# LOOKING OUT OF THE CRADLE. POSSIBLE GEOGRAPHICAL PERSPECTIVES ON THE BEGINNING OF HUMAN EXPANSION IN OUTER SPACE

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*Our planet is the cradle of intelligence,*
*but one cannot eternally live in a cradle*
*(K. Tsiolkovsky, 2006, p. 114)*

## A Geography to come: Exogeography

The core subject of geographical studies is human presence and actions in the spaces where they occur. Throughout the past centuries, communities and peoples expanded and developed their access to different environmental contexts by using resources, establishing settlements and creating increasingly complex economic, social and cultural systems. In some cases, collective entities relied on *ad-hoc* explorations carried out by individuals or specialized groups. This process developed entirely within the physical boundaries of planet Earth from the age of the Fertile Crescent to the beginning of the so-called Space Age. For the latter, one official, highly symbolical date, is April 12th, 1961. On that day, Soviet cosmonaut Yuri Gagarin reached low-Earth's orbit in the Vostok 1 spacecraft. His 108-minute flight can be considered a pivotal event in human history but was rapidly surpassed by new records, set in the first «race-to-space» between the USSR and the USA. So is the case for the first Lunar landing, by US Apollo 11 on July 20th, 1969, marking the first human travel from Earth to a destination outside of it (Marshall, 2023, pp. 40-49).

The acquired ability of moving from purely Terrestrial environments into what has long been called the «Outer Space» was not, *per se*, an indication that anything was radically different from the past. In fact, the competition between the Cold War superpowers to put men on the Moon (and, had that not be conclusive, Mars) had mainly political reasons and was a demonstration of industrial power (Surdich, 2021, pp. 36-37). Furthermore, it would be unsustainable as a business when it took place and for many years after that. That is why after 1972 no crewed flight was attempted out of Earth's orbit and aerospace technologies focused on other goals. Exploration, up to the borders of the Solar System, was continued by automatic probes, while longer human presence was established in Earth's orbit through generations of spacecraft and Space stations. Public attention was easily captured by spectacular achievements such as records and «firsts», while science, technology, and industry progressed in the background. The combined outcome of these advancements engendered quite a different scenario: Astronautics began to affect our everyday life with only a few of us noticing that what was actually occurring in Space, albeit close to Earth, was in fact a geographical process.

According to the Space Debris User Portal, since the time of Sputnik 1, i.e. October 1957, as of December 6th 2023, over 6,500 successful rocket launches put a total of about 16,990 artificial satellites (i.e. industrial machinery for national and international services) in various orbits (i.e. commercial regions of different characteristics and value)[1]. About 11,500 of them are still in Space and approximately 9,000 are active, but the numbers are rapidly growing. Space debris includes, now, millions of elements and fragments (European Space Agency, 2023). The Space environment near Earth appears increasingly clogged, especially in most valuable orbits such as the low-earth orbits (LEO) and the geostationary ones (GEO).

Generations of different technologies enabled to use these devices for communication, Earth observation, and global positioning, only to mention the most common cases. A vast majority of these technologies is in place to serve industrial, commercial and political

1 See also *https://sdup.esoc.esa.int/discosweb/statistics/* (last acceded: February 20th, 2024).

purposes: little to do, then, with traditional motives for Space travel, such as exploration or science. A remarkable deal of research conducted by astronauts in orbiting stations is oriented to developing applications for different types of innovative industries, i.e. non related to the observation of cosmic phenomena or of our planet (De Wrck *et al.* 2018).

If this is the scenario, then it becomes clear that, although located outside of our planet's atmosphere, Earth's orbits are geographical spaces in their own right. Not by chance, indeed, they are subject to intense national and international interactions, regulation and competition (Glassner, 1991, p. 435).

Even if permanently visited by only a relatively small number of astronauts in the last decades, there can be no doubt that orbits around Earth are to be intended as fully territorialized. We can discuss on whether there will be, someday, a full-blown human geography on other planets. It is hardly questionable, however, that there is already a full-blown geography of human activities in the orbits around Earth. As stated, these activities consist in the use of spatially defined infrastructures (ground-based facilities, trajectories, orbits), for spatially defined purposes (i.e. the delivery of relevant services); by geographically, economically and politically defined players (Marshall, 2023, pp. 63-69). Satellites launched by different countries to provide data and services (whether civilian or military) are in this sense not different from the ships that have been sailing the seas for centuries. Even more than traditional shipping routes and aviation airways, satellite orbits, once established and associated to a specific operational purpose, are generally determined and predictable. They can be configured as essential parts of globally relevant infrastructures: satellite constellations and systems (e.g. GPS, Beidou, Starlink etc.) are to be considered fundamental elements of ground-based services, and their direct geographical role and value cannot be denied. Extending the same kind of pattern farther from Earth towards the Moon and Mars might become a mere issue of technical development.

History teaches that when new territories are established, geopolitical confrontation, often mixed with supranational regulation and international cooperation, begins as soon as the value of geographical assets becomes worth exploiting. Such trends have been seen on Earth for centuries.

Historical good-will statements by political authorities and administrations, including the highest international organs, proclaiming the «all-humankind's» right to access Space and the Moon, e.g. the 1966 Outer Space Treaty (United Nations, 1966) and the 1979 Moon Treaty (United Nations, 1979), are *de facto* superseded by international bilateral agreements revealing clear geopolitical priorities and interests. This brings back to memory similar statements regarding the Arctic or Antarctica. In the case of the latter, in the past century official geopolitical claims by several countries on vast expanses of the White Continent (Collis, 2016) got somewhat suspended by the recognition of an «international» status of Antarctica as natural sanctuary devoted to science and environmental protection under the Antarctic Treaty of 1959. In the case of the Artic, a *res nullius* status was assumed a few centuries ago and remained so until the late 1900s (Bratspies, 2009, p. 253).

The anthropization of the region was initially limited to relatively low-latitude areas inhabited by perfectly established Indigenous cultures. These regions, however, and those at higher latitudes had been unfavorable to European standard settlements for a very long time, delaying typical European-style geopolitical claims and contrasts. Powers in the continent were interested in the region only for the exploitation of a few, high-value, natural resources and for matters of prestige. In the 1800s, competition was often confined to the realm of exploration and record-setting, within the narrative of conquering new spaces beyond the extreme frontier. Yet, history has shown that similar views may change in relatively brief time. The Arctic began to be widely territorialized, exploited and militarized when travel and life-support technologies achieved safer, easier and more stable operational conditions on the one hand; and, on the other, enabled to reach large, important reserves of very different types of resources, depending on the priorities of each era. Whaling, sealing and hunting were worth geopolitical competition in the perilous times of early European colonization. Later, military and civilian settlements, ships, aircraft and rigs can easily connect and be settled in virtually all nodes of the Arctic; competition for resources and strategic advantage is causing geopolitical tensions (McCannon, 2013). This trend is clearly evident today when, far from the old *res nullius* status, the Region is formally under layered supranational and national regulation and governance systems (Spence *et al.,* 2023).

Ironically, from the age of great geographic discoveries, the exploration of the new worlds, particularly in hostile environments, required an increasing degree of international cooperation, often forcing competing parties and alliances to work together for success.

Observing how views about the Arctic changed in time, one might argue, then, that the future of Antarctica as a neutral sanctuary for science and environmental protection – in which polar powers have already placed the dormant flags of their claims – may be in danger of lasting just until it becomes cost-effective or convenient to start a practical rush to territorialization. Will this be the destiny of the Moon and Mars as well in the future? It is too early for any answer; but it is probably about time to start considering some regions of the Solar System in geographical and geopolitical terms. To mention just one possibility, if Space migration and Space cities on Mars are definitely too far away in future perspectives, the hypothesis of extracting resources which would be rare and valuable on Earth – e.g. by automated mining on planets or asteroids – is one of the topics under current brainstorming by experts.

A discussion about the geographical value of human activity in the Outer Space may get deeper. As it was previously stated, humankind has achieved a fairly clear intellectual control over Earth's orbital spaces, a relevant material control and a well-developed degree of structural and regulatory control as well.

In this first quarter of the 21st century, a new development stage of interplanetary voyages is beginning, as new available technologies can support exploration efforts. The most important element of this new phase, however, stands on its underlying concept and, so to speak, worldview, far more than it does on its merely technological aspects. First, more powerful technology and industry at a lower cost allow for a wider and more diverse competition to emerge. More developers can set goals and catalyze interest from more stakeholders; the latter, in turn, may envision actions and strategies which could push towards further steps and goals for developers (Meriç Yazici and Haqq-Misra, 2022, pp. 26-27; Marshall, 2023, pp. 257-270). Space activities and explorations boost many economic sectors and political claims, and this can be considered strategic by the public opinion in many contexts (European Space Policy Institute, 2023, pp. 21-28; Kennedy and Tyson, 2023). Second, extraterrestrial contexts (Earth's orbit, the Moon, Mars etc.) are becoming more and more familiar for ordinary people to imagine and dream, and – in the very end – a popularized knowledge is beginning to spread in society. This is similar to what happened during the first «race to Space» in the 1960s and the 1970s, with the relevant difference of a much wider plurality of actors and a far more pervasive social-communication, along with stronger means for education and popularization.

In a certain way, the current globalized societies witnessing the efforts of their respective champions to put a person on the Moon or establish settlements on Mars are not much different from the inhabitants of the European kingdoms in the age of the great geographic discoveries. Very few of them would actually visit or migrate to the new worlds. Most of them would, nevertheless, receive news and stories (including fake-news and myths) about the discoveries; would see, in the course of their life, some new objects and products coming from far away; would even, possibly, meet the explorers and listen to their voices. This can be shared today through social networks, public science, newsreels. More information than ever can be conveyed to us creating impressions, emotions and, in the best case, knowledge.

A strong dissemination about Space activities is taking place, of course seamlessly fueled by the industry and its tycoons, gurus, decision makers, various types of businesses and lobbyists. Popular support to exploration can be sectorial, biased and variable even when space agencies and/or governments seek for it (Nadeau, 2013; Launius, 2017; Hines, 2022). It cannot be denied, however, that the general narrative has a clear grip in the heart, imagination and expectations of a worldwide audience.

Paraphrasing Tsiolkovsky's sentence, quoted at the beginning of this article, it can be said that, for the second time in history and more now than ever before, humankind is looking out of its cradle, towards new spaces that could someday become places. The well-known difference consists in the former being portions of human "volumes of action" that can be defined in terms of three spatial coordinates and a specific time coordinate; the latter being the same, but endowed with experiential, symbolical, cultural values from the standpoint of humans.

It is evident that, way before being in physical reach, places like the Moon and Mars are becoming acquired in the domain of human perception, conceptualization and imagination. They have been so, obviously, for millennia. Never before as in the past few decades, however, science got to know so much about their features and environments; never before as in the past few years, indeed, bits and parts of this knowledge have been so widely shared in public culture, communication and engagement. Never so much, as in the last years, it became possible for ordinary people to perceive some kind of –

albeit illusionary – personal participation to endeavours towards the possible new worlds (Dunnett, 2023).

The term Exogeography points to the fundamental continuity between the expansion of ecumenical boundaries on Earth and that on other celestial bodies or interplanetary regions (Pyne, 1988; D'Ascenzo, 2010; Casagrande, 2021). At the moment, there is no such a thing as a full-blown human Exogeography to be discussed at an academic level. Nevertheless, it is possible to consider a nascent Exogeography of the earliest landings on the Moon and very few other planets, and an Exogeography of potential settlements. The latter can be discussed in terms of studies on siting and environmental configurations within which the first explorers could establish outposts for increasingly longer stays. Such perspective implies a more or less complex set of material variables to be considered through scientific and technical methods. Even more, it brings up fundamental questions of geographical nature. For example, we could ask ourselves how would human groups adjust to the new environments, or use local resources, or achieve self-support as well as sustainable and permanent presence. A subsequent set of questions involves how this all could be implemented so as to become a routine, allowing for stable connections between the communities of origin and the new settlements.

## Preparing for the journey: observation, representation, simulation

In Yi-Fu Tuan's conceptualization about space and place, direct knowledge of the latter can be partially substituted by the acquisition of analytical/scientific information (Tuan, 2011, p. 200). Although insufficient to convey the full sense of presence that may come from direct experience, analytical – and, we may add – culture-based knowledge of spaces and places enabled humans to prepare and conduct travel and exploration far beyond their initial reach. In some sense, this information-based knowledge can contribute to the development of some awareness of far-off phenomena, leading in our opinion to the development of a certain limited but actual experience of those phenomena. Now, what kinds of indirect experience and information did humankind achieve so far about the vast expanses beyond Earth's atmosphere? In general, two possible domains could be considered. Respectively, the experience through scientific observation and the experience through simulation/analogy. The first is obtained by acquiring all possible data that current technological devices allow to gather and to process them so as to obtain meaningful synthetic representations. The second focuses on starting from representations to create practical experiences which could partially enable to practice presence and action in extra-Terrestrial settings. This is obtained by simulations of the expected phenomena in appropriately constructed or adapted Terrestrial settings. The two dimensions (observation and simulation) co-exist in the current development of Space research, education and popularization.

Let us first focus on observation and representation through maps.

From the ancient times of early astronomical observations to the current perspective of precision landings on large planets and on small and complex celestial bodies, human science and technology developed an increasing ability to observe Space objects and their physical characteristics. More advanced navigational capabilities allow to improve Space travel. Space travel, in turn, pushes exploration ahead, thus producing more observations and deeper knowledge in a virtuous cycle.

Exploration involves gradually increasing awareness of the nature of a particular environment, irrespective of human presence. Such awareness fosters human capability of constructing representations of the explored environment. Since the beginning of the Space Age and to this day, many representations have been prepared in the form of maps, charts (along with more complex information systems) to be used *per se* or as models to create simulations. In any case, maps as specific «information systems» are meant to provide partial but accurate reproductions of spaces, whether interplanetary regions, orbits or trajectories of bodies and spacecrafts, or the features of planetary surfaces are to be represented.

With reference to the latter, it is worth noting that since the early days of interplanetary travel of uncrewed vehicles in the Solar System, detailed maps were developed through different types of remote sensing. Naturally, maps were constructed according to the well-established concepts developed for Terrestrial maps. Regardless of their being printed on large paper sheets with informational annexes as in the early days, or of their being stored in digital geodatabases as it occurs now, maps of bodies such as the Moon, Mars, Venus, and Mercury were developed following geographic information science as it was invented for Earth, merely adapted for the planetary context and the representation needs (Naß *et al.,* 2017, pp. 106, 108).

It is not by chance that a relevant contribution was given to NASA in its efforts to send manned missions to the Moon in the late 1960s by the United States Geological Survey (USGS), an institute tasked with preparing maps for most Terrestrial needs of the United States. Furthermore, it is not by chance that planetologists and geologists would find no problem in calling «geological» a geological map of Mars or the Moon. Space scientists conduct complex analyses on current planetary maps to investigate phenomena of geophysical relevance, to select optimal study areas for measurements and sampling, to determine the most appropriate places for landing a probe and so on.

If this is the case, then, one should ask what would be the appropriate use of the term «geographical» when the subject of the representation is not a section of Earth but, rather, that of another celestial body. We could then call «geographical» a map of an object outside of Earth as long as it provides information about human *symbolization*, *action* and *presence*. *Symbolization* could be interpreted as tracing human conceptualization through a "symbolically charged" nomenclature or toponymy, i.e. not merely technical labels, but names imbued with cultural, emotional, or experiential meaning. *Action* may refer to tracking temporary human direct or indirect activity, e.g. astronauts' moonwalk or the "nomadic" roving of an automated vehicle. *Presence* might indicate the actual or potential long-term or permanent "settlement" of human beings or uncrewed infrastructures (e.g. a map for siting a permanent base on the Moon or – why not? – the orbital track of a permanent gateway). Obviously, these definitions may well overlap in practice.

In the current development of Space travel – and, therefore, in the current development of Exogeography – these «geographical maps» would hardly express more than a mere geography of outposts. Remarkably, most of these traces (e.g. the Apollo landing stations, the places of the dead rovers on the Moon or Mars) have already concluded their life-cycles. While they stand in their resting places as silent testimonies of human expansion, history is moving on and the generation of those who launched those missions is turning the work over to a new generation. The contribution of past explorations to human knowledge about the Solar System can now reasonably be deemed relevant in traditional historical and archaeological terms (O'Leary and Capelotti, 2015).

In the future, if human presence on other celestial bodies should become more relevant and persistent, exogeographical maps could overlap the role that normal geographical maps play on Earth, i.e. to facilitate the interpretation of human-driven processes in their interactions with the respective spatial contexts. In this perspective, the purpose of geographic information would include the support to the evaluation of the establishment of habitable bases and permanent settlements, as well as organization of essential services, search for and access to natural resources. Environmental conditions – whether, for example, a certain area is more or less favorable for human settlers – can be studied and better understood with the help of accurate mapping and documentation.

Let us now briefly focus on analogy and simulation, i.e. the second aforementioned domain for experiencing exogeographical contexts.

Map data can be used to develop multimodal simulated environments. Although, in principle, this can be considered as a more complex – but conceptually consistent – way of organizing available geographic information on a certain subject, the role of simulations is crucial in Space science and so will be in the perspective of Exogeography. Virtual models created from observed data and geographic information can be used for simulations, enabling to verify the behavior of systems, whether human- or machine-driven, or both (Banks, 2009, pp. 5-7). This not only allows to familiarize operators and organizations with carrying out certain tasks for which practice in Space could not be conveniently offered: it also allows to more easily detect potential criticalities and issues that could emerge, before the problems show-up in concrete operation (Kranz, 2000, pp. 234-235).

Simulations in Space Science have been in place for decades, involving setting-up of technologies and crews for what could not be tested in practice. In recent years, more general analog missions are conducted in Terrestrial environments (so-called «analogs») whose characteristics replicate (in part or in all) expected environmental conditions on other celestial bodies (von Ehrenfried, 2019, p. 199; Gingras *et al.,* 2020 p. 2; Ito *et al.,* 2022, p. 1; D'Incecco *et al.,* 2024, p. 1). Although some of these analog missions involve setting up technologies and procedures to be performed in future Extra-Terrestrial settings, some other involve more human-related aspects such as long term permanence in confined environments, medical or psychological dimensions, relational studies (Bell, Brown and Mitchell, 2019, pp. 1-4). If long spaceflights and/or stays in crewed gateways or surface stations are to be considered, then this type of experimentation is just as important as medical or biological research, addressing general issues of suitability or unsuitability of direct human presence and action (Campa, Szocik and Braddok, 2019). Furthermore, all of these investigations should consider a progressively wider envelope of personnel categories, as future astronauts or Space/planetary settlers might not necessarily be of the traditional, highly skilled, highly trained and physically quasi-flawless human type.

It is way too early to envision large permanent settlements on the Moon and on Mars: mass-migrations are beyond present-day technical capabilities and they would only make sense in case of world-wide catastrophes which are possible but far from imminent (for some scenarios of the Moon as a refuge, see Szocik, 2021). It is already feasible – and reasonable – to start inquiring about small temporary communities of well qualified and trained personnel settling on the Moon and on Mars to directly supervise and maintain automated processes of some value for Earth's communities (Campa, Szocik and Braddok, 2019, pp. 162, 168). While solutions for dealing with exposure to cosmic radiation, meteoroids and other hostile phenomena are found by science, possible scenarios consider to settle human crews in appropriately equipped habitats or caves (Von Ehrenfried, 2019; Modi, Acker and Gutierrez, 2023; Puumala, Sivula and Letho, 2023; Vidimachenko, 2024), far more a viable approach than attempting terraforming processes (Javaheri Khah and Valiente Lopez, 2023). It is already possible, indeed at the operational level, to create long-term orbiting outposts around Earth, e.g. the ISS (Damjanov and Crouch, 2018) and around the Moon, e.g. the Lunar Gateway (Fuller *et al.,* 2022).

Scientific and technological progress allows for envisioning increasingly realistic and accurate simulations, capable of replicating at a very high level of similarity operational situations and contexts of Space travel and settlement. On the one hand, these simulations are a set of powerful training tools for future Space scientists, travelers and operators; on the other hand, they dramatically boost the potential of teaching and learning, and also popularizing conditions, means and problems of the future travels that will expand human reach to unprecedented levels.

## Place names leaving Earth

According to Angelo Turco (1988 and 2010), the first logical step in a new territorialization process is denomination, i.e. place-name assignment. An individual or a community assign toponyms based on their specific worldview and every new place name is both an anchor to a conceptualization of Space and an expression of meaning for the culture that generates it. In other words, the first step for creating a place is to assign to a certain space a name that serves as a marker towards layers of symbolical textures created as a product of material, historical and social interactions. Places are understood as outcomes of experience, shared by individuals and communities within a certain culture.

The observation of some specific place-name assignments to locations on the Moon and on Mars offers insights about the potential evolution of a territorialization process. They provide further evidence of the geographical process of human perspective moving potentially away from Earth, towards new possible future contexts.

When Apollo 11 arrived to the Moon, the descent of its Lunar Module (LM), callsign «Eagle», was more adventurous than expected. A computer malfunction forced commander Neil A. Armstrong to switch control to manual mode and personally guide the spacecraft down to the surface of the Moon. The landing site was therefore not exactly the planned one (Collins, 2019, pp. 399-404). Yet, upon touch-down, Armstrong wanted first of all to reassure ground controllers at Houston by confirming the successful arrival. He therefore used the message: «Tranquility Base here, the Eagle has landed» (National

Aeronautics and Space Administration, 1969, p. 317). This expression contained two important pieces of technical information. First, spacecraft Eagle had stopped its relative motion with regard to the Moon and was safely on the surface in a place to be called, from that moment on, Tranquility Base, after the wider geographical region of Mare Tranquillitatis (which means «Sea of Tranquility»). Second, Apollo 11 had just set the first static human outpost on the Moon. But then, the technical information had a major, anthropological implication: Armstrong had just given it a toponym, hence setting the first direct place-name assignment by a human explorer physically present somewhere outside of Earth. This act was similar – even more historically relevant – to Christopher Columbus naming his first landing island «San Salvador» after his dangerous voyage across the Atlantic (Columbus, 1493). The perspective of place-name assignment, once again, follows, outside of Earth, a process similar to that occurred for centuries on our planet.

The evolution of how toponyms are assigned to celestial bodies reflects, in a sense, that of human exploration of those bodies. I am not referring to the formal procedures: since 1922, the International Astronomical Union (IAU) rules Space objects naming and establishes criteria for the operation, its role having been recognized at the highest level by the United Nations (United Nations, 1982)[2]. Rather, the focus is on the conceptual process that generates the names (or the candidate names) converging to the assignment, before and after the advent of IAU.

In the early days of Space observation, when Astronomical Geography was entirely based on data and measurements from the surface of the Earth, it was common to find echoes of purely Terrestrial concepts or categories in selected toponyms. The coexistence, layering and sometimes competition of names based on

2 See also *https://www.iau.org/public/themes/naming/* (last accessed: February 20th, 2024).

similarities, or based on associations between new discoveries and ancient cultural and mythological references, made the process quite complex (Montgomery, 1999, pp. 192-218). Whatever the criteria for decision, while exploration technologies developed, features on other celestial bodies were initially named after objects and concepts of Earth; the correspondence was often literal: there are Alpes Montes on the Moon, named after the Alps on Earth by Hevelius in the 17th century; Hellas and Lybia on Mars, named after the corresponding geographical regions of Earth by Giovanni Schiaparelli in the 19th century (Vidimachenko, 2024, p. 219).

With the development of astronautical exploration, the capability of sensors brought closer to the observed landscapes, enabled to dramatically increase the resolution of imagery, boosting the cartographic scale of representation and even making it possible to see what had never been seen before in human history, e.g. the far side of the Moon. Massive new data and information were to be processed, a plethora of new toponyms were to be assigned. In this phase, scientists, technicians and prophets of Astronautics became increasingly aware of their pivotal role, thus opening a new season of toponyms chosen after those who made the new exploration possible (Shevchenko, Rodionova and Michael, 2016). Then came the first direct exploration by astronauts and unmanned spacecraft, physically moving on the Moon, Mars and Venus, taking direct measures, collecting rock samples, performing increasingly complex scientific tasks. Exploration, consequently, ceased to be conducted from Earth; and began to be carried out on the very celestial body, «on behalf» of scientists on Earth. The *event of exploration*, in other words, was not happening on Earth through observing something in a far-off place; rather, it was happening *closer* or even *in* the remote place. This change in perspective was reflected in some toponyms: Valles Marineris on Mars owes its name to the automated probe (Mariner 9) that surveyed it for the first time in 1971 (Duxbury *et al.,* 2014, p. 10). When Mars Exploration Rover «Opportunity» arrived at the rim of Endeavour crater, the spot was informally called «Spirit Point» by NASA (Jet Propulsion Laboratory, 2011) after the name of Opportunity's twin rover «Spirit», which had recently ceased operating after a successful mission. Around the aforementioned Tranquility Base on the Moon, small craters Armstrong, Collins and Aldrin were named after the astronauts who visited the place (Shevchenko, Rodionova and Michael, 2016, p. 100). This is the revealing reiteration of a century-old geographical process. Venezuela, for instance, owes its name to the resemblance found by Amerigo Vespucci of a stilt settlement in the gulf of Maracaibo with the appearance of Venice in the northern Italian peninsula. The concept of such association was soon lost and Venezuela became a widely known toponym with its own symbolical and experiential value, as European explorers and colonizers established their territorialization in the area (Iannettone, 2003, pp. 369-370). New Plymouth, on the coast of present-day Massachusetts where the Pilgrim Fathers set foot in 1620, had been named by Captain John Smith after the British city, like many other sites in the region he had called New England (Smith, 2006, pp. iii, 3).

Later, however, in the Americas, toponyms flourished with no connection whatsoever to remote homelands: rather, with direct reference to the physical, cultural and situational elements settlers encountered in the New World. Two easy examples: Yellowstone owes its name to a characteristic geological conformation (Keefer, 1972 pp. 3-4), Salt Lake City to its proximity with Utah's Great Salt Lake (Tullidge, 1886). The naming process in Outer Space just follows the same type of experience-based evolution in the new worlds beyond Earth.

## Conclusions

Exogeography is Geography that continues out of the boundaries of Earth, facing old questions in new contexts. It is clear that this new branch of research and application will need to foster cross-disciplinary approaches, similarly – and even more – to what happened in the historical evolution of Terrestrial Geography. The need of getting a comprehensive picture of opportunities and issues requires that kind of strategy (Tuckler and Alewine, 2023). It is evident that, along with the traditional hard science-perspectives, social sciences and humanities too will become more and more relevant in Space exploration.

Since the dawn of civilization, human groups began to develop Geography as a scientific and cultural discourse to answer fundamental questions about their place in the world. In order to succeed, they had to draw on elements from Astronomy, Math, Geometry, History, Philosophy, Anthropology. After many centuries, Geography integrates hard-sciences with social studies and, now that we are getting deeper into the 21st century, it should start reflecting on new possible worlds, bringing its specific point-of-view for a fruitful discussion (Pass, 2020). Moving its first small steps beyond its traditional frontiers, Geography is joining, along with other humanities, the usual fields of hard-sciences – Astronomy, Astrophysics, Planetology, Geology – in a wider, common quest for knowledge (Dick, 2016). The simple reason is that the time has come in which human expansion in the Solar System begins to *actually happen*. The possibility of permanent crewed orbiting stations (around Earth, the Moon and, possibly, Mars) is well studied and demonstrated by several decades of successful activities in low-Earth orbit. From what was achieved in the past, Lunar or Martian gateways and bases will not be much more than a matter of technical improvements (von Ehrenfried, 2019, p. 96). Many questions remain on how humans will be able to deal with long travel in hostile environments: however, similar, apparently overwhelming problems were solved several times in history. Present-day humankind's technological level is continuously increasing and there is no reason to believe that they cannot be solved again by science in the future (Giang *et al.,* 2023).

Humans should be landing on the Moon and establishing permanent gateways and surface activities by the half of the current century. At some point between its end and the beginning of the 2100s, it is possible that there will be early settlements on Mars. Then what?

Our history on Earth teaches that the boundaries of the Ecumene have been pushed ahead, either constantly or by relatively sudden expansions, sometimes triggered by political and historical contingencies. Whatever the circumstances, spaces which were originally out of reach become first marginal, then actual contexts for human presence and activity. In each context, human groups take time and effort to establish methods so as to stay and to take advantage from the newly «conquered» status.

When this happens, accessibility and usability of acquired spaces progressively make them convenient to exploit, possibly generating geopolitical confrontation.

The current rush to the Moon after over half a century of virtual neglect, by traditional and new players, indicates that our satellite is now already worth the effort by its sole presence. As a target to be reached, it offers a goal to several nations for showing their power of proposal, along with their technical and industrial capabilities. Though for entirely Terrestrial purposes, with some continuity and variations from the race to Space of the old 1950s-1970s, the Moon is already proving to be a resource to be exploited, at least politically.

On the other hand, however, the history of Space exploration provided several elements to support that international cooperation and distributed efforts will be necessary.

They will be required to speed-up endeavours and, most of all, to increase their effectiveness. A demonstration-by-contrast of this fact is a side-consequence of the Russia-Ukraine war begun in 2022. The conflict reverberated quite heavily on international Space exploration programmes, by interrupting a long and fruitful collaboration between the US, EU and Russia on some crucial *dossiers*. It *de facto* caused years of delay in already scheduled activities and some of them might turn out obsolete by the time they can reach operational status.

If the hypothesized human colonies and settlements will be successfully established – it all depends on whether they will be profitable in some sense or not – it is likely that their geographical relationship with «homeland» Earth will be for a long time in an «island-to-mainland» type of connection. It is far too early to try and see farther; but the way is open and the expansion of the Ecumene is moving to new chapters.

The future will be in the hands of new generations, as it has always been in the past millennia.

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