewhere will choose to launch a nuclear war, knowing full well that it could result in self-destruction. One does not need to resort to irrationality, however, to imagine nuclear war under MAD. Nuclear weapons may deter leaders from intentionally launching full-scale wars, but they do not mean the end of international politics. As was discussed above, nuclear-armed states still have conflicts of interest and leaders still seek to coerce nuclear-armed adversaries. Leaders might, therefore, choose to launch a limited nuclear war.⁵⁰ This strategy might be especially attractive to states in a position of conventional inferiority that might have an incentive to escalate a crisis quickly to the nuclear level. During the Cold War, the United States planned to use nuclear weapons first to stop a Soviet invasion of Western Europe given NATO's conventional inferiority.⁵¹ As Russia's conventional power has deteriorated since the end of the Cold War, Moscow has come to rely more heavily on nuclear weapons in its military doctrine. Indeed, Russian strategy calls for the use of nuclear weapons early in a conflict (something that most Western strategists would consider to be escalatory) as a way to de-escalate a crisis. Similarly, Pakistan's military plans for nuclear use in the event of an invasion from conventionally stronger India. And finally, Chinese generals openly talk about the possibility of nuclear use against a US superpower in a possible East Asia contingency. Second, as was also discussed above, leaders can make a 'threat that leaves something to chance'.⁵² They can initiate a nuclear crisis. By playing these risky games of nuclear brinkmanship, states can increase the risk of nuclear war in an attempt to force a less resolved adversary to back down. Historical crises have not resulted in nuclear war, but many of them, including the 1962 Cuban Missile Crisis, have come close. And scholars have documented historical incidents when accidents nearly led to war.⁵³ When we think about future nuclear crisis dyads, such as Iran and Israel, with fewer sources of stability than existed during the Cold War, we can see that there is a real risk that a future crisis could result in a devastating nuclear exchange. Nuclear Terrorism The spread of nuclear weapons also increases the risk of nuclear terrorism.⁵⁴ While September 11th was one of the greatest tragedies in American history, it would have been much worse had Osama Bin Laden possessed nuclear weapons. Bin Laden declared it a 'religious duty' for Al-Qa'eda to acquire nuclear weapons and radical clerics have issued fatwas declaring it permissible to use nuclear weapons in Jihad against the West.⁵⁵ Unlike states, which can be more easily deterred, there is little doubt that if terrorists acquired nuclear weapons, they would use them.⁵⁶ Indeed, in recent years, many US politicians and security analysts have argued that nuclear terrorism poses the greatest threat to US national security.⁵⁷ Analysts have pointed out the tremendous hurdles that terrorists would have to overcome in order to acquire nuclear weapons.⁵⁸ Nevertheless, as nuclear weapons spread, the possibility that they will eventually fall into terrorist hands increases. States could intentionally transfer nuclear weapons, or the fissile material required to build them, to terrorist groups. There are good reasons why a state might be reluctant to transfer nuclear weapons to terrorists, but, as nuclear weapons spread, the probability that a leader might someday purposely arm a terrorist group increases. Some fear, for example, that Iran, with its close ties to Hamas and Hizballah, might be at a heightened risk of transferring nuclear weapons to terrorists. Moreover, even if no state would ever intentionally transfer nuclear capabilities to terrorists, a new nuclear state, with underdeveloped security procedures, might be

vulnerable to theft, allowing terrorist groups or corrupt or ideologically-motivated insiders to transfer dangerous material to terrorists. There is evidence, for example, that representatives from Pakistan's atomic energy

establishment met with Al-Qa'eda members to discuss a possible nuclear deal.⁵⁹ Finally, a nuclear-armed state could collapse,

resulting in a breakdown of law and order and a loose nukes problem. US officials are currently very concerned about what would happen to Pakistan's nuclear weapons if the government were to fall. As nuclear weapons spread, this problem is only further amplified. Iran is a country with a history of revolutions and a government with a tenuous hold on power. The regime change that Washington has long dreamed about in Tehran could actually become a nightmare if a nuclear-armed Iran suffered a breakdown in authority, forcing us to worry about the fate of Iran's nuclear arsenal. Regional Instability The spread of nuclear weapons also emboldens nuclear powers, contributing to regional instability. States that lack nuclear weapons need to fear direct military attack from other states, but states with nuclear weapons can be confident that they can deter an intentional military attack, giving them an incentive to be more aggressive in the conduct of their foreign policy. In this way, nuclear weapons provide a shield under which states can feel free to engage in lower-level aggression. Indeed, international relations theories about the 'stability-instability paradox' maintain that stability at the nuclear level contributes to conventional instability.⁶⁰ **Historically,** we have seen that **the spread of nuclear weapons** has emboldened their possessors

and contributed to regional instability. Recent scholarly analyses have demonstrated that, after controlling for other relevant factors, nuclear-weapon states are more likely to engage in conflict than nonnuclear-weapon states and that **this aggressiveness is more pronounced in new nuclear**

states that have less experience with nuclear diplomacy.⁶¹ Similarly, research on internal decision-making in Pakistan reveals that Pakistani foreign policymakers may have been emboldened by the acquisition of nuclear weapons, which encouraged them to initiate militarized disputes against India.⁶² Currently, Iran restrains its foreign policy because it fears major military retaliation from the United States or Israel, but with nuclear weapons it

could feel free to push harder. A nuclear-armed Iran would likely step up support to terrorist and proxy groups and engage in more aggressive coercive diplomacy. With a nuclear-armed Iran increasingly throwing its weight around in the

region, **we could witness an even more crisis prone Middle East. And in a poly-nuclear Middle East**

with Israel, Iran, and, in the future, possibly other states, armed with nuclear weapons, **any one of those crises could result in a catastrophic nuclear exchange.**

Nuke war causes extinction AND outweighs other existential risks

- Checked

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

<http://www.reachingcriticalwill.org/images/documents/Disarmament-fora/OEWG/2016/Documents/NGO13.pdf> //Re-cut by Elmer

Consequences human survival 12. **Even if the 'other' side does NOT launch** in response the smoke from 'their' burning cities (incinerated by 'us') **will still make** 'our' country (and the rest of **the world**) **uninhabitable,** potentially **inducing global famine** lasting up to **decades.** Toon and Robock note in 'Self Assured Destruction', in the Bulletin of Atomic Scientists 68/5, 2012, that: 13. **"A nuclear war between Russia and the United States, even after the arsenal reductions planned under New START, could produce a nuclear winter.**

Hence, an attack by either side could be suicidal, **resulting in self assured destruction. Even a 'small'**

nuclear war between India and Pakistan, with each country detonating 50 Hiroshima-size atom bombs--only about 0.03 percent of the global nuclear arsenal's explosive power--as air bursts in urban areas, **could produce** so much **smoke that**

temperatures would fall below those of the Little Ice Age of the fourteenth to nineteenth centuries, shortening the growing season around the world and threatening the global food supply.

Furthermore, there would be massive ozone depletion, allowing more ultraviolet radiation to reach Earth's surface. Recent studies predict that agricultural production in parts of the United States and China

would decline by about 20 percent for four years, and by 10 percent for a decade.” 14. A conflagration involving USA/NATO

forces and those of Russian federation would most likely cause the deaths of most/nearly all/all humans (and severely impact/extinguish other species) as well as destroying the delicate interwoven

techno-structure on which latter-day 'civilization' has come to depend. Temperatures would drop to below those of the last ice-age for up to 30 years as a result of the lofting of up to 180 million tonnes of very black soot into the stratosphere where it would remain for decades. 15.

Though human ingenuity and resilience shouldn't be underestimated, human survival itself is arguably problematic, to put it mildly, under a 2000+ warhead USA/Russian federation scenario. 16. The Joint Statement on

Catastrophic Humanitarian Consequences signed October 2013 by 146 governments mentioned 'Human Survival' no less than 5 times. The most recent (December 2014) one gives it a highly prominent place. Gareth Evans' ICNND (International Commission on

Nuclear Non-proliferation and Disarmament) Report made it clear that it saw the threat posed by nuclear weapons use as one that at least threatens what we now call 'civilization' and that potentially threatens

human survival with an immediacy that even climate change does not, though we can see the results of climate change here and now and of course the immediate post-nuclear results for Hiroshima and Nagasaki as well.

immediate post-nuclear results for Hiroshima and Nagasaki as well.

1AC: Framing

The Standard is maximizing expected wellbeing

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

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

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

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

Evolutionary theories of pleasure: The love connection BO:D

Charles Darwin and other biological scientists that have examined the biological evolution and its basic principles found various mechanisms that steer behavior and biological development. Besides their theory on natural selection, it

was particularly the sexual selection process that gained significance in the latter context over the last century, especially when it comes to the question of what makes us “what we are,” i.e., human. However, the capacity to sexually select and evolve is not at all a human accomplishment alone or a sign of our uniqueness; yet, we humans, as it seems, are ingenious in fooling ourselves and others—when we are in love or desperately search for it.

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

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

There have been theories linking pleasure as a required component of health benefits salutogenesis, (salutogenesis). 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 afterlife. 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 shifting 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 – Extinction outweighs under any framework

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

There appears to be lot of disagreement in moral philosophy. Whether these many apparent disagreements are deep and irresolvable, I believe there is at least one thing it is reasonable to agree on right now, whatever general moral view we adopt: that it is very important to reduce the risk that all intelligent beings on this planet are eliminated by an enormous catastrophe, such as a nuclear war. How we might in fact try to reduce such existential risks is discussed elsewhere. My claim here is only that we – whether we’re consequentialists, deontologists, or virtue ethicists – should all agree that we should try to save the world. According to consequentialism, we should maximize the good, where this is taken to be the goodness, from an impartial perspective, of outcomes. Clearly one thing that makes an outcome good is that the people in it are doing well.

There is little disagreement here. If the happiness or well-being of possible future people is just as important as that of people who already exist, and if they would have good lives, it is not hard to see how **reducing existential risk is easily the most important thing in the whole world.** This is for the familiar reason that there are **so many people who could exist in the future** – there are **trillions upon trillions**... upon trillions. There are so many possible future people that **reducing existential risk is arguably the most important thing in the world, even if the well-being of these possible people were given only 0.001% as much weight** as that of existing people. Even on a wholly person-affecting view – according to which there's nothing (apart from effects on existing people) to be said in favor of creating happy people – the case for reducing existential risk is very strong. As noted in this seminal paper, this case is strengthened by the fact that there's a good chance that many existing people will, with the aid of life-extension technology, live very long and very high quality lives. You might think what I have just argued applies to consequentialists only. There is a tendency to assume that, if an argument appeals to consequentialist considerations (the goodness of outcomes), it is irrelevant to non-consequentialists. But **that is a huge mistake.** Non-consequentialism is the view that there's more that determines rightness than the goodness of consequences or outcomes; **it is not the view that the latter don't matter.** Even John Rawls wrote, "All ethical doctrines worth our attention take consequences into account in judging rightness. One which did not would simply be irrational, crazy." **Minimally plausible versions of deontology and virtue ethics must be concerned in part with promoting the good, from an impartial point of view.** They'd thus imply very strong reasons to reduce existential risk, at least when this doesn't significantly involve doing harm to others or damaging one's character. What's even more surprising, perhaps, is that even if our own good (or that of those near and dear to us) has much greater weight than goodness from the impartial "point of view of the universe," indeed even if the latter is entirely morally irrelevant, we may nonetheless have very strong reasons to reduce existential risk. Even egoism, the view that each agent should maximize her own good, might imply strong reasons to reduce existential risk. It will depend, among other things, on what one's own good consists in. If well-being consisted in pleasure only, it is somewhat harder to argue that egoism would imply strong reasons to reduce existential risk – perhaps we could argue that one would maximize her expected hedonic well-being by funding life extension technology or by having herself cryogenically frozen at the time of her bodily death as well as giving money to reduce existential risk (so that there is a world for her to live in!). I am not sure, however, how strong the reasons to do this would be. But views which imply that, if I don't care about other people, I have no or very little reason to help them are not even minimally plausible views (in addition to hedonistic egoism, I here have in mind views that imply that one has no reason to perform an act unless one actually desires to do that act). To be minimally plausible, egoism will need to be paired with a more sophisticated account of well-being. To see this, it is enough to consider, as Plato did, the possibility of a ring of invisibility – suppose that, while wearing it, Ayn could derive some pleasure by helping the poor, but instead could derive just a bit more by severely harming them. Hedonistic egoism would absurdly imply she should do the latter. To avoid this implication, egoists would need to build something like the meaningfulness of a life into well-being, in some robust way, where this would to a significant extent be a function of other-regarding concerns (see chapter 12 of this classic intro to ethics). But once these elements are included, we can (roughly, as above) argue that this sort of egoism will imply strong reasons to reduce existential risk. Add to all of this Samuel Scheffler's recent intriguing arguments (quick podcast version available here) that most of what makes our lives go well would be undermined if there were no future generations of intelligent persons. On his view, my life would contain vastly less well-being if (say) a year after my death the world came to an end. So obviously if Scheffler were right I'd have very strong reason to reduce existential risk. **We should also take into account moral uncertainty.** What is it reasonable for one to do, when one is uncertain not (only) about the empirical facts, but also about the moral facts? I've just argued that there's agreement among minimally plausible ethical views that we have strong reason to reduce existential risk – not only consequentialists, but also deontologists, virtue ethicists, and sophisticated egoists should agree. But even those (hedonistic egoists) who disagree should have a significant level of confidence that

they are mistaken, and that one of the above views is correct. Even if they were 90% sure that their view is the correct one (and 10% sure that one of these other ones is correct), they would have pretty strong reason, from the standpoint of moral uncertainty, to reduce existential risk. Perhaps most disturbingly still, **even if we are only 1% sure that the well-being of possible future people matters,** it is at least arguable that, **from the standpoint of moral uncertainty, reducing existential risk is the most important thing in the world.** Again, this is largely for the reason that there are so many people who could exist in the future – there are trillions upon trillions... upon trillions. (For more on this and other related issues, see this excellent dissertation). Of course, it is uncertain whether these untold trillions would, in general, have good lives. It's possible they'll be miserable. It is enough for my claim that there is moral agreement in the relevant sense if, at least given certain empirical claims about what future lives would most likely be like, all minimally plausible moral views would converge on the conclusion that we should try to save the world. While there are some non-crazy views that place significantly greater moral weight on avoiding suffering than on promoting happiness, for reasons others have offered (and for independent reasons I won't get into here unless requested to), they nonetheless seem to be fairly implausible views. And even if things did not go well for our ancestors, I am optimistic that they will overall go fantastically well for our descendants, if we allow them to. I suspect that most of us alive today – at least those of us not suffering from extreme illness or poverty – have lives that are well worth living, and that things will continue to improve. Derek Parfit, whose work has emphasized future generations as well as agreement in ethics, described our situation clearly and accurately: "We live during the hinge of history. Given the scientific and technological discoveries of the last two centuries, the world has never changed as fast. We shall soon have even greater powers to transform, not only our surroundings, but ourselves and our successors. If we act wisely in the next few centuries, humanity will survive its most dangerous and decisive period. Our descendants could, if necessary, go elsewhere, spreading through this galaxy.... Our descendants might, I believe, make the further future very good. But that good future may also depend in part on us. If our selfish recklessness ends human history, we would be acting very wrongly." (From chapter 36 of *On What Matters*)

UV

- Yes 1AR Theory - k2 checking NC abuse else guarantees infinite abuse & magnifies unfairness
- No RVIs on 1AR Theory - they'll just stick me with 6 minutes of frontline and brute force a ballot for "not being abusive?"

Overview

Private entities don't care about legislation, they will appropriate lunar heritage sites now. Lunar Heritage sites are key to moon basing since they are critical for research around the impacts of dust and moon conditions.

First scenario is that moon basing produces the best observatories that solve for climate change through adaption. We are missing data that allows us to best adapt and moon observatories uniquely solve.

Second scenario is neutrinos, earth's atmosphere limits neutrino research. Neutrino research allows us to detect antineutrinos from nuclear weapons using tech developed on the moon. This deters proliferation by detecting illicit nuclear weapons products. Else proliferation will cause nuclear war its try or die.

4 – Death is bad and o/w—ontologically destroys the subject. Death is prereq to your ontology

Paterson 1 – Department of Philosophy, Providence College, Rhode Island. (Craig, "A Life Not Worth Living?", Studies in Christian Ethics, <http://sce.sagepub.com>)

Contrary to those accounts, I would argue that it is **death** per se that is really the **objective evil** for us, not because it deprives us of a prospective future of overall good judged better than the alternative of non-being. It cannot be about harm to a former person who has ceased to exist, for no person actually suffers from the subsequent non-participation. Rather, **death in itself is an evil to us because it ontologically destroys the current existent subject** – it is the ultimate in **metaphysical lightening strikes**.⁸⁰ The evil of death is truly an ontological evil borne by the person who already exists, **independently of calculations about better or worse possible lives. Such an evil need not be consciously experienced** in order to be an evil for the kind of being a human person is. **Death** is an evil because of the change in kind it brings about, a change that **is destructive of the type of entity that we essentially are. Anything**, whether caused naturally or caused by human intervention (intentional or unintentional), **that drastically interferes in the process of maintaining the person in existence is an objective evil** for the person. What is crucially at stake here, and is dialectically supportive of the self-evidence of the basic good of human life, is that death is a radical interference with the current life process of the kind of being that we are. In consequence, **death itself can be credibly thought of as a 'primitive evil' for all persons, regardless of the extent to which they are currently or prospectively capable of participating in a full array of the goods of life**.⁸¹ In conclusion, concerning willed human actions, it is justifiable to state that **any intentional rejection of human life itself cannot therefore be warranted since it is an expression of an ultimate disvalue** for the subject, namely, the destruction of the present person; a radical ontological good that we cannot begin to weigh objectively against the travails of life in a rational manner. To deal with the sources of disvalue (pain, suffering, etc.) we should not seek to irrationally destroy the person, the very source and condition of all human possibility.⁸²

AT: Shell

Counterinterp: The aff can fiat a plan in order to prove their general thesis

You don't meet your own interp since you literally fiat the anarchist space program

Prefer –

1] Debatability - Almost all topics happen in the future in order to access edu we need fiat

2] Topic Lit - Most of the topic lit is about future projects internal link to edu

3] Truth Testing is horrible its forces us to generic phil which limits edu about native liberation in space or afro futurism for ex. We intrinsically view consequences

TURN. Being semantically correct in ONE way justifies marginalizing forms of English and language that are not “correct” which is violent and excludes them from the debate space. Link turns your ROB since dialogue is the method of rejection,.

Rebar **Niemi**, *Mr. Nebel's neighborhood, OR Nebel Tea I sip it.* 2015

Though I believe Mr. Nebel to be fundamentally wrong on the debate theoretical level, I have a more serious objection. I will make this claim in the strongest terms I possibly can. Correctness is racism. Correctness is “you must be either a boy or a girl or you are wrong.” Correctness is “the ideal functioning body versus all others.” Correctness is one kind of person having access to The Truth and others lacking it. Correctness is “sit down and shut up.” Correctness is “your kind aren't welcome here.” Any debater who runs so called **“Nebel T” and any judge who votes for this argument must**

acknowledge that they are situationally and strategically embracing a perspective from which there is an implicit or explicit metric of what it means to be a competent english speaker. What is the logical conclusion of speaking

competent english? **The notion that “mongrel” forms of english are inferior,** diminished,

unpersuasive, **and should not have access to the ballot.** Quite possibly the notion that those who

can't live up to these standards should not be involved in debate. After all, *their* dialects are not what resolutions are written in – it is people like Mr. Nebel whose dialect prescribes correct resolutional meaning. You may say that “competent speakers” was a rhetorical flourish, I am nitpicking, and that Mr. Nebel should certainly be allowed to take back his offensive speech. I will say this:

the **competent english speaker, aka the correct type of thinking and being, is the fundamental goal and top-level value that Mr. Nebel appeals to** throughout his

articles. If this is “not what he meant” then he did not mean that debaters should pay any attention to nor follow his logic. Either he defends correctness or he concedes the irrelevance and negative impacts to fairness and education of his position. Nebel may appeal to pragmatics as a way out of the appeal to correctness, but in fact, his pragmatic claims are a pragmatic justification for correctness. This concedes pragmatics first anyway, and that so to speak, is a flow I can win on. It is my opinion that there is no in or

out of round benefit that correctness could provide sufficient to outweigh the toxicity of its implementation and rhetorical

methodology. In one sense we should be thankful that Mr. Nebel has let the cat out of the bag: **T arguments from the**

perspective of correctness have always been the vehicle for racism and

exclusion of all sorts. I cannot imagine a construction of competent english or correct grammar that is not racialized,

gendered, and further influenced by its origins. To me it is impossible to endorse the claim to correctness without conceding that one is invested in a justification of domination (of course they won't call it that) stretching across axes of class, race, gender, flesh, and cultural origin. The one place where Mr. Nebel speaks to this question, he dismisses it by claiming that specific examples are insufficient to deal with the bare plurality of his arguments. Mr. Nebel is kind to differentiate for us that there is "generic" or "competent" english, and that is its own dialect, where as these other dialects or ways of speaking are simply different uncomparable dialects. This truly tests my credulity. Are higher pitched so-called "feminine" voices less competent speakers of english? Are those who have read words in books but never heard them pronounced due to lack of high-grade prep school educations less competent? What about those who speak in accents, vernaculars, or dialects of english? For that matter, what about overlaps and points of connection between those ways of speaking and "generic english?" We can easily assume what Mr. Nebel thinks about speech impediments, or those who are unfamiliar with formal usage of grammar. Perhaps even run on sentences disqualify one from being a competent english speaker? Or an overabundance of rhetorical questions? Does anyone have memorized the full and formal set of rules for speaking competent or proper english? Does anyone actually trust that all those rules aren't implicitly ideological? It is hard to believe that Mr. Nebel is blind to the values he endorses. Perhaps we should accurately hold him to them. I am proud to be an incompetent english speaker. No way will I speak correct english for Mr. Nebel, and no way will I designate any student the worse debater for failing to live up to a standard that is entirely dependent on a single way of interpreting how to speak, think, and be in the world. Mr. Nebel has read too much of his neighbors in analytic philosophy and not enough James, either C.L.R. or William. The only impact to semantic difference is a pragmatic one or it is merely a claim that "the rules are the rules." Truth has no value if it does not "work" in the world or is actively opposed to what does work. **His claim to lexical priority is false**

generally and specifically in debate. He does not understand how a T debate should work. **More**

disturbingly, he is wholly disconnected from the concrete history of

violence that correctness in language embraces and grows out of. In Mr. Nebel's

neighborhood, we had (and have to) kill the indian to save the person. In Mr. Nebel's neighborhood of debate, all the folks are the same, equally well off, and nobody says y'all.

Our warrant is just more reasonable - We can't engage a topic without using fiat