Darvas, Tamás*

Objective of Space Law – Questions of Non-Appropriation, Use and the Human Genome Theory

"Ignoranti, quem portum petat, nullus suus ventus est."

– Seneca[1]

Abstract

The non-appropriation principle is considered by many scholars as the *grundnorm* (basic law) of international space law. Many also see this basic law being under attack. In this Article, I will argue that the principle of non-appropriation is in its current form is too vague to be applied consistently. This interpretation is supported by an analysis of basic problems emerging during the interpretation of this principle. In this Article, I will also argue that in addition to the problem of the principle of non-appropriation, space law has no clear objective. These two issues fundamentally determine the future of the field. I also outline that the objective of space law and space jurisprudence relates to certain scientific definitions for example, the human genome.

Keywords: space law, objective, territorial sovereignty, national appropriation, non-appropriation, principle, right to use, human genome

I. Introduction

We are living in a new space age.[2] It is evident that during this new era of space, space law faces many serious challenges. Just to mention a few examples: the failure of soft law in the field of mitigation of space debris, the challenges of commercialisation and

* Darvas, Tamás is a junior associate at the Sárhegyi and Partners Law Firm.

1 "There is no favourable wind for the sailor who doesn't know where to go."

2 On the concept of the "new space age" see E. Quintana, The New Space Age, (2017) 162 (3) *The RUSI Journal,* 88–109. https://doi.org/10.1080/03071847.2017.1352377

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exploitation, and the questions of militarisation and self-defence.[3] However, there is one challenge that relates to the very objective of space law: the failure of the principle of non-appropriation in relation to exploitation. In this article, I focus on the very roots of this problem, outline some basic theoretical and philosophical concepts, and correct some misunderstandings in relation to the objective and principles of space law. Meanwhile, I also try to show how the purpose of space activity and space law might relate to the survival of the human genome.

II. Principles of space law and the principle of non-appropriation (Article II of the Outer Space Treaty)

The basic concepts and principles of space law include the freedom of exploration and use,[4] non-appropriation,[5] the common heritage principle[6] and the concept of the use of space for the benefit for all mankind.[7] This article mainly focuses on the principle of non-appropriation; however (as it will be further indicated), these principles are very interrelated.

The principle of non-appropriation is set out in Article II of the Outer Space Treaty, as it stipulates that "Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[8] This principle is closely related to the concept of sovereignty (i.e. a states' supreme authority within a territory or the ultimate power

[3] In relation to space debris, commercialisation and exploitation see Darvas T., A világűrjog fogalmi és történeti alapjai, új kihívásai, (2020) 8 (3–4) *Arsboni,* 3–16. In relation to exploitation also see Sipos A., Az emberiség és a világűr. Zsákmányoljuk ki a mindenkiét! in Kajtár G. and Sonnevend P. (eds), *A nemzetközi jog, az uniós jog és a nemzetközi kapcsolatok szerepe a 21. században: Tanulmányok Valki László tiszteletére,* (ELTE Eötvös Kiadó, Budapest, 2021) 429–441. In relation to self-defence see Sulyok G., Világűr és önvédelem, in Kajtár G. and Sonnevend P. (eds), *A nemzetközi jog, az uniós jog és a nemzetközi kapcsolatok szerepe a 21. században: Tanulmányok Valki László tiszteletére,* (ELTE Eötvös Kiadó, Budapest, 2021) 451–467.

[4] S. Hobe, Adequacy of the Current Legal and Regulatory Framework Relating to the Extraction and Appropriation of Natural Resources in Outer Space, (2007) 32 *Annals of Air and Space Law,* 204–205.

[5] A. D. Pershing, Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today, (2019) 44 (1) *Yale Journal of International Law,* 151.

[6] R. Wolfrum, The Principle of the Common Heritage of Mankind, (1983) 43 *Heidelberg Journal of International Law,* 312–337.; S. J. Shackelford, The Tragedy of the Common Heritage of Mankind, (2008) 27 *Stanford Environmental Law Journal,* 131.

[7] K. Nyman-Metcalf, Space for the Benefit of Mankind New Developments and Old Problems, (2009) 34 *Annals of Air and Space Law,* (621–644) 622.

[8] Article II of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies [GA Res. 2222 (XXI)].

within that territory), as set out in the *Customs Regime* Advisory Opinion and the *Las Palmas* case *(Palmas Island Arbitration).*[9]

Every state has sovereign authority within its territory, and its limit is the boundary between Earth's atmosphere and outer space (which is not yet precisely defined by law).[10] This suggests that the principle prohibits the acquisition of territorial sovereignty over any part of outer space.[11] However, Article II of the Outer Space Treaty almost instantly raised debates, and the exact meaning of appropriation, national appropriation, sovereignty, extraction and exploitation were questioned, even though customary international law originally treated the non-appropriation principle of the Outer Space Treaty as unambiguous and broadly applicable to all space activity.[12] Non-appropriation was among the very first principles of space law that emerged.[13] Nevertheless, even this (claiming that this was one of the first and most fundamental principles of space law) does not make our situation easier, since the right of all countries to use space was developed at about the same time.[14]

It seems that the draft of Article II of the Outer Space Treaty was founded on two assumptions that ceased to be evident: that only States would seek to appropriate space resources; and that the phrase "the moon and other celestial bodies" would be interpreted as the all celestial bodies, including extracted resources, such as mined minerals.[15] Abigail D. Pershing notes that Stephen Gorove highlighted the potential loopholes early on, since the Outer Space Treaty appears to contain no prohibition regarding individual appropriation or acquisition by a private association or an international organisation, even if other than the United Nations.[16] Thus, at present, an individual acting on his own behalf or on behalf of another individual or a private association or an international organization could lawfully appropriate any part of outer space, including the moon and other celestial bodies. This means that even though this (supposedly) was not the original intention, in the absence of such prohibition,

[9] Customs Regime between Germany and Austria, Advisory Opinion, 1931 P.C.I.J. (ser. A/B) No. 41 (Sept. 5) (Individual opinion of Judge Anzilotti) p. 57.; Arbitrator Max Huber in the *Island of Palmas Case (Netherlands v. USA),* The Hague, April 4, 1928. p. 8.

[10] Sipos A., A légtér jogi státusza és használata, (2016) (1) *Jogelméleti Szemle,* http://jesz.ajk.elte.hu/2016_1.pdf (Last accessed: 30 December 2021) 97–105.

[11] Z. A. Paliouras, The Non-Appropriation Principle: The Grundnorm of International Space Law, (2014) (27) (1) *Leiden Journal of International Law,* (37–54) 43. https://doi.org/10.1017/S0922156513000630

[12] Pershing, Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today, 151.

[13] Nyman-Metcalf, Space for the Benefit of Mankind New Developments and Old Problems, 624.

[14] Ibid.

[15] S. Gorove, Interpreting Article II of the Outer Space Treaty, (1969) 37 (3) *Fordham Law Review,* (349–354) 350–352.

[16] Pershing, Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today, 156–157.

resources are up for grabs for private associations. Therefore, the current situation is that the Outer Space Treaty only prohibits *national* appropriation by means of use or occupation, or by any other means, in outer space.[17] Naturally, such appropriation could be limited by the state (i.e., the launching state) responsible for such private actor's activity. However currently there is no clear guideline or good practice for such limitation.

III. The freedom of exploration and use (Article I para 2 of the Outer Space Treaty)

However, the roots of the problem mentioned not only relate to the questions of individual or national appropriation. The questions of private property rights, and the freedom of exploration and use of outer space are also relevant in this context. It is also worth noting that the freedom of exploration and use and the principle of non-appropriation are also very much interrelated.

Article I of the Outer Space Treaty sets out two very basic space law concepts: in Article I para 1 the concept of use of space for the benefit for all mankind and in Article I para 2 the freedom of exploration and use of outer space. The concept of use of space for the benefit for all mankind means that: "The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind." Whereas the freedom of exploration and use of outer space according to the Outer Space Treaty means that "Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies."

Based on the meaning of the principle of non-appropriation, it is clear that this freedom of use of outer space is not without limitations. The main limitation is by the principle of non-appropriation.[18] The main question here is what the content of this freedom of use of outer space is and to what extent and how the principle of non-appropriation limits it.

[17] Paliouras, The Non-Appropriation Principle: The Grundnorm of International Space Law, 43.; S. Gorove, Sovereignty and the Law of Outer Space Re-Examined, (1977) 2 *Annals of Air and Space Law,* 314.

[18] Hobe, Adequacy of the Current Legal and Regulatory Framework Relating to the Extraction and Appropriation of Natural Resources in Outer Space, 204–206.

IV. The problem of the principles, the war of interpretations

The heart of the current dubious relationship of the two principles is this: as mentioned, the Outer Space Treaty contains no prohibition regarding individual appropriation or acquisition by a private association or an international organisation. However, according to some, there is still a consensus that both national appropriation and private property rights are denied under the Outer Space Treaty.[19] This interpretation limits the use to pure use (similar to a rental agreement) without any appropriation (national or individual). Based on this it is no wonder that some see the legal proposals arguing the need for amending or expanding the scope of Article II in order to promote the commercial development of outer space as an attack on the principle of non-appropriation.[20]

This so-called consensus therefore seems to be very much in doubt. Proposals to amend the principle of non-appropriation also outline practical difficulties that arose in relation to its application. Even though there are arguments to accept the principle of non-appropriation as a customary rule based on state practice, as previously shown, the true nature of the principle was almost instantly debated.[21] It is no question that the principle of non-appropriation is the basic principle of space law. However, this basic norm seems to be too vague to be applied consistently.

The freedom of use generally relates to the extraction of resources from planets and asteroids.[22] Stephan Hobe considers extraction as the part of the freedom of use, and also highlights that the wording of Article I and II of the Outer Space Treaty is rather vague.[23] But what are the practical difficulties and the new proposals in relation to the above?

The current state of space law serves as a basis for different interpretations of the legal situation of non-appropriation. The exact problem emerges at exactly the moment when people are trying to apply these principles to a specific space activity. This is when different people arrive at different conclusions on the legality of the activity.[24]

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[19] F. Tronchetti, The Non-Appropriation Principle Under Attack: Using Article II of the Outer Space Treaty in Its Defence, in *International Astronautical Congress* (2007) (IAC-07-E6.5.13) available at: https://iislweb.org/docs/Diederiks2007.pdf (Last accessed: 30 December 2021) 3.

[20] Tronchetti, The Non-Appropriation Principle Under Attack: Using Article II of the Outer Space Treaty in Its Defence, 2. and F. Tronchetti, The Non–Appropriation Principle as a Structural Norm of International Law: A New Way of Interpreting Article II of the Outer Space Treaty, (2008) 33 *Air and Space Law,* 277–305. https://doi.org/10.54648/AILA2008021

[21] For the argument relating to customary rules and state practice: Tronchetti, The Non-Appropriation Principle Under Attack: Using Article II of the Outer Space Treaty in Its Defence, 4–5.

[22] F. G. von der Dunk, Asteroid Mining: International and National Legal Aspects, 26 (2018) *Michigan State International Law Review,* 83–84.

[23] Hobe, Adequacy of the Current Legal and Regulatory Framework Relating to the Extraction and Appropriation of Natural Resources in Outer Space, 206–207., 212.

[24] Nyman-Metcalf, Space for the Benefit of Mankind New Developments and Old Problems, 622.

An overall summary of the viable interpretations of proposals addressing this issue could be as follows: there is no international law of any relevant specificity addressing ownership rights over extracted resources (except for the Moon Agreement which indirectly addresses it through the concept of common heritage of mankind, however many consider this treaty a failed treaty as no major space power has ratified it).[25] However, if we regard space law (including the concept of non-appropriation) as a set of rules that regulate celestial bodies but not the natural resources contained in them, this gives way to certain solutions and a concept where the unilateral licensing of exploitation (extraction) of the resources is allowable, without ownership of a certain part of the surface or claim for sovereignty on the over any part of outer space. According to some, such interpretation would not be considered illegal, since what we have is only an existing but vague principle (the principle of non-appropriation).[26] If there is no clear set of rules, such proposals become merely a particular interpretation of an existing but vague international legal principle. From here, it is only one step to allow "national licensing of mining operations as long as the relevant overriding public interests in the safety, security, and general international legality of space activities would be guaranteed to be protected thereby."[27] Another similar proposal mentions the introduction of a "first-come, first-served principle".[28] This proposal argues that, if this principle is detailed enough, it could serve as a valid basis for fair competition while also serving the public interest.

This is exactly the heart of the problem: when even the basic principles of space law are too vague, and the legal field has no clear idea of what is illegal and what isn't then, from there, everything is possible. The interpretations above stem from a logical and valid need: the need for clear rules, and the need for a realistic (and effective) solution, with ensuring respect for the public order and safety. By this, the principle of non-appropriation could be interpreted not as a death-knell for resource extraction, but a functional starting point permitting a robust system of rights and responsibilities.[29] Earth-based approaches, impossible treaty-based solutions (such as the Moon Agreement) and further "fragmentations" of interpretations seem to be unviable.[30] More than 20 years ago,

[25] von der Dunk, Asteroid Mining: International and National Legal Aspects, 97.; The "Moon Agreement" – Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (General Assembly resolution 34/68).

[26] von der Dunk, Asteroid Mining: International and National Legal Aspects, 97.

[27] Ibid. 101.

[28] F. G. von der Dunk, Private Property Rights and the Public Interest in Exploration of Outer Space, (2018) 13 (2) *Biological Theory,* (142–151) 148. https://doi.org/10.1007/s13752-017-0271-9

[29] J. G. Wrench, Non-Appropriation, No Problem: The Outer Space Treaty Is Ready for Asteroid Mining, (2019) 51 (1) *Case Western Reserve Journal of International Law,* (437–462) 461.

[30] von der Dunk, Asteroid Mining: International and National Legal Aspects, 100–101.; Wrench, Non-Appropriation, No Problem: The Outer Space Treaty Is Ready for Asteroid Mining, 461.

Bin Cheng wrote about the "need for new treaties".[31] Today, it is clear that multilateral treaties are not enough. This is because we have come to the end of multilateralism: the age of formal space law treaties has come to an end, since (due to diverging interests) it is unlikely that spacefaring nations could reach a consensus and therefore no new space law treaties have been adopted since the Moon Agreement of 1979.[32]

These partially valid interpretations described above typically use a "fragment" of the complete ownership *(dominium)*.[33] According to my interpretation, such fragments might include, for example, the right to use *(ius utendi),* possess *(ius possidendi),* profit *(ius fruendi),* dispose *(ius disponendi)* and/or alienate *(ius alienandi).* However, the true fragmentation is due to certain countries going in one direction and others going in another.[34] All in all, it is clear that, in order to make things clearer, there needs to be a properly thought-out and detailed system (either in a form of a binding or non-binding document, for example: a guideline).

Katrin Nyman-Metcalf emphasises two very important points besides the fact that several authors have elaborated on types of rights, limited periods of use and concepts of liability.[35] The first is that, in order to avoid appropriation, any system should be based on licensing and not on the award of permanent property rights. Even in this case the ownership on extracted resources remains unaddressed. The main aim of licensing would be to limit the domination of certain entities to areas they would usefully and profitably exploit over a limited period of time.[36] It is worth noting that another (but rather vague) alternative to ownership right is the introduction of "safety zones" on the surface of the Moon and other celestial bodies.[37] The idea of these safety zones or "keep-out zones" (establishment of safety areas around space objects, for example: lunar stations or other installations) is not new;[38] however, the concept recently raised debates due to its introduction in the Artemis Accords.[39]

[31] B. Cheng, The Commercial Development of Space: the Need for New Treaties, in B. Cheng (ed.), *Studies in International Space Law,* (Oxford, 1997, 641–667) 667. https://doi.org/10.1093/acprof:oso/9780198257301.003.0025

[32] F. Lyall and P. B. Larsen, *Space Law – A Treatise,* (Ashgate, 2009) 467–468.

[33] J. Tjandra, The Fragmentation of Property Rights in the Law of Outer Space, (2021) 46 (3) *Air and Space Law,* 376. https://doi.org/10.54648/AILA2021021

[34] Ibid. 373–394.; von der Dunk, Asteroid Mining: International and National Legal Aspects, 100–101.

[35] Nyman-Metcalf, Space for the Benefit of Mankind New Developments and Old Problems, 639.

[36] Ibid. 640.

[37] See J. W. Nelson, Safety Zones: A Near Term Legal Issue on the Moon, (2020) 44 *Journal of Space Law,* 604–624.

[38] K. Schwetje, Protecting Space Assets: A Legal Analysis of Keep-Out Zones, (1987) 15 *Journal of Space Law,* 131.

[39] *The Artemis Accords: Principles For Cooperation In The Civil Exploration And Use Of The Moon, Mars, Comets, And Asteroids For Peaceful Purposes,* https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf (Last accessed: 30 December 2021).

The second point is that the need for an international authority and self-regulation should be examined.[40] Similarly to Frans G. von der Dunk, Katrin Nyman-Metcalf also mentions that a system based on first possession may be positive, as it requires very little government intervention.[41] Based on the above, she describes a system where the decisive question when permitting use is whether the activity has an element that is for the significant benefit for mankind or not.[42] Therefore "benefit for all mankind" is described as the decisive element of use versus appropriation.

Without judging which of the above is the best proposal and without judging whether it is the use of the first come first serve concept or the element of the significant benefit (or both), the following two statements can be said: a) if sufficiently elaborated, the concept of benefit for all mankind (or any similar principle) can be the border between use and appropriation; b) this framework (or limitation) would limit space activity *per se;* however it is still not decided whether such activity should actively serve the benefit of mankind or it should (passively) "not hurt" it.

V. The objective of space law and space jurisprudence; natural law roots

As argued above, the basic norm of space law (in the form of the principle of non-appropriation) exists, but it is too vague. In this part I will argue that not only it is too vague but, in addition to that, space law has no clear objective. I will also argue that this makes space jurisprudence and the interpretation of space law a fairly hard task. Finally, I will argue that the objective of space law and space jurisprudence relates to certain scientific definitions.

What is the objective of space law and space jurisprudence? It is clear that the current discussion about space law mainly focuses on the practical problems of the implementation of (mostly vague) principles and regulations. However, as we saw, such practical problems relate to the very roots of the field. And not only that, but this also relates to our very vague conception of the objective of space law and space jurisprudence. As George S. Robinson stated:

> Clearly, the direction of the present discussion is the focusing upon space jurisprudence and implementing positive laws as critical in assisting humankind migration off-Earth as

[40] Nyman-Metcalf, Space for the Benefit of Mankind New Developments and Old Problems, 639.; K. Nyman-Metcalf, National and international regulatory aspects of commercial space activities: self-regulation as the way forward?, in J. Wouers, P. de Mann and R. Hansen (eds), *Commercial Uses of Space and Space Tourism,* (Edward Elgar, 2017) 268–275. https://doi.org/10.4337/9781785361074

[41] Nyman-Metcalf, Space for the Benefit of Mankind New Developments and Old Problems, 639.

[42] Ibid. 623.

> a rational activity to protect and encourage the evolution of biological, biotechnological, and perhaps, ultimately, even the bio-technologically embraced "essence" of humankind.[43]

So, what is clear is that the present discussion focuses on something that Robinson calls "implementing positive laws". Today, space jurisprudence has a clear notion of what space law is.[44] Since the provisions of the treaties of international space law are very often not detailed enough to be applied consistently, it is also clear that space law depends upon the implementation of daily space law positivisms, domestic legislation and implementing rules, and also the variety of multilateral and bilateral space related public and private international treaties and conventions.[45] But how does space law relate to the humankind migration off-Earth and the "essence" of humankind?

Robinson states that the objective of space law is

> to facilitate the variety of activities upon which space migration depends. Again, such migration is critical to humankind survival and that of its transhuman and post human descendants. These various laws and treaties, etc., are critical, also, to the facilitation and enhancement of the space migration and ultimate evolution and survival, or extinction, even of humankind's "essence".

and also states that

> It is organised information used in varying ways to enhance personal and societal/civilisation survival for the purpose of perpetuating a species' genome survival and evolution, as well as that of the individual and collective "essences" of that species. The objective, to the extent an objective can be characterised, is one of evolving and continuing the development of the odyssey of trying to comprehend existence as well as the requirement or purpose and need for existence. This idea is not limited to modern humans – Homo sapiens sapiens who stands on the shoulders of the first simplistic form of organic, carbon-based life (also embracing a degree of "essence"). It very likely applies to "unique" life forms not yet identified by humans.[46]

These foggy, yet very important statements must be further analysed for our understanding. Based on the above, what has to be clarified is the objective of space activities

[43] G. Robinson, What does Philosophy do for Space Jurisprudence and Implementing Space Law? Secular Humanism and Space Migration Essential for Survival of Humankind Species and its "Essence", (2016) (19) *McGill University Institute of Air and Space Law, Occasional Paper Series,* 47.
[44] Darvas, A világűrjog fogalmi és történeti alapjai, új kihívásai, 4–6.
[45] Robinson, What does Philosophy do for Space Jurisprudence and Implementing Space Law?, 37.
[46] Robinson, What does Philosophy do for Space Jurisprudence and Implementing Space Law?, 5.

(including space travel and space migration, off-Earth habitation i.e. the colonization of space), the objective of space law and space jurisprudence.

Besides Robinson, other scientists also state that the ultimate objective of space activities (including space travel and space migration, off-Earth habitation i.e. the colonization of space) is the survival of mankind.[47] Based on their description of this objective, mankind's travel to other planets seems to be an urgent task. Robinson also mentions (as stated above) "genome survival" besides the survival of humankind and its "essence". From this perception of the objective of space activities comes the idea that the objective of space law and space jurisprudence is to assist such activities.[48] Such objectives are not explicit in treaties, and a globally agreed upon set of objectives, such as a species' genome survival and evolution is absent from current regulations.[49] The space treaties and most of the implementing positive laws seem to ignore the genomic competition that currently drives space migration (the genesis of that competition is found in the philosophy of space law and its roots in natural law theory).[50] Robinson states that it can be well argued that time is reaching a stage of criticality for revision of the Outer Space Treaty in a fashion that helps facilitate long term and permanent habitation of humankind off-Earth for purposes of human genome survival and that of its evolving transhuman and posthuman descendants.[51] It is also worth noting that according to some, the objective of space activities and space law may be different from the above. The above is only one (very straightforward and coherent) interpretation of the many interpretations available.

According to some, space travel beyond Mars will never be possible.[52] Or, even if it will be possible, it will never be a reasonable endeavour.[53] Some even say, that space travel will always be a foolish hope.[54] Of course, with the current technology available to humanity reaching Alpha Centauri system's exoplanet Proxima b – orbiting in the habitable zone of the red dwarf star Proxima Centauri, which is the closest star to the Sun – would take an awful lot of time.[55] On the other hand, some scientists do not discard the possibility of space travel so easily, and they say that humanity will

[47] S. Hawking, *Rövid válaszok a nagy kérdésekre,* (Akkord Kiadó, Budapest, 2019) 173–175.
[48] Robinson, What does Philosophy do for Space Jurisprudence and Implementing Space Law?, 47.
[49] G. S. Robinson, The Devolution of Space Law Positivisms and a Reassessment of Space Law Philosophy: Natural Law Theory Roots of Space Jurisprudence, (2015) 40 *Annals of Air and Space Law,* 753.
[50] Ibid. 753–754.
[51] Ibid. 754.
[52] Gál Gy., Az égitestek jogi helyzete, (2012) 8 *Iustum Aequum Salutare,* 11.
[53] L. Friedman, Human Spaceflight: From Mars to the Stars, (University of Arizona Press, 2015); L. Friedman, Oh the Places We Won't Go: Humans Will Settle Mars, and Nowhere Else [Excerpt], *Scientific American,* 13.11.2015, https://www.scientificamerican.com/article/oh-the-places-we-won-t-go-humans-will-settle-mars-and-nowhere-else-excerpt/ (Last accessed: 30 December 2021).
[54] Bartóki-Gönczy B., Az űrtevékenységek nemzeti szintű szabályozása – A nemzetközi jogi környezet, valamint az ESA tagállamok gyakorlatának elemzése, (2020) 16 *Iustum Aequum Salutare,* 93.
[55] S. Hawking, *Az idő rövid története,* (Akkord Kiadó, Budapest, 2003) 49.

to come up with a new technology that makes space travel beyond Mars possible.[56] There are some initiatives, such as the *Breakthrough starshot*.[57] Scientist Philip Lubin also came up with a roadmap for such technology.[58] Of course, even a mission to Mars could be dangerous to the human body.[59] However, even if it is dangerous to our body and DNA, with genetic alteration methods developed in the future, this problem will be likely to be solved forever.[60] And there are some indications that Proxima b could be inhabitable or, even if it habitable, it would be extremely hard to reach escape speed from there using chemical propulsion alone.[61] Even so, it would be misguided to discard humanity's potential to reach other planets beyond Mars. Some even argue that Mars as a single "backup" copy of the human race is a thin reed on which to base long-term human survival.[62]

So, the ultimate goal of space activities is the survival of mankind. The ultimate goal of space law and space jurisprudence is to assist such activities.

But what is mankind? What is human life? What is the genome and genome survival? What is mankind's essence? If space law's objective and task is to assist this objective, what is law's exact role in this?

VI. The Human Genome and Humankind

We should start answering the questions raised previously with the concept of mankind. Mankind means – according to the Cambridge Dictionary – the whole of the human race, including both men and women.[63] That is all humans *(homo sapiens),* collectively. Human life – in very simplified terms – is a living being we call human, and a living being usually has two elements: a set of instructions that tell the system how to sustain

[56] Hawking, *Rövid válaszok a nagy kérdésekre,* 180.
[57] See: https://breakthroughinitiatives.org/initiative/3 (Last accessed: 30 December 2021).
[58] P. Lubin, A Roadmap to Interstellar Flight, (2016) 69 *Journal of the British Interplanetary Society,* 40–72.
[59] Z. S. Patel, T. J. Brunstetter and W. J. Tarver (et al.), Red risks for a journey to the red planet: The highest priority human health risks for a mission to Mars, (2020) 6 (33) *npj Microgravity,* 1–13. https://doi.org/10.1038/s41526-020-00124-6
[60] See S. Hawking, *Life in the universe,* (1996), https://www.hawking.org.uk/in-words/lectures/life-in-the-universe (Last accessed: 30 December 2021).
[61] K. Vida, K. Oláh and Zs. Kővári (et al.), Flaring activity of Proxima Centauri from TESS observations: quasi-periodic oscillations during flare decay and inferences on the habitability of Proxima b, (2019) 884 *The Astrophysical Journal,* 1–15. https://doi.org/10.3847/1538-4357/ab41f5; A. Loeb, Escape from Proxima b, *Scientific American,* 16.04.2018, https://blogs.scientificamerican.com/observations/escape-from-proxima-b/ (Last accessed: 30 December 2021).
[62] D. Skran, Book Review: Human Spaceflight, *National Space Society,* 07.02.2016, https://space.nss.org/book-review-human-spaceflight/ (Last accessed: 30 December 2021).
[63] See: Mankind, in *Cambridge Dictionary,* https://dictionary.cambridge.org/dictionary/english/mankind (Last accessed: 30 December 2021).

and reproduce itself, and a mechanism to carry out the instructions (in biology, these two parts are called genes and metabolism).[64] As we can see, genes are one element of human life (in a biological sense).[65] This (that a living being consists of two basic elements) is true in a non-biological sense as well: computer viruses can also be considered living beings.[66] We can also speculate that there might be life with some other chemical basis, such as silicon.[67]

Genes are the elementary units of heredity and a sequence of nucleotides in DNA.[68] The genome is the complete set of information in an organism's DNA.[69] However, the concept of a "gene" can mean many things. For example, genes can be said to embody messages in the classic, information-theory sense.[70] This means that genes carry on information (from one generation to the other) relating to inheritance, according to the "transmission sense of information" in genetics.[71] This transmission concept focuses entirely on the adaptive part of the genome: it is described in terms of the role of selection in determining the information that must be passed from one generation to the next, as a signal of an appropriate way to develop in the environment likely to be encountered.[72] This description of the transmission sense of information rests on genetic information having a "teleofunction": its purpose is to inform future generations.[73] Based on this notion of genetic information having a teleofunction, it is no wonder that evolutionary biologists talk about an "overarching cooperation of genetic elements temporarily united in a genome" and the "genome working together".[74]

[64] Hawking, *Rövid válaszok a nagy kérdésekre,* 86.

[65] Further see A. Danchin, From chemical metabolism to life: the origin of the genetic coding process, (2017) 13 *Beilstein Journal of Organic Chemistry,* 1119–1135. https://doi.org/10.3762/bjoc.13.111; V. V. Tetz nad G. V. Tetz, A new biological definition of life, (2020) 11 *BioMolecular Concepts,* 1–6. https://doi.org/10.1515/bmc-2020-0001; M. Peters and P. Jandric, Artificial Intelligence, Human Evolution, and the Speed of Learning, in J. Knox, Y. Wang and M. Gallagher (eds), *Artificial Intelligence and Inclusive Education,* (Springer, Singapore, 2019) 195–206. http://dx.doi.org/10.1007/978-981-13-8161-4_12

[66] Hawking, *Rövid válaszok a nagy kérdésekre,* 86–87.

[67] Ibid. 86–90.; R. Dessy, Could silicon be the basis for alien life forms, just as carbon is on Earth? *Scientific American,* 23.02.1998, https://www.scientificamerican.com/article/could-silicon-be-the-basi/ (Last accessed: 30 December 2021).

[68] S. Benzer, The elementary units of heredity, in W. D. McElroy and B. Glass (eds), *The chemical basis of heredity*, (Johns Hopkins Press, Baltimore, 1957) 70–93.; The New York-Mid-Atlantic Consortium for Genetic and Newborn Screening Services, *Understanding Genetics: A New York, Mid-Atlantic Guide for Patients and Health Professionals,* (Genetic Alliance, Washington D.C., 2009) Appendix A.

[69] S. C. Roth, What is genomic medicine?, (2019) 107 *Journal of the Medical Library Association,* 443. https://doi.org/10.5195/jmla.2019.604

[70] L. Bromham, What is a gene for?, (2016) 31 *Biology and Philosophy,* 114.

[71] Ibid. 117.

[72] Ibid.

[73] Ibid. 117–118.

[74] D. C. Lahti and B. S. Weinstein, The better angels of our nature: group stability and the evolution of moral tension, (2005) 26 *Evolution and Human Behavior,* 52. https://doi.org/10.1016/j.evolhumbehav.2004.09.004

Weinstein describes this as follows: "The genome works together, and subsets only rarely seek their own interests at the expense of other elements, because the persistence of a gene or chromosome depends on the survival and reproduction of the individual housing it. Cooperation to increase individual fitness is therefore usually the best strategy for a genomic element."[75]

Relating to the "transmission sense of information" it can be stated that first, the transmission was based on transmission by genes (internal record of information, handed down to succeeding generations in DNA); this is what Hawking calls the "Darwinian phase" which lasted about three and a half billion years.[76] However, during the last ten thousand years or so, we have been in what Hawking calls an "external transmission phase".[77] This type of evolution (information handed down externally) is based on the external record, in books, and other long-lasting forms of storage. This idea is somewhat similar to the idea that not only consciousness and language are what makes humans different from animals but our memory too: by memory and storing information mankind accumulates, possesses and uses its past and, by this, each person's present starts at a point in humankind's accumulated past.[78] This question also relates to the problem of science being a thing "in a whole" and specialists specialising in too narrow fields, and also relates to the need for interpreting law and science in a multidisciplinary manner.[79]

Based on the above, it is clear that the notion of human survival and genome survival being the objective of space travel is not a foolish one. Gene survival or "persistence" and the individual housing it being its "survival machine" is not a new idea.[80]

So, what is law's role in this? In this sense, law is only a tool to be used to implement community or societal survival values formulated by means other than the legal process, itself.[81] Laws are the biochemical/biophysical articulations of bio-ecological dictates and the as yet intangible and unquantifiable need to pursue, if not satisfy, abstract curiosity beyond that which is oriented solely towards individual and collective biological survivability.[82]

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[75] B. S. Weinstein, *Evolutionary Trade-Offs: Emergent Constraints and Their Adaptive Consequences,* Dissertation at the University of Michigan (2009), https://deepblue.lib.umich.edu/bitstream/handle/2027.42/63672/fruitbat_1.pdf (Last accessed: 30 December 2021) 72.

[76] Hawking, *Rövid válaszok a nagy kérdésekre,* 94.

[77] Ibid. 93–94.

[78] J. Ortega y Gasset, *A tömegek lázadása,* (Helikon Kiadó, Budapest, 2019) 42.

[79] Szmodis J., A jog mint multidiszciplináris jelenség, (2011) (5) *Magyar Tudomány,* 514–516.

[80] See R. Dawkins, *The Selfish Gene,* (Oxford University Press, 1976).

[81] G. S. Robinson, Space Law: Addressing the Legal Status of Evolving Envoys of Mankind, (2011) 36 *Annals of Air and Space Law,* 510.

[82] Ibid. 510–511.

Individuals also house what George S. Robinson calls mankind's "essence". The analysis of this "essence" goes beyond the scope of this paper; however, what is worth mentioning is that George S. Robinson looks at this question by considering the concepts of "soul" and "secular humanism".[83]

VII. Conclusion

Some say that space law and its basic norm is under attack. As shown above, this impression is not without basis. However, what is also true (and might be even more true) is that the basic principle of space law is too vague to apply. Therefore, fear of the principles being under attack is a fear that might be overstated. Space law treaties use many small goals in relation to some concepts: one example is the peaceful use of outer space. Beyond these, space law has no clear and ultimate goal. Therefore space law also has no clear objective. This is problematic if we accept that space law has natural law roots and these roots relate to the purpose of space activities. This problem makes space jurisprudence and the interpretation of space law a fairly hard task. The objective of space law and space jurisprudence relates to certain scientific definitions, which should be considered when creating rules and drafting regulations. In the above I argued that the ultimate goal of space activities is the survival of mankind. The ultimate goal of space law and space jurisprudence should be to assist such activities.

Based on the above an interpretation developed using such objective could solve the problem of principles, especially the principle of non-appropriation.

There is an urgent need for the development of a guideline in relation to Article II of the Outer Space Treaty and space resources. The concept of benefit for all mankind (or any similar principle) can be the border between use and appropriation. The sky calls to us and space activity is in mankind's interest in the end: regulators must give way to the use of outer space and the extraction of space resources in an equitable manner and with a clear set of objectives. This could be done with or without allowing the acquisition of ownership on extracted resources. The possibility of acquisition of ownership on the surface of celestial bodies also has to be addressed.

The issue of the non-appropriation principle and the objective of space law fundamentally determine the future of the field. Besides discussing possible implementations of positive laws and principles, more emphasis should be put on the objective of space law. Or following what Seneca reminded us about: without a clear objective there will be no right solution to these problems.

[83] Robinson, What does Philosophy do for Space Jurisprudence and Implementing Space Law?, 2–50.