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30 December 2019| Draft

Symbolic Disconnection from the Stars and the Universe?

Surreptitious global implementation of full-spectrum dominance and shielding

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Connecting the dots -- recognizing the pattern
Overt consequences of ongoing technological initiatives
Psycho-social and covert implications of star loss
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Produced in anticipation of the imminent launch of a vast array of communications satellites

Connecting the dots -- recognizing the pattern

This is an exercise in noting a pattern to very recent events and their implications for the immediate future.

Unilateral mass launching of thousands of satellites: The Starlink satellite constellation is a formation by SpaceX, purportedly to provide global broadband Internet service. In June 2015 the company requested the US regulatory authorities for permission to begin testing for a project that aimed to build a constellation of 4,425 satellites in 1,100 km orbits capable of beaming the Internet to the entire globe, including the remotest currently lacking Internet access. As of March 2017, plans were filed with those authorities to field a constellation of an additional 7,518 "V-band satellites in non-geosynchronous orbits to provide communications services" in an electromagnetic spectrum that had not previously been heavily employed for commercial communications services. As of November 2019, some 122 satellites had been launched, with the ultimate goal of **deploying some 12,000 satellites by the mid-2020s**.

- Stephen Clark: *SpaceX poised to accelerate launch cadence with series of Starlink missions* (*Spaceflight Now*, 20 December 2019)
- Tim Fernholz: *SpaceX builds out satellite network with a milestone launch* (*Quartz*, 11 November 2019)
- *Why SpaceX and Amazon plan to drastically increase the number of satellites orbiting Earth* (*CNBC News*, 15 December 2019)
- *SpaceX wants to triple the number of satellites in our skies* (*World Economic Forum*, 5 January 2017)

Amazon is planning a constellation of 3,200 satellites. OneWeb (a UK company) is aiming to launch 650 satellites -- potentially to be increased to 2,000 if there is enough customer demand. As of the beginning of 2019, some 8,950 satellites had already been placed into orbit – and while 5,000 of those were still in space, only about 1,950 were still functioning.

These initiatives promise to sharply accelerate the physical presence of human technology in space. There is no requirement or facility for seeking global consensus on such unconstrained use of outer space or of effectively considering its potential implications.

Establishment of space war forces: A space force is a military branch that conducts space warfare of which 8 have been variously constituted. These are a feature of the progressive militarisation of space.

The only nation which currently has an independent space force is the United States, which established the United States Space Force in December 2019. In 1992 the Russian Space Forces were established as a separate service branch within the Russian Armed Forces, becoming the first independent space force in the world -- subsequently merged with other military forces from which it has since been variously independent. In 2015 China established the People's Liberation Army Strategic Support Force as an independent service branch of the People's Liberation Army, responsible for space, cyber, and electronic warfare.

As argued by Michael Nayak (*Fighting a War in Space: The Case for a Space Innovation Force*, *Astropolitics: The International Journal of Space Politics and Policy*, 16, 2018, 2):

> Air Force Space Command (AFSPC) is gearing up to face the challenge of a contested, degraded space environment that may degenerate into a full-on battleground. The U.S. space enterprise needs to be ready to not just respond, but dominate.... To win a war in space, AFSPC must build rapid breakaway capabilities that can asymmetrically rearrange the Space Order of Battle. This work proposes the formation of a top-down "Space Innovation Force" (SIF) to complement the bottom-up SMF. If appropriately empowered, this autonomous flat-management cadre of SIF warriors provides revolutionary technological capabilities that an enemy will be unable to counter in the near term.

Systematic disruption of astronomical observation: This has been of increasing concern in relation to light pollution (as discussed below) and the potential degrading of the space environment (noted above), now exacerbated by the mass launching of near orbit satellites as variously noted:

- Rebecca Morelle: *Satellite Constellations: astronomers warn of threat to view of Universe* (*BBC News*, 27 December 2019) -- **including indicative images**
- Ethan Siegel: *Latest Starlink Plans Unveiled By Elon Musk And SpaceX Could Create An Astronomical Emergency* (*Forbes*, 11 December 2019)
- Henry Samuel: Astronomers around the world warn massive satellite build-up could 'cut us off from the cosmos' forever (*The Telegraph*, 12 November 2019)
- Rhiannon Williams: *Elon Musk's internet satellites risk destroying the night sky* (*INews*, 2 December 2019)
- Charlotte Edwards: *Elon Musk's Starlink 'internet satellites' caught ruining footage of last week's rare Unicorn meteor shower* (*The Sun*, 27 November 2019)
- Miriam Kramer: *1 big thing: Hunting for asteroids is about to get harder* (*Axios Space*, 3 December 2019)
- Michael J. I. Brown: *Lights in the sky from Elon Musk's new satellite network have stargazers worried* (*The Conversation*, 28 May 2019)
- Victoria Gill: *Light pollution: huge fall in stars that can be seen with naked eye* (*BBC News*, 20 January 2023)
- Rosie Frost: *Stars are becoming 'invisible' to the human eye at an alarming rate, scientists warn* (*Euronews*, 20 January 2023)
- *What satellites will do to our view of the night sky* (*World Economic Forum*, 22 November 2019)
- *SpaceX plans to launch thousands of satellites: Is this the end of dark skies?* (*ABC News* , 12 December 2019)
- *As SpaceX Launches 60 Starlink Satellites, Scientists See Threat to 'Astronomy Itself'* (*The New York Times*, 11 November 2019)
- *Elon Musk's satellites threaten to disrupt the night sky for all of us* (*The Washington Post*, 5 June 2019)

Unchallenged accumulation of orbital debris: Space debris (also known as space junk, space waste, space trash, or space garbage) is a term for defunct human-made objects in space -- principally in Earth orbit -- which no longer serve a useful function. This can include nonfunctional spacecraft, abandoned launch vehicle stages, mission-related debris and fragmentation debris. Examples of space debris include derelict satellites and spent rocket stages as well as the fragments from their disintegration, erosion and collisions, such as paint flecks, solidified liquids from spacecraft breakups, unburned particles from solid rocket motors, etc. Space debris represents a risk to spacecraft

Various estimates include the following:

- as of January 2019, there are estimated to be over **128 million pieces of debris smaller than 1 cm**. There are approximately **900,000 pieces from one to ten cm**. The current count of large debris (defined as 10 cm across or larger) is 34,000.
- as of October 2019, nearly 20,000 artificial objects in orbit above the Earth including 2,218 operational satellites
- as of July 2016, nearly 18,000 artificial objects are orbiting above Earth, including 1,419 operational satellites.
- as of July 2013, estimates of more than 170 million debris smaller than 1 cm (0.4 in), about 670,000 debris 1–10 cm, and approximately 29,000 larger pieces of debris are in orbit,
- as of 2009, 19,000 debris over 5 cm (2 in) were tracked.

In systemic terms, as a symbol of the concrete outcome of human endeavour, this curiously parallels the unchallenged accumulation of waste in the Great Pacific garbage patch -- for which none assumes responsibility or is able to organize an effective remedy.

Intensification of permanent cyberwarfare: Cyberwarfare is the use of technology to attack government agencies, corporations or other electronic facilities, causing comparable harm to actual warfare. Many states including the United States, United Kingdom, Russia, India, China, Israel, Iran, and North Korea have active cyber operations for offensive and defensive operations.

The processes involved are in many respects indistinguishable from invasive marketing and surveillance -- as these may relate to foreign disruption of democratic electoral processes, now the focus of increasing concern following the Facebook–Cambridge Analytica data

scandal of 2018.

Of more general concern is how these processes combine with the anticipation of future information warfare, proliferation of fake news, and memetic warfare (Brian Hancock, *Memetic Warfare: the future of war*, *Military Intelligence Professional Bulletin*, April-June 2010; *Noopolitics and memetic warfare within the noosphere*, 2014; *Varieties of Fake News and Misrepresentation*, 2019)

Deployment of 5G: As the fifth generation wireless technology for digital cellular networks, 5G has begun wide deployment in 2019. Like previous standards the covered areas are divided into regions (called cells), serviced by individual antennas. Virtually every major telecommunication service provider in the developed world is deploying appropriate antennas or intends to deploy them soon.

Various concerns have been raised by that deployment:

- Interference issues: The spectrum used by various 5G proposals will be near that of passive remote sensing such as by weather and Earth observation satellites, particularly for water vapor monitoring. Interference will occur and will potentially be significant without effective controls.
- Surveillance concerns: Due to fears of potential espionage of foreign users by equipment vendors, several countries have taken actions to restrict or eliminate the use of equipment in their respective 5G networks (*Concerns over Chinese involvement in 5G wireless networks*). Chinese vendors and the Chinese government have denied these claims.
- Health concerns: Health concerns related to radiation from cell telephone towers and cell telephones are not new (*Mobile phone radiation and health*). Although electromagnetic hypersensitivity is not scientifically recognized, diffuse symptoms such as headache and tiredness have been claimed to result from exposure to electromagnetic fields such as those that carry 5G and Wi-Fi. The further development of the technology has elicited a range of responses regarding concerns that 5G radiation could have adverse health effects. It has been noted that complete scientific research regarding its effects has not been conducted and that there could be health risks (Joel M. Moskowitz, *We Have No Reason to Believe 5G Is Safe*, *Scientific American*, 17 October 2019)
- Security concerns: It has been asserted that 5G technology could open the possibility of a new era of security threats. The technology has been described as immature and insufficiently tested, enabling the movement and access of vastly higher quantities of data, and thus broadening vulnerability to attack (*Criticism of Huawei -- Espionage and security concerns*).
- Marketing of non-5G services: The deployment of 5G is recognized as liable to cause customer confusion with respect to other development of wireless technology.

Uncontrolled dependence on artificial intelligence: There are various indications of the increased dependence on artificial intelligence and the associated algorithms, some intimately related to past and emerging crises, as previously discussed (*Uncritical Strategic Dependence on Little-known Metrics: the Gaussian Copula, the Kaya Identity, and what else?* 2009). More recent indications include:

- Rebecca Heilweil: *New York City couldn't pry open its own black box algorithms*. (*Recode*, 18 Dec 2019) -- raising the question: *So now what? From policing to schools, algorithms impact the lives of nearly 9 million New Yorkers. Nobody seems to really understand how, though.*
- New York City: *Automated Decision Systems Task Force Report* (November 2019)
- Rashida Richardson (Ed.): *Confronting Black Boxes: A Shadow Report of the New York City Automated Decision System Task Force* (AI Now Institute, 4 December 2019)
- Neil C. Renic: *Death of efforts to regulate autonomous weapons has been greatly exaggerated* (*Bulletin of the Atomic Scientists*, 18 December 2019)
- Brad Allenby: *5G, AI, and big data: We're building a new cognitive infrastructure and don't even know it* (*Bulletin of the Atomic Scientists*, 19 December 2019)
- Matt Field: *As the US, China, and Russia build new nuclear weapons systems, how will AI be built in?* (*Bulletin of the Atomic Scientists*, 20 December 2019)

Of particular relevance are the assumptions relating to initiatives whereby the massive flows of "intelligence" are correlated intelligently -- potentially through what has been framed metaphorically as a "global brain". A particular instance is the highly secretive Intelligence Community Comprehensive National Cybersecurity Initiative Data Center (Bluffdale, Utah), namely the primary facility for the United States Intelligence Community.

Further indications are offered in a report of a presentation on "Enterprise Disruption" on behalf of the National Geospatial-Intelligence Agency (NGA) at the 2019 Space Symposium in Colorado Springs regarding the soon-to-be implemented facility named Sentient:

> ... “geospatial intelligence” no longer simply means pictures from satellites. It means anything with a timestamp and a location stamp, and the attempt to integrate all that sundry data...: When would that translate to near-instantaneous understanding and strategy development?... *Sentient is (or at least aims to be) an omnivorous analysis tool*... A product of the National Reconnaissance Office (NRO), Sentient is (or at least aims to be) an omnivorous analysis tool, capable of devouring data of all sorts, making sense of the past and present, anticipating the future, and pointing satellites toward what it determines will be the most interesting parts of that future. That, ideally, makes things simpler downstream for human analysts at other organizations, like the NGA, with which the satellite-centric NRO partners. (Sarah Scoles, *It's Sentient: Meet the classified artificial brain being developed by US intelligence programs*, *Verge*, 31 July 2019).

Intensification of invasive global surveillance: Global mass surveillance refers to the mass surveillance of entire populations across national borders, potentially with a view to influencing (if not manipulating) public opinion. Its roots can be traced back to the middle of the 20th century with an agreement jointly enacted by the United Kingdom and the United States, and later expanded to Canada, Australia, and New Zealand. This created the present Five Eyes alliance. That alliance has developed cooperative arrangements with several "third-

party" nations, eventually resulting in the establishment of a global surveillance network, code-named ECHELON. The extent and nature of its operations have become the subject of widespread debate following the global surveillance disclosures of 2013 and thereafter.

The various technologies described above are recognized as increasing the probability and degree of such invasive surveillance and the vulnerability of populations to it.

Psycho-social and symbolic implications? There is an inevitability to such ill-considered developments, as with other unconstrained dynamics now engendering global crises. The focus here is on the subtler implications which are so readily ignored in the unchallenged promotion of technology by which they are so effectively disguised.

It can however be readily recognized that there is a symbolic drama to configuring a constellation of satellites around the Earth. This is the stuff of legend -- reminiscent of tales of deities and mythical figures of the past. It is the fulfillment of dreams envisaged in the imaginings of the science fiction by which so many have been nourished. However it can also be recognized as devious exploitation of those dreams in the service of darkly dubious agendas.

The following notes how the technology constituting that constellation will be seen as a precursor for shading the Sun as a means of fixing climate change. This is effectively blaming the Sun for global warming, with all that implies, given the significance of the Sun for the human psyche over millennia. And will the pattern of satellites be recognized as a form of "graffiti" scrawled across the starscape? Will it be considered, by some, as a kind of "electromagnetic contraceptive" -- a "global condom" reducing the risk of infectious inspiration from the stars? This is reminiscent of efforts by artists to wrap monuments in plastic -- and the extent to which the proliferation of plastic now separates humanity from nature.

Most intriguing in symbolic terms is the extent to which any such constellation can be understood as a form of "crown" -- beyond any acknowledgement as a crowning achievement of technology. As a pattern, such a global configuration recalls the significance of both the Omphalos of Ancient Greece and that attributed to the crown chakra of Asian traditions. Given the strategic strife between the "heartless heads" and the "headless hearts" at this time, a crown of some kind may herald the emergence of a form of wisdom transcending such conflict. Beyond the imaginings of its proponents, and any criticism, would such an "electromagnetic crown" enable more fruitful engagement with the Universe -- a reconnection?

Overt consequences of ongoing technological initiatives

The technological developments described above have been in process for some time. The launching of a constellation of satellites is but the indication of an explicit tipping point. The implications have yet to become fully apparent. They could be seen to include the following.

Reduction in ability to detect extraplanetary threat: A particular implication of concern is the reduction in the ability to detect asteroids heading towards Earth with the potential of colliding with it, otherwise known as potentially hazardous objects (termed PHAs). As of October 2019 there are 2,018 known PHAs (about 10% of the total near-Earth population), of which 156 are estimated to be larger than one kilometer in diameter. In 2012 NASA estimated 20 to 30 percent of these objects had been found. Asteroids larger than approximately 35 meters across can pose a threat to a town or city. However the diameter of most small asteroids is not well determined, as it is usually only estimated based on their brightness and distance, rather than directly measured from radar observations

- David K. Lynch: *Earth-Crossing Asteroids: how can we detect, measure and deflect them?* (*Geology*, 2007)
- Karri Muinonen, et al: *Collision Probability for Earth-Crossing Asteroids Using Orbital Ranging* (*Celestial Mechanics and Dynamical Astronomy*, 81, 2001)
- Sergio Camacho, et al: *Responding to the Threat of Potentially-Hazardous Near Earth Objects*
- *Risk of comet hitting Earth is greater than previously thought, say researchers* (*The Guardian*, 23 December 2015)

Hypothetical or not, hostile or not, there is the related implication of a reduced ability to detect the existence or impending arrival of extraterrestrials (as discussed below).

Reframing any sense of outer space as *terra nullius*: Understood as the property of nobody, *terra nullius* has been a principle sometimes used in international law to justify claims that territory could be acquired by seizure or occupation of it. As noted by *Wikipedia*, current claims in that regard include Antarctica; historical claims have most notably included Australia and Eastern Greenland. Such claims continue to be the subject of controversy and ambitions for their exploitation -- most obviously as a consequence of disputed treaties with traditional indigenous occupants of such territories.

Any notion of *terra nullius* is now challenged by the placing of objects in orbit, exploitation of resources on the Moon, on asteroids, and on the planets (notably Mars), and responsibility for debris engendered there. Issues in this regard have been highlighted by Wian Erlank (*Rethinking Terra Nullius and Property Law in Space*, *Potchefstroom Electronic Law Journal*, 18, 2015, 7):

> With a new era dawning with regard to access to space and an increase in the number of nations capable of reaching and exploiting space, the field of space law as a whole needs to be re-evaluated. One such area where current legal thinking needs to be examined is with regard to the property rights to objects in space. While it was sufficient in the past for governments to frown upon the institutions of ownership in outer space and leave many space-related issues unresolved, one would need to re-examine the current body of space-law and related international instruments in the light of the ability of private enterprises' and other new players' ability to partake in and commercially exploit space travel.

That paper:

> ... investigates whether property rights should be available to space-faring nations and individuals, as well as how these rights could be acquired. Also very important is how these rights could be limited or structured in such a way as not to unnecessarily interfere with the aims of current space law. Characteristics such as the impersonality, tangibility, independence, susceptibility to control, and the usefulness and value for mankind of an object in space will once again be of crucial importance when it is necessary to determine if it can be classified as an object with regard to which one can have property rights. This is discussed against the background of objects that are deemed to be *res nullius* (things belonging to nobody) as well as the theory of terra nullius (land belonging to nobody).

For Christy Collis (*Territories beyond possession? Antarctica and Outer Space*, *The Polar Journal*, 7, 2017, 2):

> ... neither of these vast areas of our planetary environment is partitioned into standard state-sovereign spatial units. But it would be naïve to assume, therefore, that Antarctica and Outer Space are therefore exceptional, similar, uncontested spaces of "peace and science", free from the territorial drives of states and non-state actors such as mining corporations. There are important minerals in both spaces; both spaces have significant strategic value to both states and non-state actors. This article anatomises to what extent Antarctica and Outer Space are un-owned spaces. Whether they are *terra nullius* -- land owned by no one -- or *terra communis* -–– land collectively owned by humanity -- remains a fundamental tension in the international laws and treaties that produce them as legal geographies.

As argued by Louis de Gouyon Matignon (*The res communis concept in Space Law*, *Space Legal Issues*, 28 February 2019):

> Since the inception of the Outer Space Treaty of 1967, international law regarding the use of outer space by States and individuals has been dominated by the *res communis* doctrine, the concept that outer space belongs to mankind and not to one individual or country; the non-appropriation principle prevails and reference to the State sovereignty is absent. Outer space is a *res communis omnium* (a thing of the entire community). Accordingly, the 1967 Outer Space Treaty, which sets out the rules governing the interactions between States in outer space, establishes that its use and exploration are "*province of all mankind*" (Article I). Therefore, the OST in essence sets outer space aside as an extra-jurisdictional territory and no State can exercise any sovereign rights over it.

Reframing space exploration as a form of neocolonialism: The SpaceX initiative is specifically understood as a means of developing the funds to enable the colonisation of Mars (Mike Brown, *SpaceX Has a Bold Timeline for Getting to Mars and Starting a Colony*, *Inverse*, 3 July 2019). The intent is to build a robust human presence on Mars based on the supporting transportation infrastructure from Earth via SpaceX. (Darrell Etherington, *Elon Musk says building the first sustainable city on Mars will take 1,000 Starships and 20 years*, *TechCrunch*, 8 November 2019).

Framed in this way it would appear that nothing whatsoever has been learned from the history of colonisation and the degradation of the related environments -- and the inability to manage such processes appropriately.

- Matt McGrath: *Climate change: 12 years to save the planet?* (*BBC News*, 24 July 2019)
- Jonathan Watts: *We have 12 years to limit climate change catastrophe, warns UN* (*The Guardian*, 12 October 2018)
- Bob Berwyn: *What Does '12 Years to Act on Climate Change' (Now 11 Years) Really Mean?* *Inside Climate News*, 27 August 2019)

The enthusiasm for space exploration framed in this way -- unconstrained by any consequences whatsoever -- is a remarkable replication of the irresponsibility of a scientific mentality currently deploring the lack of appreciation of of its warnings regarding climate change. Curiously the proposed timeline parallels that of the warnings regarding the catastrophic degradation of the Earth environment -- readily leading to suggestions and assumptions regarding the use of space as a means of escaping the challenges of Earth which science and technology have been so complicit in engendering and so ineffectual in addressing (*Challenges More Difficult for Science than Going to Mars -- or exploring the origins of the Universe or of Life on Earth*, 2014).

More curious is the possibility that hypothetical extraterrestrials might have, or require, levels of responsibility for the sustainable conservation of territory -- as controversially highlighted in the movie *Avatar* (2009).

Unilateral appropriation and re-purposing of outer space: It is appropriate to argue that current initiatives with regard to the placement of satellites in orbit, the planned exploitation of resources on planetary bodies, and the effective use of either for waste disposal, constitute a redefinition of any understanding of *terra nullius* and especially of *res communis*. The arguments cited above make it clear that a range of issues remain unresolved and that initiatives underway effectively exploit loopholes in the legal provisions to date. The exploitation of Antarctica could be seen as anticipating this.

Of particular relevance is the manner in which, as with the colonial powers of the past, any mandate for exploitation for such resources is sought and justified through individual nations states -- each considering themselves free to act, potentially in a purely competitive manner -- now to be supported by "space forces".

Comparison with such framings of the past have been challenged by Elizabeth Mendenhall (*Treating Outer Space Like a Place: a case for rejecting other domain analogies*, *Astropolitics: The International Journal of Space Politics and Policy*, 16, 2018, 2). This argues such analogies are a misleading foundation for constructing a governance regime in outer space. They overlook essential and distinct features of outer space, and misguide the decisions of policymakers by influencing interest formation and problem definition.

The primary institution for relevant international regulation is the International Telecommunications Union, a specialized agency of the United Nations. The ITU has, in the past, acted not so much as an international regulator than as a coordinator of national policies on telecommunications. To date, no consensus on regulation of satellites transmission has been reached by the ITU. Russia's delegation to this international body, playing a key role as the leader in the Regional Commonwealth Communications segment within the ITU, has been a staunch proponent of the national approach as opposed to a multi-stakeholder approach.

Who indeed are those esteemed to be legitimate "stakeholders" and who are excluded from this category?

Effective withdrawal from constraints of Outer Space Treaty: Just as initiatives continue to be undertaken to bypass any constraints implied by treaties with the indigenous occupants of what has been framed for convenience as *terra nullius*, it can be argued that initiatives by nations states, corporations and individuals are now seeking to bypass any constraints implied by the 1967 Outer Space Treaty.

Commenting on the creating of the US Space Force, Karl Grossman notes:

> The formation of a U.S. Space Force and the U.S. drive for "American dominance" of space will inevitably turn space into a war zone because other nations, China and Russia and then more, will respond in kind. There will be an arms race in space. The landmark Outer Space Treaty of 1967 was put together by the U.S., the former Soviet Union, and the U.K., and since signed by most nations on Earth.... The Outer Space Treaty prohibits the placement of weapons of mass destruction in space, and although the Trump administration and U.S. military have been claiming a Space Force is necessary because of Russia and China moving into space militarily, in fact Russia and China -- and U.S. neighbor Canada -- have been leaders for decades in pushing for an expansion of the Outer Space Treaty. They have been advocating the *Prevention of an Arms Race in Outer Space* (PAROS) treaty under which the placement of any weapons in space would be barred. (*Trump Signs Measure Enabling Establishment of a U.S. Space Force*, *Global Research*, 30 December 2019)

As noted by a Chinese foreign ministry spokesman, the new US Space Force sets a dangerous precedent for the militarization of outer space:

- Andrea Germanos: *Calling Trump's Space Force a Violation of Global Consensus, China Condemns US 'Weaponization of Outer Space'*, *Common Dreams*, 23 December 2019): *The relevant U.S. actions are a serious violation of the international consensus on the peaceful use of outer space, undermine global strategic balance and stability, and pose a direct threat to outer space peace and security*.
- Clark Mindock: *China calls Trump's Space Force a 'direct threat to peace' and 'serious violation of international consensus' Pentagon report raises concerns that China and Russia could launch space attacks in time of conflict* (*Independent*, December 2019)
- *China voices strong dissatisfaction with U.S. defense act negative clauses regarding China* (*Xinhua*, 23 December 2019)

More problematic is the emerging tendency to ignore the constraints of multilateral treaties, to dispute them, to pay only lip-service to them, or to withdraw from them. The latter tendency is evident in the recent US withdrawal from the UN Climate Change Agreement and its challenges to the World Trade Organization. The pattern has wider implications (*New World Order of Walk-away Wheeling and Dealing: creating strategic dependency and vulnerability through confidence tricks*, 2018). This is evident in the withdrawal of the USA from UNESCO -- given the latter's role with respect to the Word Heritage List -- discussed below with regard to light pollution and the right to starlight.

Extrajudicial justification for unilateral initiatives: As part of the above pattern, also evident is the emergence of arguments justifying extrajudicial initiatives and impunity -- seemingly an extension of the provisions of just war theory:

- United States Department of Justice: *International Extradition and Related Matters*: Further, 18 U.S.C. 3181 and 3184 permit the United States to extradite, without regard to the existence of a treaty, persons (other than citizens, nationals or permanent residents of the United States), who have committed crimes of violence against nationals of the United States in foreign countries. The pattern is now documented in terms of extraordinary rendition.
- Peter Kiama: *They Deserve to Die: The Increasingly Accepted Justification for Extrajudicial Killings* (*The Elephant*, 4 May 2017)
- *Experts Express Alarm over Extrajudicial Killings, Attacks against Human Rights Defenders* (United Nations, 21 October 2016)

With respect to impunity recently highlighted by the amnesty granted by President Trump to soldiers convicted of war crimes, the emerging reality (of "just torture theory"?) is illustrated by legal rulings in the UK following election of Boris Johnson as Prime Minister:

- *U.K. Security Service Can Let Informants Commit Crimes, Court Rules* (*The New York Times*, 21 December 2019)
- *MI5 spies can kill without fear of prosecution if they can prove public interest, High Court rules* (*The Telegraph*, 20 December 2019)
- *Court Rules British MI5 Agents Can Murder, Kidnap and Torture* (*Bloomberg*, 20 December 2019)
- *Power to commit crimes 'critical' for informants, MI5 lawyers say* (*BBC News*, 19 November 2019)

With respect to outer space, it could be argued that current initiatives constitute a *de facto* reframing in extrajudicial terms. These effectively supersede the legal constraints previously presented optimistically by Gbenga Oduntan (*Sovereignty and Jurisdiction in Airspace and Outer Space: legal criteria for spatial delimitation*, 2011):

> ... the position that the present regime of common ownership created for outer space means that, as with the high seas, powerful states: "cannot 'occupy' that is physically exclude neutrals - or enemies - from, space as one might with respect to territory on land". The preference of those writers... for the USA to engage in a "normative command of space" is illegitimate at law. Such

> definitions... will support the acquisition of ownership and sovereignty whereas most writers in the American Air Force schools recognise and admit that "the very nature of a commons is that no state has sovereignty over it" . Therefore, if the aim of such normative struggle is to grant in favour of certain states authoritative control over outer space, the aspiration is demonstrably morally reprehensible. The idea that outer space militarisation is inevitable is far from convincing... If the definition of 'spacefaring state' includes states that procure satellite launchings through other states then it becomes clear that the predominant attention of states in relation to their use of outer space has been meteorological, telecommunications, commercial and not militarily . The idea that the UN and the COPUOS [United Nations Committee on the Peaceful Uses of Outer Space] will abandon their very primal duties to maintain global peace and move towards the facilitation of a regime allowing militarisation of outer space is even by the standards of military academics overly ambitious. In view of all these, it may be concluded that "tactical lawfare", "strategic lawfare", "spherical battlespace", "command of space" are all fanciful flights of fancy with little or no chance of legitimation within the field of space law. The power-realist approach to the exploration and use of outer space is prone to the projection of lawlessness and chaos into outer space. The introduction of a "playstation mentality" to the environment of outer space via space weaponisation will no doubt produce regrettable results. (pp. 267-268)

A lawless context of course frames the possibility of a variety of problematic unilateral initiatives:

- to target and destroy a global array of satellites -- as variously portrayed in science fiction. Laser technology renders this increasingly credible.
- to take over, possibly surreptitiously, the operation of any such array -- effectively to re-purpose it
- to launch an array of satellites readily recognized as having an intent that would be otherwise framed as criminal -- the current operation of the Dark Web being but one indication
- to use the Moon and Mars as dumping grounds for accumulating radioactive waste

What possibilities will a higher order of global interconnectivity offer to those of malign intent -- skilled in the exploitation of legal loopholes? Intriguing however is whether the extrajurisdictional origin of satellites falling to the Earth. at the end of their life cycle, will lead to the reframing of any damage caused as an Act of God -- for insurance purposes.

Enabling full-spectrum dominance: The technological developments can be readily recognized as consistent with the US military strategy of full-spectrum dominance supported by full-spectrum diplomacy. The former is understood as control over all dimensions of the battlespace, effectively possessing an overwhelming diversity of resources in such areas as terrestrial, aerial, maritime, subterranean, extraterrestrial, psychological, and bio- or cyber-technological warfare. The latter is a combination of traditional, government-to-government diplomacy with the many components of public diplomacy as well as the integration of these two functions with other instruments of statecraft.

The global internet connectivity, which is the purported justification for establishing a constellation of orbital satellites, can be seen as directly serving this strategic agenda. It is appropriate to note that the declared purposes of the existing satellites range between "civil", "commercial", "government" and "military". As of 2013, there are 950 satellites of all types in Earth orbit. As noted by *Wikipedia*, it is not possible to identify the exact number of these that are military satellites partly due to secrecy and partly due to dual-purpose missions such as GPS satellites that serve both civilian and military purposes. As of December 2018 there are 320 military or dual-use satellites in the sky, half of which are owned by the US, followed by Russia, China and India.

The probable subtle purpose of establishing a dense constellation of satellites calls for diligent attention to the manner in which it may delibrately serve the declared long-term strategy of military dominance. Such diligence is all the more justified following the recent publication of a confidential trove of government documents obtained by *The Washington Post* revealing that senior U.S. officials failed to tell the truth about the war in Afghanistan throughout the 18-year campaign, making rosy pronouncements they knew to be false and hiding unmistakable evidence the war had become unwinnable. (Craig Whitlock, *At War with the Truth*, *The Washington Post*, 9 December 2019). U.S. officials constantly said they were making progress:.

> The documents were generated by a federal project examining the root failures of the longest armed conflict in U.S. history. They include more than 2,000 pages of previously unpublished notes of interviews with people who played a direct role in the war, from generals and diplomats to aid workers and Afghan officials.... "*We were devoid of a fundamental understanding of Afghanistan -- we didn't know what we were doing*," Douglas Lute, a three-star Army general who served as the White House's Afghan war czar during the Bush and Obama administrations, told government interviewers in 2015. He added: "*What are we trying to do here? We didn't have the foggiest notion of what we were undertaking*"... The interviews, through an extensive array of voices, bring into sharp relief the core failings of the war that persist to this day. They underscore how three presidents -- George W. Bush, Barack Obama and Donald Trump -- and their military commanders have been unable to deliver on their promises to prevail in Afghanistan.

Futher comment on this trove of papers is separately available (Ron Paul, *Afghanistan War -- The Crime of the Century*, *Transcend Media Service*, 30 December 2019). Given this background regarding miliary strategy, it is appropriate to ask how the prolongation of this mindset may be playing out with respect to the recently created US Space Force and its relation to the authorised constellation of StarLink satellites. The Pentagon stated in 2013 that there were "around" 5,000 bases total, with "around" 600 of them overseas (*List of United States military bases*, *Wikipedia*). As later noted by David Vine:

> Despite recently closing hundreds of bases in Iraq and Afghanistan, the United States still maintains nearly 800 military bases in more than 70 countries and territories abroad -- from giant "Little Americas" to small radar facilities. Britain, France and Russia,

> by contrast, have about 30 foreign bases combined. (*Where in the World Is the U.S. Military? Politico*, July/August 2015).

Creation of a US Space Force offers the possibility of transferring a significant proportion of the functionality of such bases into an array of satellites from which laser and other weaponry could be used in response to arenas of conflict. The array to be launched could be used to explore this option, just as it may be used to anticipate geo-engineering responses to climate change (as discussed below). Indication of this are offerd by the plan to rename selected U.S. Air Force bases as U.S. Space Force bases, as reported by *Space News*.

Repetition of the pattern of competitive colonial and wild-west exploitation: The engagement with outer space as a means of ensuring full-spectrum dominance can be seen as echoing to a remarkable degree the engagement with distant lands in centuries past by colonial powers with imperial ambitions.

As exemplified by current foreign policies of the USA, it is a case of wheeling and dealing "because we can" -- partially echoing the processes of the "Wild West" cultivated as iconic and heroic by that culture. Presumably the "Indians" are those to be understood as constraining such pioneering endeavours. Readily to be reframed as terrorists, "being not with us, and therefore against us".

Orbital and bandwidth racketeering is to be expected.

Internet lockout -- "shielding" and "walling off": In contrast with the purported intention of enabling "global interconnectivity", a counteracting process is already evident. This takes the form of variously blocking access to global connectivity understood most generally as Internet censorship. As detailed by *Wikipedia*, methods of technical censorship include: blacklists, points of control, content approaches, over and under blocking, and use of commercial filtering software. Internet filtering may be implemented in response to perceived threats to national security by targeting web sites of those framed as insurgents, extremists, and terrorists. An understandable framing of such justification may be the protection of existing economic interests and copyright

Some governments resort to shutting down most or all Internet connections in their country. *Wikipedia* offers an overview of *Internet censorship and surveillance by country* and separate coverage by continent:

- Internet censorship and surveillance in Africa
- Internet censorship and surveillance in the Americas
- Internet censorship and surveillance in Asia
- Internet censorship and surveillance in Europe
- Internet censorship and surveillance in Oceania

Access restrictions of various kinds are detailed in terms of the so-called splinternet. Also referred to as cyber-balkanisation or internet balkanisation), this is a characterization of the Internet as splintering and dividing due to various factors reviewed by *Wikipedia* in terms of technology, commercial lock-in, politics and nationalism, security and espionage, religion, and cyberbalkanisation (*A virtual counter-revolution*, *The Economist*, 2 February 2010).

Some countries are developing their own versions of the Internet. Examples include:

- Russia:
  - Jane Wakefield: *Russia 'successfully tests' its unplugged internet* (*BBC News*, 24 December 2019);
  - Gregory Gleason: *Satellite Internet and Russia's Control Over Its Cybersphere* (*Eurasia Daily Monitor*, 15, 8 March 2018) .
- China: Of relevance are the Golden Shield Project and the related Great Firewall of China.
- Arab world: Probable emergence of a variant following the activities and concerns of the Arab Internet Governance Forum
- Africa: African Internet Governance Forum
- Iran: *Tehran's Unplugged Internet Plan* (*Global Voices*, 5 November 2010)
- Military: As developed by the NATO Communications and Information Agency (NCI), for example, notably through use of the Crisis Response Operations in NATO Operating Systems (CRONOS), namely a system of interconnected computer networks used by NATO to transmit classified information, in addition to its use of the Minerva network. The so-called Internet of Military Things encompasses a large range of devices that possess intelligent physical sensing, learning, and actuation capabilities through virtual or cyber interfaces that are integrated into systems.
- Facebook surrogates
- etc

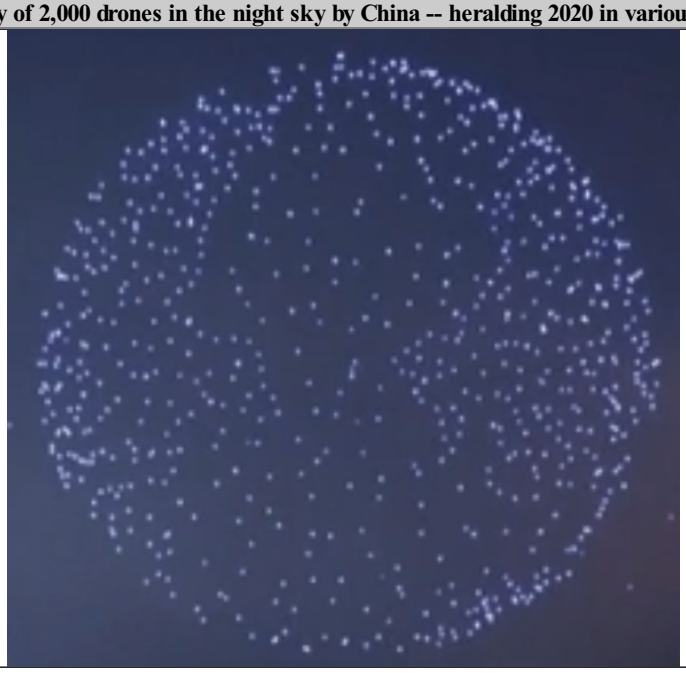
It is in the light of this pattern that the global interconnectivity of the Starlink constellation of satellites -- and its emerging competition -- calls for consideration. This is especially the case given the degree to which there is every probability that such systems are only authorised by US regulatory authorities (and their allies) because of the backdoor and dual-use possibilities offered by such systems for security-related purposes promoted under the guise of unquestionable public benefit.

For example, in the case of costly dual-use technology developed in support of a Global Positioning System, this can also be used for invasive surveillance and military purposes. A backdoor designed into an information device typically offers a covert means of bypassing overt methods of protection. It has long been suspected that the computer equipment and software sold by one country to others may contain backdoors to enable some form of surveillance. As is most probably the case with US and Chinese technology, Russian authorities have compelled enterprises to provide “backdoors” to computer programs and devices, which allow them oversight and the capacity to intervene.

Exploitation of propaganda potential: The very recent period has witnessed widespread recognition of the controversial use of social media and related facilities to influence public opinion -- most notably with respect to national elections. Claims of enabling "global internet connectivity" can be readily recognized as enabling such processes to an even higher degree -- possibly to be understood as

having the ambition to mould "global opinion" as variously envisaged in dystopian science fiction.

More concretely, given past initiatives with respect to skywriting and controversial use of chemtrails, there is the curious possibility that visible satellite constellations might be periodically reconfigured for marketing or propaganda purposes, however controversial -- "Coca Cola", "Jesus", "Starbucks", etc? An indication of the poztential effect can be simulated by drone displays, as shown below.

Display of 2,000 drones in the night sky by China -- heralding 2020 in various configurations				
				

Anticipating unilateral geo-engineering response to climate change: The manner in which the SpaceX constellation of satellites has been authorised by US regulatory authorities can be readily seen as anticipating any future US response to climate change through a unilateral geo-engineering initiative. This has effectively been anticipated by the redefinition of "geo-engineering" as "climate engineering", namely the deliberate and large-scale intervention in the Earth's climate system, usually with the aim of mitigating the adverse effects of global warming

The technology of satellite constellation deployment could be readily adapted to deployment of what are termed space sunshades or solar sunshields. Such parasols divert or otherwise reduce some of the Sun's radiation, preventing it from hitting a spacecraft or the Earth and thereby reducing its insolation, which results in reduced heating.

One option involves placing a large occulting disc, or technology of equivalent purpose at the L1 Lagrangian point between the Earth and Sun. This is now considered to be of particular interest as a climate engineering method for mitigating global warming through solar radiation management (John Hickman, *The Political Economy of a Planetary Sunshade*, *Astropolitics: The International Journal of Space Politics and Policy*, 16, 2018, 1). Such interest follows from concerns that internationally negotiated reductions in carbon emissions may be insufficient to stem climate change. The L1 point is about 1.5 million kilometers from Earth, namely 1/100th the distance to the Sun.

As argued by Hickman:

> Geoengineering is attractive, the possible moral hazard notwithstanding, because of differences in the economic effects of climate change across countries, which are organized as factions seeking to shift the burden of carbon reductions or to delay response. This article outlines the political economic advantages of a planetary sunshade to reduce the amount of sunlight reaching the Earth. Rather than adopt the more common game theoretic model to describe the relevant international relations, construction of the planetary sunshade is characterized as an auction in which a single spacefaring power completes construction of the megaproject as a global good, comparable to the willingness of the United States to provide the dollar as a global reserve currency, and then determines the average global temperature based upon financial or material contributions from other countries

Other articulations of the sunshade option include:

- Zaria Gorvett: *How a giant space umbrella could stop global warming* (*BBC*, 26 April 2016)
- Joan-Pau Sánchez and Colin R. McInnes: *Optimal Sunshade Configurations for Space-Based Geoengineering near the Sun-Earth L1 Point* (*PlosOne*, 26 August 2015)
- Ethan Siegel: *Can We Build A Sun Screen To Combat Global Climate Change?* (*Forbes*, 26 May 2018)
- Peter Beaumont: *Scientists suggest a giant sunshade in the sky could solve global warming* (*The Guardian*, 5 April 2018)

One alternative extensively studied is the release of sulfur aerosols into the atmosphere (John Fialka, *The Best Way to Shade Earth*, *Scientific American*, 5 July 2018). As with any constellation of satellites, little weight is given to the foreseeable and unforeseen environmental consequences.

Many of the issues relating to the range of geo-engineering proposals for climate change have been reviewed separately (*Geo-engineering Oversight Agency for Thermal Stabilization*, 2008).

Disruption of patterns of long-distance bird navigation? As noted by Tom Warren (*How Birds Navigate the Night Sky*, *Old Farmer's Almanac*, 29 January 2019):

> In autumn, millions of songbirds migrate at night to their winter homes in Central and South America from breeding grounds in the northern United States and Canada... Birds leave as soon as the Sun sets... with some flying as high as 21,000 feet. In the 1960s, German ornithologists Franz and Eleanore Saver discovered that birds navigate the night sky by using the stars. A decade later, a Cornell scientist was able to identify the specific star patterns used by the indigo bunting.

As for humans, starlight is indeed an orientation cue, as discussed by James J. Foster, et al (*How animals follow the stars*, *Proceedings of the Royal Society B: Biological Sciences*, 285, 201):

> What information animals have evolved to extract from a starry sky and how they do so, is a topic of study that combines the practical and theoretical challenges faced by both astronomers and field biologists. While a number of animal species have been demonstrated to use the stars as a source of directional information, the strategies that these animals use to convert this complex and variable pattern of dim-light points into a reliable "stellar orientation" cue have been more difficult to ascertain.... For the purposes of this review, we will mainly address the stars themselves as orientation references, but the quality and clarity of stellar orientation cues in nature are undoubtedly a combination of light from all visible celestial bodies, zodiacal light, *Gegenschein* and atmospheric effects

It seems to be unclear whether consideration has been given to the impact on bird navigation capacity of the planned dense constellation of satellites. The argument promoted by the NASA Earth Observatory that *Satellite Data Helps Migrating Birds* (24 September 2015) therefore merits a degree of suspicion -- coming as it does from a party with a vested interest in the satellite program. There is seemingly far greater interest in the use of satellite telemetry to track bird migration than in the question as to the point at which the proportion of visible satellites disrupt those patterns.

Is SpaceX heading into a disaster comparable with that of the *Exxon Valdez* oil spill (1989)? Immediate effects included the deaths of 100,000 to 250,000 seabirds, as well as otters, seals, orcas, and an unknown number of salmon and herring. The response of Exxon has been extensively studied (Sarah Emerson, *Let's Remember Exxon's Extremely Fucked Up Response to Its Catastrophic Oil Spill After the Exxon Valdez oil spill*, *Vice*, 24 March 2017). As with the effect on sea life, any problematic consequences of a satellite constellation for bird migration may well be dismissed by cororpate interests as unworthy of attention, especially given the threat of bird strike to aviation. Birds Guidance System,

It is recognized that some birds sense magnetic fields to create a natural version of the global-positioning system although this process is still not fully understood -- nor especially how this might be disrupted by the electromagnetic operations of a constellation of satellites. A related concern has been raised with respect to the associated deployment of 5G (Anthony Steele, *5G Beam Waves in Air Destroy the Birds Guidance System*, *YouTube*, 18 October 2019; Arthur Firstenberg, *Birds Falling from the Sky: knowing how 5G could affect us*, *Wild Culture*, 17 December 2018).

Psycho-social and covert implications of star loss

Satellite constellations as "stellar graffiti" or "nightscape graffiti"? The thousands of satellites to be launched as a "constellation" will be variously visible. They will be perceived as configured into one or more recognizable patterns. These patterns -- as constellations in their own right -- could be usefully seen as graffiti permanently inscribed on the night skyscape of Earth, possibly over millennia --and with no consideration of the views of the populations of the world.

The resulting effect merits comparison with the graffiti now so evident in urban environments. As such the controversy with regard to the value of such graffiti, as noted by *Wikipedia*, may be explored in the light of their role in: personal expression, radical and political expression, advertising, and as deliberately offensive.

Whilst the resulting display may be hailed as art by those with enthusiasm for art of that form, the question calling for exploration is its appropriateness on a global scale. More fundamental is the psychological effect of such art as a consequence of its modification of the night skyscape, valued otherwise over centuries. Understood as consisting of the defacement of public spaces and buildings, it remains a nuisance issue for cities, as noted with respect to *Graffiti in the United States*. The concern with graffiti has even been related to the Internet (*Why The Internet Is Part Of The Graffiti Problem*, *RemoveMyGraffiti*, October 2019)

There is extensive literature on the psychology motivating production of graffiti in urban settings:

- Myra Taylor, et al: *The psychology behind graffiti involvement*. (In: *Routledge Handbook of Graffiti and Street Art*, 2016)
- Benjamin F. Walker: *Graffiti Psychology: Why Vandals Strike* (*CleanLink*, 1 February 2004)
- Theodore Dalrymple: *Tattooing Buidings: What do graffiti and tagging tell us?* (*Psychology Today*, 14 June 2015)
- *Graffiti Psychology - "Why do they do that?"* (*RemoveMyGraffiti*, December 2019)

Whilst there is comment on the problematic environmental consequences of graffiti through use of aerosols, of greater relevance is the manner in which it affects the "image" of an urban environment (*Negative effects of graffiti*, *Graffiti and Modern Culture*). Central to the controversy associated with graffiti is whether disruption of conventional images is beneficial in its own right.

This question goes to the heart of the issue as to whether disrupting the conventional pattern of constellations is of value in its own right. Arguably those of technological persuasion would see the conventional pattern of 12 constellations, or even the extended list of 88, as reflective of an outmoded form of thinking which merits disruption -- especially in the eyes of those who abhor the enthusiasm for the ignorant promotion of astrology.

Globalization by subterfuge? Given the unresolved controversies regarding globalization, and the specific criticism of globalization, the blatant use of technology to assert a form of global internet connectivity can be understood as a provocation of a high order -- as exemplified by the reactions of some governments and other interests.

Reactions to implementation of some form of constellation of satellites have been explored in a range of science fiction novels and films (as noted above).

Exemplification of global psycho-social failure: There is of course considerable irony that the obvious inadequacy -- or effective failure -- of multilateral institutional initiatives should be recognized as in process of being superseded by globally organized information systems. These of course beg the question as to how they are controlled globally -- given the obvious challenge by efforts to ensure that control by particular countries.

Any global information system therefore merits exploration as a "distorting mirror" of what might have been a global institutional system.

Exemplification of the problematic relation between global and local: This can be explored in terms of efforts to:

- ensure dominance of global perspectives over local considerations -- highlighted in the criticism of globalization, but more particularly in the forms of "public relations" thereby enabled, readily recognized as a higher order of systematic manipulation
- promotion of local perspectives in contrast to global preoccupations -- typical of anti-globalization initiatives and populist discourse

In this sense the Starlink constellation (and others) could be understood as constituting the **antithesis of its declared objective of enabling global connectivity**. Reaction to it engenders and reinforces a form of global delinking, long noted with respect to the proliferation of Internet usage (*Dynamically Gated Conceptual Communities: emergent patterns of isolation within knowledge society*, 2004).

Intelligibility vs. Interconnectivity: the challenge of any "global brain": Much emphasis is placed on the advantages of a constellation of satellites for "global interconnectivity". Virtually nothing is articulated with regard to "global intelligibility", namely the capacity to process vast amounts of information meaningfully. To the extent that attention is given to the outcome of interconnectivity, it appears to be the secretive domain of the intelligence services -- beyond their obvious preoccupation with secretive data gathering. The manipulative use of such information for marketing and other purposes is of course another matter -- questionably understood as a form of intelligibility,

In a period of global crisis, it could be argued that the connectivity is indeed "fit for purpose" -- whereas the capacity for intelligibility is most obviously "not fit for purpose". Deliberately instigated or or not, this could be seen as a consequence of "**global intelligence failure**" -- a tragic reframing of the "great game" (*Playing the Great Game with Intelligence: authority versus the people*, 2013) . Some of the relevant possibilities are noted separately (*Envisaging a Comprehensible Global Brain -- as a Playful Organ: patterns connecting the dots between hemispheres, epicycles and quavers*, 2019). This followed from the recent controversial assertion made by President Macron of France with respect to the "brain death" of NATO and the potential implications for any "global brain" (*Are the UN and the International Community both Brain Dead -- given criteria recognizing that NATO is brain dead?* 2019).

Spurious promotional arguments: It is strange to note that those promoting constellations of satellites avoid any consideration of the possibility that their deployment might be other than universally appreciated -- and that their problematic environmental consequence might merit attention. It is naively assumed that -- want it or not -- universal access needs to be ensured as a priority.

This is consistent with the dubious track record of technological development in which detection of problematic consequences is left to others. In a computer context this is most evident in the manner in which "bug detection" is effectively outsourced to users to avoid the costs and delays of adequate testing by their developers.

The seemingly benign and unquestionable justification for inclusive global internet interconnectivity therefore merits vigorous challenge -- given the obvious agendas of marketing and manipulation of public opinion (a major factor in eliciting funding).

One such challenge can be presented in speculative terms (*Sustainable Internet Penetration of Rural Areas: reframing the global challenge of the digital divide through fruitful local metaphors*, 2003). The latter highlights the sense in which "interconnectivity" implies "marketing" to the vulnerable of messages from the more powerful -- following the playbook of colonial exploitation as assiduously practiced by missionaries and business interests in disseminating their respective messages.

To what extent will global internet connectivity enable a form of communication enslavement -- notably through marketing devices of ensuring "buy in", "customer lock-in" and rewarding loyalty? Will this necessarily involve systematic "dumbing down" and even "psychic numbing"? To what extent does such potential misuse feature in proposals to regulatory authorities?

Exacerbation of global distrust: The past period has evoked multiple commentaries on the increasing level of distrust of authorities of every kind. This pattern extends to relations between institutions and groups, and to that between individuals. The promotion of global interconnectvity will in all probability highlight this pattern to an even greater degree -- given the variety of studies noting the manner in which Internet usage reinforces patterns of social isolation.

Any constellation of satellites, especially one that it visible to some degree, may well serve to epitomize the realm of the "haves" as distinct from that of the "have nots" -- irrespective of the interconnectivity it purportedly provides (at a price).

Unexamined symbolic implications of disrupted star light?

There has been little opposition to the technological developments associated with launching a constellation of satellites. Indeed, like the story of the frog placed in slowly heated water, at what point would the frog recognize the need to leap out -- even if it was then able to do so? And indeed, through what agency could protest be appropriately articulated, given the manner in which such initiatives are authorised by governments -- and most obviously that of the USA?

The nature of the ineffectual protest formulated by astronomers is a reflection of this. More concern has been expressed at the foreseeable and unforeseen environmental side effects of the geo-engineering proposals noted above, of which the planned massive satellite arrays may well be a precursor.

Symbolism? Of more fundamental significance may well prove to be the subtle psychological implications of such initiatives -- seemingly ignored in discussion by techno-optimists for whom matters psycho-social are readily deprecated, if not regarded as an indulgence in various degrees of outmoded superstition.

Curiously, but perhaps exemplifying this neglect, is a reference to "symbolism" briefly made by Maxwell Cohen at an early Conference on the Law of Space and of Satellite Communications (Chicago, 1963):

> ... the satellite program is not simply another system of communications, having its own special national and international aspects, but it also is symbolic of a. whole new international experience. There are three features that are worth thinking about, but to which I shall refer only briefly here. There is, first of all, the actual symbolism of the communications satellite, commonly shared by mankind. It is perhaps, par excellence, an illustration of a "sharable resource." Even though it is no more than another transmission channel, its symbolism, it seems to me, is of a different order from that of a cable from Newfoundland to Ireland. Spinning out a cable once perhaps had drama, but nothing like the drama of putting up a system in space for intercontinental communications. The symbolism itself is important and gives these instrumentalities a unique status. (*Proceeding*s, NASA, 1964, p. 185)

Whilst the significance of symbolism may be called into question in a technological era faced with technical issues, it is appropriate to recall the degree to which engagement with space has been dependent to a strange degree on symbolism and has exploited its potential to engender and nurture political support to fund such endeavours:

- Space historian Robert Pearlman is noted as declaring: *In the 55 years since Sputnik first beeped its way around the planet, the small silver sphere with its whip-like antennas has transcended the Soviet Union's success to become a symbol for a global Space Age* (Clara Moskowitz, *How Sputnik Changed the World 55 Years Ago Today*, *Space*, 4 October 2012)
- The iconic photograph of the Earth from lunar orbit, taken on 24 December 1968 during the *Apollo 8* mission, and subsequently named *Earthrise*,
- Pioneer plaques were placed on board the 1972 *Pioneer 10* and 1973 *Pioneer 11* spacecraft, featuring a pictorial message for any entities in distant space

Valuable indications have been offered at a relatively early stage by Erik Davis (*TechGnosis: myth, magic and mysticism in the Age of Information*, 1998). Citing David Noble (*The Religion of Technology; the divinity of man and the spirit of invention*, 1997). Davis noted that:

> ... the American space program has been touched by the spirit since the rocket-man Wernher von Braun, freshly arrived from post-Nazi Germany, converted to fundamentalist Christianity in the early 1950s. Indeed with all the bibles and communion wafers that astronaut have trucked back and forth to the moon, and with all the Mormons and born-agains running the show at home, it is hardly surprising tht General Motors, one of the fathers of the U.S. space program, attempted to build a Chapel of the Astronauts near he Kennedy Space Center in the early 1970s. (p. 153).

Tellingly Davis continues:

> Space technologies do not just materialize the offworld yearnings of those desperate to flee the grave fate of earthly life. They also literalize the cosmic homesickness that vibrates in som many human hearts, a longing for a transcendental level of authenticity, and being reflected in the heavens. (p. 153).

Noble's original argument is the focus of a subsequent appreciative critique by L. M. Sacasas (*Revisiting "The Religion of Technology"*, *The Frailest Thing*, 28 April 2012) ad has been succinctly summarized (*The Ascent of the Saints: Space Exploration*, *Interdisciplinary Encyclopedia of Religion and Science*. 1997).

The continuing role of mythical framings is noted with respect to Project Icarus by Ross Andersen (*Project Icarus: Laying the Plans for Interstellar Travel*, *The Atlantic*, 23 February 2012). The project takes its inspiration from Project Daedalus, a five-year study launched by the British Interplanetary Society in 1973. The disaster associated with the original Icarus myth is now reframed in order to brush away some of the inhibitions the name otherwise reinforce in some.

It is therefore appropriate to explore the possible psycho-social significance of launching a "constellation" of thousands of satellites -- especially when this exploits widespread imaginative engagement in space travel. The question is the extent to which this exploitation serves other surreptitious purposes whose implications are assiduously avoided, if indeed they could be comprehended as credible by

techno-optimists.

"Constellations" and skyscapes? The stars, and their configuration into constellations by cultures around the world, have been of fundamental significance to the development of many cultures over millennia. Formative legends are typically associated with such constellations, notably deities -- with the pattern of the constellation serving as a mode of instructive communication (Anthony Aveni, *Star Stories: Constellations and People*, 2019; Norm McCarter, *Constellation Legends*; Nancy Alima Ali, *Exploring the Intersections of Astronomy and Culture*, *Astronomers without Borders*).

It is relatively recently that concern has been expressed regarding the need to protect landscapes and -- to a far lesser extent -- seascapes and soundscapes. The concern with regard to skyscapes and nightscapes has primarily been articulated by astronomers for technical reasons relating to light pollution.

Whereas landscapes may be subject to protection through the UNESCO World Heritage List, little is said of the need to protect starscapes -- despite their importance to cultures. Although seemingly correct regarding **skyscapes**, this conclusion should be qualified by the global survey by the International Astronomical Union and the International Council on Monuments and Sites of astronomical heritage **sites** from the standpoint of the identification and evaluation relating to astronomy and archaeoastronomy. These potentially demonstrate outstanding "universal value" as required for recognition listing in the World Heritage List (*Heritage Sites of Astronomy and Archaeoastronomy in the context of the UNESCO World Heritage Convention: a thematic study*, 2010).

Naming the night sky? The ability to name the visible features of the sky at night, as with the constellations, has clearly offered people a sense of place in the Universe. This recalls the process of psychosocial appropriation of a space at the collective level. This is described by the process of *land nam,* coined by Ananda Coomaraswamy (*The Rg Veda as Land-Nama Book*, 1935), to refer to the Icelandic tradition of claiming ownership of uninhabited spaces through weaving together a metaphor of geography of place into a unique mythic story.

This territorial appropriation process, notably practiced by the Navaho and the Vedic Aryans, was further described by Joseph Campbell (*The Inner Reaches of Outer Space: metaphor as myth and religion*, 2002):

> *Land nam* ("land claiming or taking") was [the Norse] technical term for this way of sanctifying a region, converting it thereby into an at once psychologically and metaphysical Holy Land.... *Land nam*, mythologization, has been the universally practiced method to bring this intelligible kingdom to view in the mind's eye. The Promised Land, therefore, is any landscape recognized as mythologically transparent, and the method of acquisition of such territory is not by prosaic physical action, but poetically, by intelligence and the method of art; so that the human being should be dwelling in the two worlds simultaneously of the illuminated moon and the illuminating sun.

What indeed might be understood as the **"inner reaches" of an outer space constellation of satellites**?

Such naming is to be contrasted with the names attributed to distant objects by astronomers -- honouring each other in the process according to a well-defined astronomical naming convention. Ironically the thousands of satellites to be launched will necessarily be "named" for technical identification, but without any psychological significance.

Opportunistically defensive public relations operation are however highly probable, given the mindset nourished by the Hollywood Walk of Fame on which some 2,500 5-pointed stars are embedded -- bearing the names of celebrities (a mix of musicians, actors, directors, producers, musical and theatrical groups, fictional characters, and others). Alternatively, an opportunity may be taken to offer the public the possibility of naming individual satellites -- for a price -- as with the marketing of plots of land on the Moon and the planets.

"**Stellar extinction**"? Strangely reference has long been made to the "stars going out" (*The Stars Are Going Out*, *TV Tropes*). The latter even cites the biblical prophecy:

Immediately after the distress of those days *the sun will be darkened,* *and the moon will not give its light;* *the stars will fall from the sky...* Matthew 24:29

The process was envisaged in a famous science fiction tale by Arthur Clarke (*The Nine Billion Names of God*, 1953). The tale is of a Tibetan lamasery in which the monks seek to list all of the names of God -- the stars -- believing that the Universe will end appropriately once this process is completed. Taking advantage of computer technology, the manual process is speeded to the point at which the stars do indeed start to disappear. The theme has been echoed otherwise by science (Caleb A. Scharf, *The Stars Are Beginning To Go Out... Scientific American*, 19 November 2012; Robbie Gonzalez, *The lights in the universe are going out. Now astronomers think they know why*, *Gizmodo*, 23 August 2011). Use of satellite telescopes has played into the theme (*Hubble Captures Stars Going out in Style*, NASA, 9 November 2007). In the context of this argument, it is more a case of "putting out the stars" using satellites.

Shading the Sun? To the extent that a new constellation is recognized as a technical precursor to the challenge of climate change, the possibility of shading the Sun in any way also calls for careful "reflection". There has seemingly been little consideration of the importance of the Sun's role in individual and collective psychology -- if shading the Sun is to be envisaged (Mark E. Beecher, et al, *Sunshine on my Shoulders: weather, pollution, and emotional distress*, *Journal of Affective Disorders*, 205, 2016). A trivial indication is offered by seasonal affective disorder (SAD), namely the mood disorder in which people who have normal mental health throughout most of the year exhibit depressive symptoms at the same time each year, most commonly in winter. Shading the Sun might then be "sad" in more ways than one.

The Sun has an even more fundamental role in many cultures -- to an even greater degree than the pattern of constellations. Especially indicative are the many much-valued cultural rituals associated with the Sun -- from those of the past to current widespread enthusiasm for sunbathing, or simply viewing the rising and setting Sun.

Any promotion of projects to diminish the impact of sunlight calls for recognition of the extent to which this is tantamount to **"blaming the Sun" for the failure to address the challenges of climate change** appropriately. Any such collective projection of blame could evoke valuable critical commentary from the psychological professions.

"Walling off"? There is tradition of building walls to separate a culture from perceived external threats. Historical examples include the Great Wall of China and Hadrian's Wall -- currently in process of emulation by Trump's Wall separating the USA and Mexico. The most common form has been that of walled cities. Rather than being "walled", cities may be divided -- namely split by walls.

This process of "walling off" clearly has both psycho-social and symbolic implications -- with any commentary on the process necessarily controversial in its own right:

- Jon Calame and Esther Charlesworth: *Divided Cities: Belfast, Beirut, Jerusalem, Mostar, and Nicosia* (2011)
- Lisa Strömbom and Annika Björkdahl: *Divided Cities: Governing Diversity* (2015)
- Frank Gaffikin and Mike Morrissey: *Planning in Divided Cities* (2011)
- Ronald van Kempen: *Divided Cities in the 21st century: challenging the importance of globalisation* (*Journal of Housing and the Built Environment*, 22, 2007, 1)

Missing from such studies is precisely any exploration of the extent of the trauma resulting from such division, especially given its symbolic significance in the case of Jerusalem. What effect does such deliberate division have on the global psyche of humanity in that case -- especially for those identifying with any of the three religions complicit in that division?

Of potential relevance to any such inquiry is a degree of recognition accorded to the Jerusalem Syndrome. This is a group of mental phenomena involving the presence of religiously-themed obsessive ideas, delusions, or other psychosis-like experiences that are triggered by a visit to the city of Jerusalem. It is not endemic to one single religion or denomination but has affected Jews, Christians, and Muslims of many different backgrounds.

The issue of "divided minds" in divided cities is evoked by Jacob D. Lindy (*Legacy of Trauma and Loss*, In: *Beyond Invisible Walls*, 2013). Relevant insight is presumably to be found in studies of the experience of living in divided cities, as indicated (if only allusively) by:

- Jerusalem:
  - Yaakov Garb and H. V. Savitch: *Urban Trauma in Jerusalem: Impacts and Possibilities for Recovery* (Floersheimer Institute for Policy Studies, 2005).
  - Ifat Maoz: *Psychological Factors in the Transition to Post-Conflict Cooperation and Reconciliation: The Case of Jerusalem* (Floersheimer Institute for Policy Studies, 2007)
- Berlin:
  - *Living in a Divided City: West-Berlin* (*Visit Berlin*)
  - *Palace of Tears: Fascinating museum showing the sadness of living in a divided city*
- Mostar: *The Divided City and the Grassroots: the (un)making of ethnic divisions in Mostar* (Springer, 2018)
- Urumqi: *Life in a divided city on the edge of the Middle Kingdom* (*The Telegraph*, 20 August 2014)

It is this dimension which calls for attention in the case of "walling off" the planet Earth from the Universe by a global pattern of satellites. The pattern recalls Buckminster Fuller's ambitions for domed cities -- itself potentially an urban response to climate change. Curiously there appears to be a dearth of studies of the psychological consequences of such deliberate division -- and perhaps deliberately so -- despite the fact that it is a driving force for conflict in the Middle East. This is in strange contrast to the plethora of studies on post-traumatic stress disorder consequent on such conflict.

"Extraterrestrial contact"? In addition to the widely appreciated speculation of science fiction and media depictions, much serious thought has been given to the possibility of contact with intelligent life from distant parts of the Universe. A degree of attention to the effects on such contact of human technological development (as noted above) therefore merits consideration. Of particular concern are:

- Unconstrained accumulation of space debris, reflecting the pattern of marine waste disposal, as separately discussed (*Earth as a Shithole Planet -- from a Universal Perspective? Understanding why there are no extraterrestrial visitors*, 2018). ETs may readily conclude that the capacity of humanity to "f**k up" a planat knows no bounds, being even upheld by interpretations of sacred scripture regarding dominion over nature -- an interpretation with which the highest principles of science and technology are held to be complicit
- Constellation of orbit satellites, as envisaged, potentially serving:
  - to obscure technosignatures signals from elsewhere. The SETI program notably monitors electromagnetic radiation for signs of transmissions from civilizations on other planets
  - as an electromagnetic analogue to a "missile shield", a form of Faraday cage effectively excluding communications and contacts from elsewhere (David Vergun, *Strong Missile Shield Protects U.S., Allies*, *US Joint Chiefs of Staff*)
  - as a cage, unconsciously designed by humanity to insulate its problematic tendencies from the rest of the Universe -- with the satellite orbits functions as "bars" on that cage. Such a meaphor suggests the possibility that the cage will come to be reframed and promoted as a "gilded cage" -- despite the ambiguity variously imagined in myth.

More generally, and with unforeseeable legal implications, there is the ironic possibility that Earth may itself be framed as *terra nullius* by extraterrestrials -- with the protocols for any contact understood as most appropriately defined by humanity itself, as may be

speculatively explored (*Writing Guidelines for Future Occupation of Earth by Extraterrestrials: Be done by as you did ?* 2010).

ETs may however perceive the unconsciously inspired "self-incarceration," achieved by the establishment of a dense constellation of satellites, to be one of the few saving graces of a pathological civilization (John Ralston Saul, *The Unconscious Civilization*, 1995).

Aesthetic inspiration? As noted above, the stars have been a major source of aesthetic inspiration for millennia -- most explicitly for poets. Degrading the degree of human contact with the mystery of the Universe, exemplified by the pattern of stars, has the potential for engendering disaster -- to the extent that aesthetics has a vital role to play in enabling creativity and unforeseen forms of cultural integration. This would be especially ironic if aesthetics prove to be fundamental to appropriate communication with extraterrestrials -- as variously explored in science fiction.

Is the interplay of satellites across the nightscape to be promoted as comparable to the artificiality of festive displays -- and consequently assumed to be desirable by all?

Freudian interpretation of engagement with space? The poetic inspiration evoked by the heavens has long been entwined with romantic connotations of interpersonal relations. It is therefore appropriate to consider their further implications -- with one example offered by the widely-cited arguments of Richard Sherry (*The Psychology of Space Exploration: what Freud might have said*, 2018).

Despite the subtitle of that study, little attention has seemingly been accorded to the sexual connotations of space travel (Abigail E. Sherriff, et al, *Modern Psychology for Space Exploration*, *International Astronautical Congress*, 2016). Consideration of sex in space has seemingly focused on intercourse during space travel. Potentially more fundamental are the implications in gender bias (Michael P. Oman-Reagan, *Unmanning Space Language*, *Sapiens*, 7 March 2016; Camille Standen, *Why Are Vaginas So Unwelcome in Space? Vice*, 20 March 2013).

Allusion may indeed be made to spreading the "human seed", as argued by Christopher Phillips in the face of global crisis, overpopulation, and the need to escape to other worlds:

> So what are we to do? Well if we take a page from Christopher Nolan and the plethora of sci-fi directors and authors of years past, we should think about colonization of other worlds. We can spread the human seed so that no single catastrophe can wipe us from existence (*Have Spacecraft, Will Travel? Space*, 4 November 2014).

Missing is consideration of the far more fundamental symbolism of any rocket-launched space vessel projected towards the Moon or Mars -- or the exoplanet of another star (Jasper Hamill, *"It's so big!": Elon Musk shows off "phallic" new SpaceX BFR rocket*, *Metro*, 17 Sep 2018). Is this a collective emulation of the human sperm and its archetypal struggle to impregnate the ovum -- especially in competion with other sperm, each striving to "be there first" and implant its special characteristics thereby ensuring its heritage? Any such frame merits careful conideration in the light of more recent biological insights (Robert Martin, *The Macho Sperm Myth*, *Aeon*, 23 August 2018).

What indeed might Freud have said? Priapism? Erectile dysfunction? Obsessive-compulsive disorder? To what extent are fantasies about space travel a compensation for the buregoning male infertility crisis -- in the absence of viable aphrodisiacs? Far more provocative, is the sense in which outer space can be construed as a "mega-vagina" via which Alpha males collectively reach a transformative singularity -- an Omega Point. Such a framing could be seen as consistent with the influential argument of Pierre Teilhard de Chardin regarding the human evolutionary journey from Alpha to Omega.

From communication engineering to memetic engineering? The argument above noted the role of satellite constellation technology as a probable precursor to orbital deployment of geo-engineering remedies to climate change. Arguably the more subtle implication (for some) is the manner in which any such configuration to enable communication can be readily re-purposed for memetic engineering in the service of a particular ideology (as indicated by the Facebook complicity in electoral disruption).

Such a form of social engineering has of course been extensively explored in dystopian science fiction. As currently framed by regulatory authorities there are no constraints against such re-purposing -- especially if it is takes the form of an undeclared secondary activity.

Adulterating imagination of the Universe? Those of technical predisposition have little awareness of the nature of the imaginative engagement with the Universe of the peoples of the world -- most notably through much-valued traditional wisdom tales. The articulations of science fiction are but a very particular subset primarily crafted for a particular culture and mindset. Whilst the latter may resonate with the constitution of a constellation of satellites, how this reinforces or erodes alternative modes of imagining the Universe is far from clear. Will such an artifact be understood by some as "cutting off" humanity from the vault of the "Heavens" -- with which the sky has so long been associated?

More complex is the sense in which technology has mythical dimensions in its own right. This is exemplified by the manner in which going into space and travelling to the stars is framed as a dream -- of which current initiatives are a form of fulfillment as variously articulated by Robert Romanyshyn (*Technology as Symptom and Dream*, 2015; *Victor Frankenstein, the Monster and the Shadows of Technology: the Frankenstein Prophecies*, 2019).

Curiously, as one of the primary modern adaptors of non-technical imagination, Disney Enterprises chose to trademark the term imagineering as the implementation of creative ideas in practical form. Given the role of a constellation of satellites in reframing engagement with the Universe, it remains to be explored how that -- combined with imagineering -- reinforces or erodes what is noted in the literature acknowledging the traditional mode, notably:

- Joseph Campbell with Bill Moyers: *The Power of Myth* (1988)

- Karen Armstrong: *A Short History of Myth* (2006)
- Mircea Eliade: *Myth and Reality* (1998)

Given the acknowledged socio-political role of dream, is the initiative of Elon Musk to be seen as the technologist equivalent to the famed assertion of Martin Luther King: *I Have a Dream*? A dream requiring "buy in" by the rest of the world?

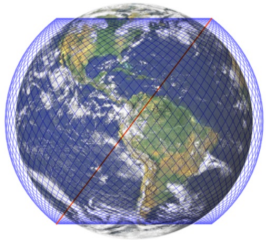
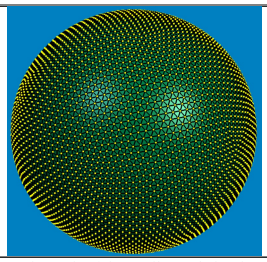
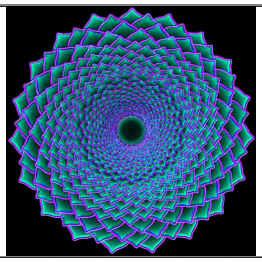
Mythical embodiment through constellation? As a theme of legends, any human interference with the "heavens" (as the realm of the gods") naturally evokes comparison with particular myths and legendary tales. Many may resonate to a greater degree with the framing of a constellation of satellites by such tales than by the articulations of technologists insensitive to such aesthetic and symbolic connotations. This suggests an epic struggle between contrasting mindsets -- itself a feature of some tales. The mythical interpretations may well serve to frame and reinforce opposition to the technological framework -- to the point of undermining its fruitful use.

As noted above, it is especially curious to note how a constellation of satellites could be said to be anticipated to some degree in the formative archetypes of the past -- if only through its visual form. For example, the Omphalos of Ancient Greece, as represented by the marble Omphalos of Delphi, has a carved knotted net covering its surface. Its emplacement was believed to define the centre of the world.

Even more evocative of reflection is the crown chakra (or Sahasrara of tantric tradition) -- notably described as a lotus flower with 1,000 petals of different colours. These petals are arranged in 20 layers, each layer with approximately 50 petals. Some designs may associate the petals with eyes -- offering closer association to the role of the individual satellites in any constellation. Given their role in enabling global consumption, rather than eyes, the satellite-petals could be recognized as nipples.

The crown chakra is held to be the most subtle in that system, relating as it does to pure cosmic consciousness. In a period characterized by unresolved political conflict between the "heartless heads" and the "headless hearts" -- readily represented by distinctive chakras -- there is considerable irony to the sense in which a constellation of satellites could be suggestively represented as the crown chakra of global civilization through which those differences might be reconciled.

It is especially curious to note that the necessary geometrical configuration of any constellation of satellites will in all probability conform to the efficacy of patterns of design envisaged by Bucklminster Fuller with respect to domes -- but also, somewhat ironically, to patterns which feature in the sacred geometry characteristic of the design of any crown (*Engaging with Globality through Cognitive Crowns*, 2009). However, given the probability of several competing constellations of satellites, it is somewhat amusing to imagine them as being variously "lopsided" (if uncoordinated) -- rather than recalling the triple crowns of various traditions, and notably that of Ancient Egypt. As with any crown, there is also the question of whether it performs an enabling function rather than a disabling one.

Contrasting representations of global constellations		
Starlink Constellation [phase 1] first orbital shell: 72 orbits with 22 each -- 1,584 satellites at 550 km altitude	Future constellation of 12,500 satellites encompassing Earth?	Crown chakra animation with 1000 petals, in 20 layers of 50 petals each.
		
Lamid58 [CC BY-SA 4.0], via Wikimedia Commons	Produced with Stella Polyhedron Navigator	Developed from an image by Colin-Bentham on DeviantArt

The animation on the right is the basis for an extensive separation exploration of that pattern in relation to the constellation pattern (*Satellite Constellation and Crown Chakra as Complementary Global Metaphors? Experimental representation of crown chakra in virtual reality*, 2020).

The image on the left is necessarily only indicative. Understanding of the orbital dynamics has been previously provided on the basis of simulation (Douglas Heaven, *The first detailed look at how Elon Musk's space internet could work*, *New Scientist*, 7 November 2018; Matt Williams, *SpaceX Gives More Details on how their Starlink Internet Service Will Work. Less Satellites, Lower Orbit, Shorter Transmission times, Shorter Lifespans*, *Universe Today*, 15 November 2018). Further clarification is noted by Caleb Henry (*SpaceX says more Starlink orbits will speed service, reduce launch needs*, *SpaceNews*, 7 September 2019):

> SpaceX has FCC approval to provide broadband services from a constellation of almost 12,000 satellites. In April, the commission approved SpaceX's request to operate around 1,600 of those satellites at 550 kilometers instead of 1,150 kilometers as originally planned. SpaceX's other authorizations allow for around 7,500 satellites between 335 and 346 kilometers, and around 2,800 satellites at altitudes between 1,110 and 1,325 kilometers. SpaceX said using 72 orbital planes for its satellites at 550 kilometers won't cause a spike in signal interference, or orbital debris risk. The company said it is working with astronomers on making sure Starlink satellites don't interfere with their research, and at this stage believes the change in orbital planes won't "have any material impact on this ongoing analysis of reflectivity".

Commentators have variously explored the relation of Elon Musk's strategy to the Kabbalah (Yonatan Gordon, *Elon Musk's "First*

Principles" Thinking According to Kabbalah, *Community of Readers*, 5 December 2013). Framing Elon Musk and his entrepreneurial colleagues in terms of religion, Sam Kriss has argued that:

> Elon Musk and his co-religionists aren't actually blinded by artifice; they're fixated on a strange and outdated notion that somewhere, there has to be a concrete reality -- they've just decided that it's not this one. (*Tech Billionaires Want to Destroy the Universe -- Seriously*. *The Atlantic*, 16 October 2016)

Confluence of geometries: Religious connotations have been exploited through reference to "ANGELS" (David Shiga, *ANGELS to watch over US air force satellites*, *New Scientist*, 4 August 2006). In this spirit there is a curious confluence between the considerations of sacred geometry and the orbital geometry of a constellation of satellites -- given the focus on the 72 orbital planes of the StarLink configuration (each with 22 satellites?). A provocative checklist by *Wikileaks* on the number 72, offers 22 references to its relevance in religious frameworks including:

- Number of names of God, according to Kabbalah; and their relation to the angels of the *Shemhamphorasch*
- Current distribution of the *Book of Revelation* in 22 chapters (adopted since the 13th century); its the oldest known division being 72 chapters.
- Number of degrees of Jacob's Ladder, according to the *Zohar*.
- Number of disciples sent forth by Jesus in *Luke* 10; and the 72 disciples of Confucius who mastered his teachings.
- Enclosure of Osiris in a coffin by 72 evil disciples and accomplices of Set; and the number of demons sealed away by King Solomon with *The Lesser Key of Solomon*.
- Number of stupas comprising Borobudur, the world's largest Buddhist temple; and the 72 major temples found at Angkor, seat of the ancient Khmer Empire.
- Number of denominations doomed to Hell, according to the *Hadith* of Islam

Any such pattern of coherence lends itself to further speculative exploration (*Engaging with Hyperreality through Demonique and Angelique? Mnemonic clues to global governance from mathematical theology and hyperbolic tessellation*, 2016). The cognitive origins of such patterns and their recognition are the theme of the argument of George Lakoff and Rafael Nunez (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2000) -- and of a separate discussion (*Patterning Intuition with the Fifth Discipline*, 2019).

With human engagement with the Universe framed as a quest for coherence, relevant pattern speculation can be taken further -- given the correlation variously explored between visual renderings of the crown chakra and those of the Mandelbrot set. For example, the M-set can be embodied as a fundamental feature of the crown chakara (*Sahasrara by StChristopher on DeviantArt*, 18 October 2005). Possible implications can be variously explored otherwise (*Psycho-social Significance of the Mandelbrot Set: a sustainable boundary between chaos and order*, 2005; *Sustainability through the Dynamics of Strategic Dilemmas -- in the light of the coherence and visual form of the Mandelbrot set*, 2005).

Given continuing reflection by astrophysicists on the shape of the Universe and on fractal cosmology, the possibility has even been raised that it could take the form of a Mandelbrot set (*Could the Universe be in the shape of a Mandelbrot? Quora*, 26 November 2017). The possibility is discussed by Nico Heidari Tari (*Plato, and the Fractal Geometry of the Universe*, Erasmus University Rotterdam, 2018). Greater detail is offered by Jonathan Dickau (*Does the Mandelbrot Set offer Clues to the Cosmological Evolution of Form? 2nd Crisis in Cosmology Conference*, 2008). later summarized in a remarkable video (*Can the Mandelbrot Set help us understand the Cosmos? YouTube*, 22 August 2014).

Unadulterated star light as a human right

From a legal perspective, of some relevance to the above argument is the understanding in UK Common Law of nuisance with regard to so-called ancient lights. This gives a landowner a right by prescription to the unobstructed passage of light from adjoining land if the landowner has had uninterrupted use of the lights for twenty years. No one can complain of a sudden or unannounced obstruction of a long-standing source of light unless the light is said to be ancient. (Howard Davis, *The Future of Ancient Lights*, *Journal of Architectural and Planning Research*, 6, 1989, 2). The metaphor has been used by a political activist (*Thom Hartmann*, *The Last Hours of Ancient Sunlight: the fate of the world and what we can do before it's too late*, 2004)

Star light could well be deemed to be "ancient", and understood as "interrupted" by an artificial constellation. The constraint may be of some relevance to the constellattion planned by OneWeb as a UK-based corporation. Of interest in legal terms is the qusttion of how fine a mesh of interweaving satellites could be interpreted as interrupting ancient lights.

It is notable that this principle has not been adopted in the USA since it is deemed to greatly hinder commercial and residential growth and the expansion of towns and cities. However the issue is evident in the preoccupation with the shadows cast by skyscrapers -- engendering so-called set-back requirements -- most evidently in New York, and most ironically with respect to the tower construction initiatives of Donald Trump (*Super-tall, super-skinny, super-expensive: the 'pencil towers*, *The Guardian*, 5 February 2019; *In the Shadow of Rising Towers, Laments of Lost Sunlight in New York*, *The New York Tmes*, 20 December 2013; *Revisiting the Last Great Debate Over Skyscraper Shadows*, *Intelligencer*, 4 May 2016).

Of far greater relevance to this argument is the 500-page compilation, edited by Cipriano Marín and Jafar Jafari (*StarLight: a common heritage*, 2008) on behalf of the International Initiative in Defence of the Quality of the Night Sky and the Right to Observe the Stars (of which the Starlight Foundation is now the organizing focus). The 70 papers are clustered into the following sections:

• The Importance of Starlight in Human Culture • Nightscapes, Biodiversity, and Sustainable Development • The Right to Starlight • Intelligent Lighting and Light Pollution	• Preservation of Astronomical Sites • *Starlight - Declaration in defence of the night sky and the right to starlight*

For Cipriano Marín (*Regaining our right to observe the stars*)::

> A right is in danger, and not the resource itself. For several reasons, for the first time in the humankind history, a large part of world population is living without any contact with the beauty of a starry sky. Suddenly we forgot the magnificence of the universe at night and its powerful aesthetic emotional impact that has been pervading the development of arts, music, poetry, dance, knowledge and science over the centuries. We are rapidly losing the incredible sensation defined by Omar Khayyam as "the heavenly solitude of the stars and roses".

The compilation unfortunately cultivates a degree of confusion between observation of the stars as the natural preoccupation of astronomers concerned by light pollution (to which thousands of satellites would contribute) and the cognitive significance of starlight (which proliferation of satellites would degrade). The IAU, which publihed the report in it *Proceedings*, necessarily suffers from a conflict of interest given the benefits that astronomers derive from satellite-based telescopes This conflation regarding the starscape is only partly remedied by the unrepresentative contribution of Juan Antonio Belmonte as President of the European Society for Astronomy in Culture (*Seeking Starlight: dreams of transcendentalism, mystery and imagination*).

With respect to its cultural significance, participants did however conclude:

> The first hominid to lift its gaze to the sky, and its arms at the same time to get the stars, became the first man. Since that moment, the night sky has been one of the most important factors for the cultural, religious, spiritual and scientific development of mankind.
>
> The sky is an integral part of the environment perceived by humanity. Mankind has always observed it, either to interpret it, or to understand the physical laws governing the universe. Nowadays we run the risk of reducing our everyday astronomical culture to the exclusive domain of a handful of scientific researchers. One of our most ancient and universal cultural values is threatened and may become extinct.
>
> Interest in the sight of heavenly bodies has also powerfully influenced artistic manifestations. For uncountable generations human beings have looked at the starry sky like a source of inspiration for the most diverse aspects of their cultural heritage. The grandeur of the universe at night, and its powerful aesthetic appeal, has impregnated the development of art, music, poetry and dance throughout the centuries.

The compilation includes a number of contributions on the legal aspects of the right to starlight, especially noteworthy being that of Phil Cameron of the Space Travel Law Association (*The Right to Starlight under International Law*). The many contributions on light pollution are especially valuable if a global network of satellites is understood as a particular instance of such pollution.

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