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Part I: PHILOSOPHY OF THE COSMOS

Intelligent Characteristics of Potential Microbial Life During the LHB

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The 'disparitas conjecture' states that unicellular life is common in the galaxy but that multicellular life is rare in comparison. A variation of this conjecture is that unicellular life may be common in the galaxy but that intelligent life is rare. However, microbial life can and does indeed display characteristics of intelligence. Thus, in this work, how life could have potentially endured through the Late Heavy Bombardment (LHB) through intelligent strategies such as decision-making, association and anticipation, communication and self-awareness was investigated. At the LHB, there would have been, for microbial life, an unpredictable environmental fluctuation regarding pools of amino acids, lipids and fluids available when impacts and reimpacts launched organisms into new habitats. Thus, evolutionary strategies must have been favoured that could stretch the available external and internal resources as long and as efficiently as possible. Thus, inclusive fitness or kin altruism could have emerged, where organisms adapt to acquire energy and nutrients from siblings who voluntarily autolysed to replenish the amino acid pool for their kin. A further strategy could also evolve where members of the same species can recognize each other and actively isolate themselves from other species, which allows them to better utilize the amino acid pool. Thus, the organisms will potentially be able to survive for a long time in this manner until new impacts launch them to new spots with amino acid pools. There has thus been an alternating increase and decrease in the number of organisms during this localized planetary reseeded, and life may have endured this way until the bombardments were over. Thus, if a world inhabited only by analogous bacteria, archaea and protists is located elsewhere in the galaxy, the existence of intelligent life there cannot be excluded.

Keywords: astrobiology, bacterial altruism, localized planetary reseeded, the Hadean.

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1. Introduction

Whether there is life elsewhere in the galaxy and beyond is a much-discussed topic, marked according to how probable the emergence of life and its subsequent evolution is considered to be. However, an ongoing search for exoplanets and exomoons with conditions suitable for life as we know it and a search for worlds actually having life are occurring.

In the search for life elsewhere, the informal middle position has emerged, which states that unicellular life is common in the galaxy but that multicellular life is rare in comparison. This ‘disparitas conjecture’ or ‘disparitas hypothesis’ may explain the reason for the silence we observe when we search the galaxy for traces of technosignatures such as radio transmissions. After all, in the majority of the Earth’s history, life has existed in the form of unicellular life and is, in fact, still the dominant form. In terms of reproductive fitness, it is also the most successful lifeform known, existing in virtually all terrestrial habitats.

A natural extension of the discussion about life elsewhere is the discussion about intelligent life elsewhere. Thus, an occasionally heard variation of this middle position is the view that unicellular life may be common in the galaxy but that intelligent life is rare. This seemingly trivial variation is important to address, as it follows that if during a search for intelligent life one locates a world where only microbial life exists, the possibility of the presence of intelligent life on that world is excluded. This has nontrivial implications, as the notions that microbial life is common but that intelligent life is rare are self-contradictory.

Thus, in microbiology, the convergent attitude is that microbial life can and indeed does display characteristics of intelligence. While a single microbial organism can be said to be an automaton (which may itself be debatable), macromolecular networks can confer intelligent characteristics in microbial organisms. Thus, microbial organisms do indeed display characteristics of intelligence such as decision-making, association and anticipation, self-awareness, robust adaptation, and problem-solving capabilities (Westerhoff et al., 2014). If a world exists where only microbial life thrives, the probability of intelligent characteristics associated with this life is also high. Therefore, the conceptual distinction between microbial life and intelligent life is a misnomer in the debate that should be moved away from, and a more precise terminology regarding the search for life elsewhere is needed.

Life can display intelligent characteristics in many different situations. As an illustration, a scenario relevant to astrobiology can be considered. The Earth has been impacted ever since its formation approximately 4.5 billion years ago, although the frequency and size of these impactors have declined since the Late Heavy Bombardment (LHB) (Reyes-Ruiza et al., 2012). This event, which may have been due to discrete early, postaccretion and later planetary instability-driven populations of impactors (Bottke and Norman, 2017), began approximately 4 billion years ago and is estimated to have ended 3.8 billion years ago, although some evidence indicates that terrestrial impacts did not cease but rather waned gradually until approximately 3.0 billion years ago (Lowe et al., 2014).

While much remains to be elucidated regarding the details, an autonomous cell with a high degree of certainty existed on the Earth 3.5 billion years ago, in the Archean Eon (Schopf et al., 2007), dated to span between 3.8 and 2.5 billion years ago (Coenraads & Koivula, 2007). However, the chemical evolution leading to this life was probably not a single event; instead, the transition from chemistry to biology was a gradual series of thresholds of increasing complexity over time (von Hegner, 2021). Thus, some lines of evidence point to the emergence of life occurring earlier, between 4.1 to 3.5 billion years ago (Bell et al., 2015), in the Hadean Eon, dated from the end of the Earth’s accretion until 3.8 billion years ago (Coenraads & Koivula, 2007).

The Hadean and early Archean world was in many ways an alien world compared with the current Phanerozoic world. Thus, the presence and composition of primitive continents at that time have been under intense debate. A study estimates that the few very large impactors that impacted the Earth would have resurfaced less than 25% of the planet's surface, meaning that most of the crust was not melted or thermally metamorphosed to a significant degree (Abramov & Mojzsis, 2009). Another study suggested that a large landmass existed in the Hadean world, with an environment that could have included nearly all geochemical conditions that favour the chemical evolution of life (Maruyama et al., 2013).

Several hypotheses regarding where and how life could have arisen have been posited over time. Life may, for example, have started at hydrothermal vents at the ocean floor, but it could also have started at shallow ponds in what has been called Deamer's 'hot little puddle' (Damer, 2019), a modern version of Darwin's 'warm little pond'.

If life indeed existed in the period when the LHB took place, the LHB must have had an influence on life, and life must have faced scenarios differently from those in later times. One such scenario is that at the LHB, the incoming impactors would have meant that there was an unpredictable fluctuation of available building material for the organisms, or in other words, that there would be a depletion of a pool of amino acids, lipids and fluids available for a cell. Thus, it is puzzling to understand how life survived through this period.

There are many variables to consider, and many microbial strategies may have been at play and tested through the LHB. However, the LHB has provided an environmental pressure different from anything else life has experienced on this planet. However, the evolutionary responses and impact dynamics can be described and predicted. Their interaction during this period may have yielded strategies different from anything else life has experienced, which could have pushed life through a unique survival strategy that has not been seen since at the same scale. Thus, the following text will examine how life could potentially have managed to survive through this period through strategies that demonstrated intelligent characteristics.

2. Discussion

In this article, Section 3 introduces the LHB and impact rate. Section 4 introduces the effect of the LHB from life's perspective. Section 5 introduces the course of action that life must have taken due to the restraints of the bombardment. Section 5.1 highlights the selection of organisms that can endure the longest. Section 5.2 highlights the evolution of altruism, a characteristic of intelligence. Section 5.3 highlights the evolution of cooperation, a characteristic of intelligence. Section 6 clarifies how evolutionary strategies have enabled life to make it through the LHB. Finally, Section 7 summarizes the results of this investigation as well as its limitations and strengths and its significance for the search for intelligent life on other worlds.

3. The Late Heavy Bombardement

Estimating how many impacts the Earth endured during the LHB is associated with considerable uncertainty, as the Earth has erased much of its own early history. A modern estimate, based on lunar cratering, radiometric data and a record of the late Archaean (3.5–2.5 billion years) impact flux provided by terrestrial impact spherule layers, yields an upper limit on the number of impacts in the time span of 4.5–2.5 billion years of 60000 impactors with bodies ≥ 10 km in diameter. This estimate is based on a smoothly declining flux (no

LHB), while a model with an LHB at 4.0 billion years would yield approximately a factor of 100 fewer impacts in the same time frame (Marchi et al., 2014; 2021).

While the record is likely incomplete and uncertainties remain, it is also the case that these estimates apply only to large impactors. Thus, it seems reasonable to hypothesize that many smaller impactors also hit the ground but failed to leave a trace. Thus, e.g., the current-day flux of extraterrestrial material in terms of meteorites falling to the Earth's surface, where it has been estimated that the global fall flux is 17,600 objects each year for masses >50 g, can be mentioned (Evatt et al., 2020).

Most of these meteorites do not cause significant damage to the Earth's surface; however, it is reasonable to assume that a scenario between these two extremes also existed during the LHB, where impactors large or dense enough to impact the Earth's surface, but not necessarily capable of leaving traces in the present, existed. Their number and frequency may have been greater than those of the large impactors, such that rather than the Earth being hit only by impactors ≥ 10 km in diameter every few million or thousand years, the Earth was also hit in different places every year by impactors able to reach the surface and affect the potential habitats for life there. Thus, it is assumed here for the sake of discussion that an impact shower situation with 1000 impactors per year on average can be expected, i.e., one impactor can be expected each:

$$\text{Impactor}_{\text{Rate}} = \left(\frac{525948.766 \text{ minutes}}{1000 \text{ impactors}} \right) \quad (1)$$
$$= 525.94 \text{ minutes},$$

i.e., one every 8.76 hours somewhere on Earth. From these values, the rate parameter for the impactor shower situation is obtained:

$$\left(\frac{1 \text{ impactor}}{525.9 \text{ minutes}} \right) \times 525948.8 \text{ minutes} = 1000 \text{ impactors expected}, \quad (2)$$

the most likely number of impactors that will be observed in a year.

At the LHB, there would thus be an almost continuous incoming of impactors on the Earth. Although this was a global influx of impactors, for microbial life, these would be experienced as locally infrequent impactors spread over time and place, i.e., there would be an unpredictable environmental fluctuation in that new impacts would hit a habitat and send some organisms off to new environments.

During impacts, a ring system is formed, and a model for this ring system has been made by von Hegner (2022), consisting of two central rings, namely, the primary ring (containing 5 rings) and the secondary ring (containing 5 rings), which will be used in the following. Thus, the first stage of the redistribution of life as a result of impact dynamics is the landing of the impactor. It will be assumed here that each ring initially contains $N = 1 \times 10^6$ organisms evenly distributed throughout. This quantitative assessment may be considered a low number today and perhaps too large a number then; however, for the sake of calculation, this will be assumed here.

Thus, in ring 1, the centre of impact, 100% of the 1×10^6 organisms perished.

In ring 2, 80% of the 1×10^6 organisms perished; thus, 200,000 organisms survived the impact blast.

For the next rings, 3, 4 and 5, the survival rate decreased correspondingly by 60%, 40% and 20%, respectively.

Thus, $n = 2 \times 10^6$ organisms out of $N = 5 \times 10^6$ organisms survived the impact blast T_1 .

In this model, the impactor could be considered invariant, as although the incoming impacters will vary in their diameters, densities and velocities, it is still the case that the organisms in the centre of the impact blast will perish, while some organisms in the adjacent rings will survive. The quantitative assessment that 100%, 80%, 60%, 40%, and 20% of the organisms perished for each ring outward is an assumption, based on the notion that the effect of the impact blast decreased for each ring outward.

Only local impactors are taken into account, the minimum impact velocity a small body has with the Earth is 11.2 km/s (Cordero-Tercero et al., 2016), capable of reaching down through the atmospheric shield and making an impact. Global planet sterilizing impactors are not considered here, although this rain of local small impactors may have given life tools to be better equipped against large global impactors.

In the second phase of the redistribution of life as a result of impact dynamics, some organisms are ejected into rings 6, 7, 8 and 9 as a result of the impact blast.

Thus, in ring 1 of the primary ring, 100% of the organisms will perish, i.e., no living organisms will be launched into the secondary ring.

In ring 2, 80% of the 2×10^5 organisms, i.e., a total of 160,000 organisms, are launched into the secondary ring.

For the next rings, 3, 4 and 5, the organisms are similarly launched over 60%, 40% and 20%, respectively.

Therefore, $n = 1.2 \times 10^6$ organisms remain in the primary ring, while $n = 8 \times 10^5$ organisms are launched into the secondary ring. A more simplified model than this will be sufficient and will be used from here on, where survivors deposited in 4 of the 5 outer rings in the secondary ring are considered to be in a ring.

Such a continuous impacting and relaunching environment can be expected to lead to the emergence of the bet hedging strategy, which was discussed by von Hegner (2022), as it was an unpredictably fluctuating environment in which it was not possible for life to obtain cues because the impactors did not hit the same place with the same frequency. Bet hedging can be characterized as a form of decision-making, a characteristic of intelligence, in that a population can maintain two variants, V_{Robustus} and $V_{\text{Intervallum}}$, even when there is a uniform environment. However, other strategies may also have arisen, as there was a demand to not only survive the pressure from impacts but also to survive in changed conditions regarding the availability of a pool of amino acids, lipids and fluids.

4. The LHB from the perspective of life

At the LHB, the incoming impactors would mean that for microbial life, there was an unpredictable environmental fluctuation in terms of available building material, or in other words, that there would be an alternating depletion of a pool of amino acids, lipids and fluids available for a cell, as the organisms may be cut off from such an external pool when sent to a new location.

Energy would indeed be available for life in the form of energy derived from light from the sun or chemical processes; however, such available energy is not sufficient, a pool of amino acids, lipids and fluids must also be present. Thus, phototrophs, organisms that can use visible light as an energy source to manufacture organic compounds, require more than light, namely, an amino acid pool and water. Even chemotrophs, organisms that obtain energy by the oxidation of reduced compounds, either organic or inorganic, are no better off, as the abrupt change in the environment is the issue here. They are sent abruptly to new environments, so there is no time for gradual adaptations. Thus, even if they can harvest the amino acids they need somewhere, they can again be sent to a place where they cannot immediately harvest it.

In today's Phanerozoic Eon, amino acid pools can be found in most places; however, in the Hadean Eon, it could be very different. There is much discussion regarding the presence of amino acids during the early Earth (McCollom, 2013), which will not be the goal of this work. It will be assumed here that amino acids existed, either as a result of terrestrial chemical processes, as a result of extraterrestrial delivery through impactors (Chyba & Sagan, 1992; Takeuchi et al., 2020), or both, and that some organisms had evolved metabolic pathways for amino acid biosynthesis. What matters is that they existed.

What is debatable is how widely spread and available they were at the time. There may have been two scenarios when the bombardment increased.

In one scenario, there may initially have been spots with amino acid pools scattered around the planet.

In the second scenario, there may initially have been an even distribution of amino acid pools on the planet, which the bombardment has gradually transformed into a lane with spots with amino acid pools on it. In the second scenario, the organisms initially had good conditions for life, though these environments gradually narrowed as the frequency of the bombardment increased, while the organisms in the first scenario already had narrow conditions for life.

However, in both scenarios, for life, when the bombardment comes to an end, it will have become the same scenario. Thus, for simplicity, the discussion will be based on the scenario in which there was not an even distribution of amino acid pools but that they were spread unevenly around, like spots on a lane.

Life faces two potential issues when launched, as the organisms can in principle land in 2 places, an area that is sterile and one that is not. As time goes on and increasingly more impacts have occurred, this will mean that the organisms can land in areas that have and have not been sterilized by a previous impact. The environment that has not been sterilized can itself be divided into two situations.

The environment can be so different that even if there is an amino acid pool there, the microbial life is initially unable to take advantage of it.

The environment can be virtually identical to the native environment of an organism, making it easy to absorb the amino acid pool there. Thus, the first of these environments may initially have the same lack of utility as the environment that has been sterilized by the impact.

It must be said that the organisms will never arrive at an ideal environment due to the very nature of the bombardment. Thus, the arriving matter will land with the same velocity as that

when they were sent up by the impact (Melosh, 1989). Thus, the incoming matter will land at a sufficiently high velocity to wreak havoc where it lands. It will not be destruction to the same extent as with an impact launch. There it was an entire impactor that landed, while here it will be fragments of material that land. Here, there will be scattered areas with the possibility of an amino acid pool.

Thus, there are 3 situations to consider.

In the first situation, the organisms are placed in an environment where there is no amino acid pool because this pool has been destroyed or was not initially present. It is possible for a world to be habitable yet uninhabited. It is also possible under certain circumstances for a region to be uninhabitable yet to be inhabited for a time. Being transported to such a spot would be similar to the transport of a person to the Atacama Desert; the person can immediately live there for a while but cannot obtain external native resources to live there indefinitely.

Thus, even if the organisms can pragmatically survive the initial arrival and placement there and the environment does not destroy them, there will not be a life-sustaining amino acid pool available for the organisms. Initially, these sterilized areas belonged to the minority, but as the bombings have hit an increasing number of areas, their number has increased, and the scale of environmental severity has increased.

In the next situation, it applies that there is an inverse proportionality between life and environments. Even if an amino acid pool were present where the organisms land, the fact is that it may be in a form they are not adapted to use. Thus, microbial life can adapt quickly to new environments, but this applies when they spread by themselves, where reproduction, variation and selection, the key mechanisms of Darwinian evolution, are at stake. However, here, the organisms are sent off abruptly to new environments without their own influence and may encounter a completely different environment. Thus, in the new environment, there may be an amino acid pool they are initially unable to utilize. This will be the issue for phototrophs and even for chemotrophs.

In the next situation, there is also an inverse proportionality between life and the environment. However, here, the environment is virtually the same as the organisms' own environment, which means that the organisms can absorb the amino acid pool.

In all 3 situations, it applies that new impacts can occur, where some organisms will again be thrown away from the impact site in all directions in the form of an expanding impact circle and land in a new place. Since this will be one of those places with no, different, or usable resources, the situations discussed will again be relevant.

5. Evolutionary strategies

Continuous but infrequent bombardment is a parameter that distinguishes this period of the Hadean from the present. In this situation, there have been two types of pressures for life. The first has been to survive the bombings in the highest possible numbers. The second has been to economize with the amino acid pool as much as possible, i.e., to evolve strategies that make the most of the available resources. Here, the specific circumstances have been able to push the evolutionary strategies in certain directions. Thus, since the external environment under these circumstances has not been reliable in terms of an available amino acid pool, selection favouring survival mechanisms through utilization of the only reliable amino acid pools available, namely, the limited amino acid pools available at the new site, must evolve and/or those existing in the various organisms themselves, have evolved. Thus, during the LHB, evolutionary strategies would have been developed to economize on the internal resources.

5.1. The first and second rounds

The third stage of the redistribution of life as a result of impact dynamics is the landing of the $n = 8 \times 10^5$ organisms in a new environment. It is assumed here that the first scenario described in Section 4 applies, i.e., that the organisms land in a place where no amino acid pool exists.

As discussed in Section 3, the organisms in each ring as a result of the impact blast perished at a percentage of 100%, 80%, 60%, 40%, and 20% for each ring outward from the blast. The material ejected from an impact crater follows a nearly parabolic trajectory, and when it begins to fall back to the surface, it will strike with the same velocity as when it was launched from the blast (Melosh, 1989). Thus, in the secondary ring, some of the organisms will perish in a reverse sequence like the one in the primary ring.

Thus, matter from ring 1 will land, although with no live organisms, as they were eliminated by impact.

Matter with 160,000 organisms from ring 2 will land, and 80% of the arrived organisms will not survive the landing. Thus, 32,000 surviving organisms will be deposited there.

For the next rings, 3, 4 and 5, the survival percentages will be 60%, 40% and 20%, respectively.

Thus, in total, $n = 4 \times 10^5$ surviving organisms will be deposited there. In the first round, there may have been different species that arrived with the deposited material. These can compete against each other for access and utilization of the external amino acid pool that became available to them (see Figure 1). They will also compete against each other to evolve the best fit for the environment in which they arrived. However, such a strategy is costly overall, as an arms race will arise in which both parties mutually evolve mechanisms against each other.

The special circumstances of the situation are that there is only a limited external amino acid pool available, so the different species cannot continue to compete for fitness as they otherwise could in today's more ideal conditions. Therefore, even if it is assumed that half of the arriving organisms perished and released their amino acid pool, there will not be enough for all the survivors to undergo reproduction. However, there may be enough for some strains to go through several reproductive cycles where adaptations can occur.

Evolution is a short-term tinkerer, not a long-term planner. Thus, the various species may eventually run out of the external amino acid pool before the next impact potentially sends them to a place where there is an amino acid pool.

The second round begins when the amino acid pool runs out. Here, a competition to stretch the internal resources as long as possible will then occur, where the organisms will have to stretch their metabolism as long as possible to survive.

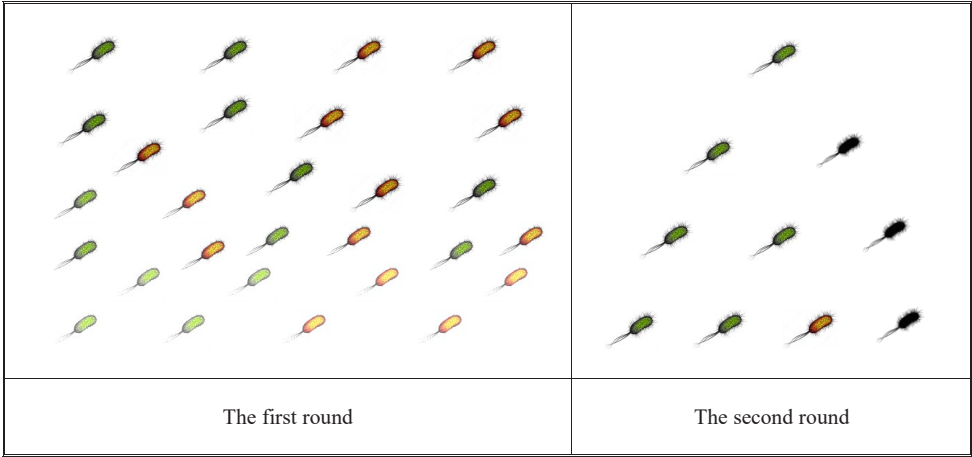


Figure 1. The initial situation in the first and second rounds. In the first round, there are external resources such that new adaptations (shown with changing colours) in two different species (green and yellow) can occur. In the second round with internal resources, organisms are seen that gradually die in a stochastic manner (shown in dark), although due to differences in constitution, one species has more survivors. When one organism in a row dies, the others in the row have enough amino acids to survive to the next row. For simplicity, the organisms’ reproduction is not depicted here. Credits: bacterial images adapted from Mirumur, 2011, 2014.

Thus, in the second round, they will not compete with regard to fitness but focus on enduring, as there are only internal resources (see Figure 1). When the second round begins, two things may have occurred in the first round.

There may be only one variant from one species left that has outcompeted the others, or there may still be several variants from different species left that have managed to survive this far. However, whether there was one or more species that made it through the first round is irrelevant with regard to the second round, as under these circumstances, there will inevitably be one organism left that will survive longer than the others.

The second round is different from the first round. In the first round, there was an external amino acid pool, whereas there was only an internal amino acid pool in the second round. It exists in every single organism and can be accessed in two ways.

The first way is by one organism consuming another to obtain its amino acid pool. Thus, if there were two species that survived through the first round, they could initially continue in the second round by devouring each other. This may in other circumstances lead to an arm’s race, but there are insufficient resources to continue this for long, even among those who manage to survive by devouring others.

Therefore, under these conditions, another way can arise. Regardless of how long they can stretch their metabolism, there are those that will perish before the others, which means their amino acid pool becomes available to the others without them taking it in a hostile way.

Thus, the organisms will be able to survive longer by peacefully absorbing the necromass pool from those who cannot survive as long as themselves. This means that it is possible for members of different species to also survive, not by hostilely devouring others but by peacefully obtaining energy and nutrients from the detritus of organisms that perish by themselves. However, there will still inevitably be one individual left through the first and second rounds, as one must perish before the other.

Strictly speaking, there could be one surviving member of each species left before the last ultimate survivor is unveiled, giving this scenario a 50% probability. However, it is more likely that the organism survived so long because of its physiological constitution, an advantage shared by the clonal colony. Thus, one species possessed an advantage that made it survive longer than the other. Thus, it is not entirely stochastic factors that come into play here. Therefore, the last two survivors are likely to be from the same species, after which one devours the other and only one individual remains.

Thus, selection between taking the amino acid pool hostilely and between taking it peacefully from randomly succumbed organisms will be able to occur.

Thus, the organisms that can stretch the available external and internal resources as long as possible and use them as efficiently as possible are also those that have the greatest opportunity to survive the longest in some spot in the first and second rounds until a new impact sends them to a place with an external amino acid pool. Since they are also the organisms with the greatest opportunity to exist in the greatest numbers, they are also the most likely to send off more members of their species, or only their species.

5.2. The third round I: altruism

The environmental pressures discussed in the previous section could potentially lead to the emergence of a remarkable strategy, namely, inclusive fitness or kin altruism. This was described by Hamilton (1963; 1964) in social insects, where one organism helps another to increase its reproductive fitness at the expense of decreasing its own. This strategy has since been shown to also exist in microbial life such as *E. coli* (Akaizin et al., 1990), where autolysis of part of a starving population occurs, thereby replenishing the amino acid pool for the surviving organisms and, thus, promoting the survival of the rest of their kin.

This is a form of microbial self-awareness, a characteristic of intelligence. For this strategy to occur, a third round is required, where the surviving organisms are selected by being sent back and forth in spots over several rounds.

In new impacts, organisms will be flung away from the impact site in all directions in the form of an expanding circle, and some of the organisms will be able to end up in a new place with an amino acid pool. If the new site possesses a suitable amino acid pool, the organisms that survive being placed there will also be able to build up their numbers strongly again. It has thus been a population that has repeatedly disappeared upon impact and landing and then grew again. Reproduction occurs by binary fission, where the number of microbial life forms increases exponentially, which can be expressed as follows:

$$N_n = N_0 2^n \quad (3)$$

where N_n represents the number of organisms at the end of a time interval, N_0 represents the initial number of organisms at the beginning of a time interval, and n represents the number of generations. Thus, if there are sufficient amino acids in the new spot, it will only take a single arriving organism 20 reproductive rounds to reach $\sim 1 \times 10^6$ organisms.

In the first and second rounds, events proceeded fairly mechanical. While evolutionary adaptations could occur in the first round and acquired or existing preadaptations could play a role in the second round, the prevailing conditions still made the events proceed in a predictable manner.

While the evolutionary adaptations in the arms race in the first round were not entirely predictable, as they could take many different directions, this is irrelevant as the organisms

would run out of external resources anyway, and the second round would be decisive as it would take its point of departure in the adaptations that were when resources ran out, and individual members surviving on internal resources would ultimately be left.

The third round occurs fairly mechanically as well. The organisms are mechanically sent back and forth between spots. Only in a few places will a new impact send them off in time for survivors to come along. Those who may remain may be infused with a necromass amino acid pool, as the impact released it from those that perished on impact.

This repeated situation can lead to cooperation between the organisms, where it is important to economize with the resources as much and as efficiently as possible. Thus, rather than organisms in the second round starting a competition against each other, they can also initiate cooperation to give cues by voluntary autolysis (see Figure 2). A cooperation will in the situation be safer, as randomly obtaining the amino acid pool from those who perish will take time and will be very uncertain, as it cannot be determined when and where it occurs.

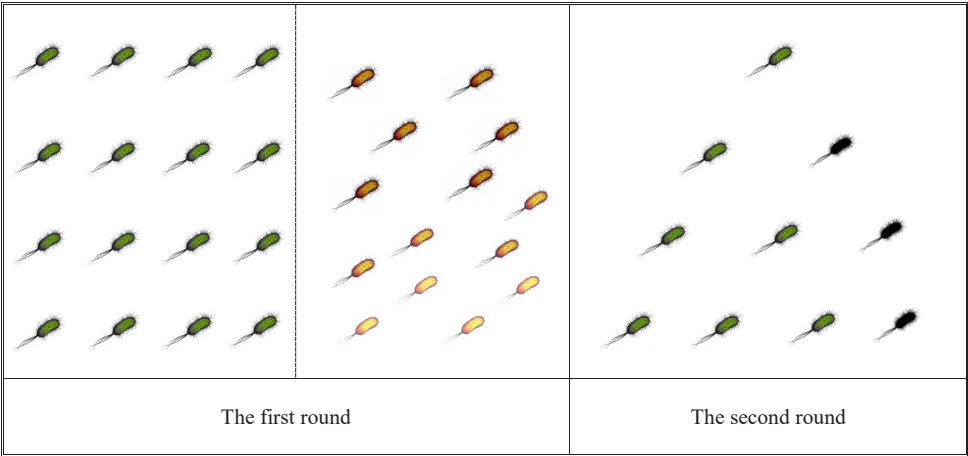


Figure 2. The subsequent situation in the first and second rounds. In the first round, there are external resources that one species (green) makes better use of by having evolved the strategy of isolating itself from the other species. Next to it is the species (changing colours in yellow) found irregularly in an arm's race. In the second round, organisms undergoing autolysis are seen in a row such that the others in the row have enough amino acids to survive to the next row. Although this scenario resembles the one in Figure 1, the latter shows stochastic events, while this scenario shows altruistic sacrifice. In reality, there will not be equal absorption of amino acids, and some will be lost each time. When reproduction is included, uptake will follow an arithmetic sequence of 11, 9, 7, 5, 3, 1. Credits: bacterial images were adapted from Mirumur, 2011, 2014.

However, when the organisms communicate with each other about when there is a need to renew the amino acid pool, this will reduce the randomness that prevails in these circumstances, and the chance of survival will increase as a result of communication, again a characteristic of intelligence.

Thus, a selection will gradually occur such that it will not be a random forced act that an organism dies and gives its amino acid pool to a sibling, but a selection will actually be able to occur, whereby the colony will evolve such that a part of them voluntarily sacrifices themselves as food for their siblings, and the colony can even communicate when it happens or when it is best for this to occur (Figure 2).

This scenario has indeed been observed. Thus, an *E. coli* population experiencing starvation would gradually split into two subpopulations. One subpopulation eventually perished through autolysis, whereas the other subpopulation utilized the released cellular detritus and continued growing and reproducing (Akaizin et al., 1990). The interesting point here is that in other situations when a population of organisms reproduces, there will be a doubling in number. However, in this situation, the population will both reproduce and yet decrease in number. If this happened over several rounds of being sent back and forth, there could now be adaptations in an arm's race to stretch the metabolism further, as there is now a selection for this in the renewed first round, and cues that this will be needed in the renewed second and third rounds will occur. Thus, association and anticipation, characteristics of intelligence, can now be evolved.

The following calculation can illustrate the value of this. It is assumed that there are initially $N = 8 \times 10^5$ organisms in the same clonal population in the spot. Of those, 4×10^5 will be destroyed or autolyse voluntarily, leaving 4×10^5 organisms. For example, 15% of cellular detritus is used for metabolism, reproduction and growth.

Of course, it is not a reproductive *perpetuum mobile*. Thus, even if it is half of the population that sacrifices themselves, there will not be a doubling in reproduction of the other half of the population, as the amino acid pool will diminish over time both because the energy released by an autolysed organism is less than the amount of energy required to build a new organism and because some of the cellular detritus is lost, which, for the sake of the example, is set to 5% for each round.

Therefore, 20% of the detritus is collectively used or lost up to the first round and again after each new round, while 80% of the detritus is reintroduced into the remaining population each time. Thus, the first generational cycle is given by:

$$\begin{aligned} G_{\text{cycle}} &= P \times (1 - r \%)^n & (4) \\ &= 8 \times 10^5 \times (1 - 0.20\%)^n \\ &= 8 \times 10^5 \times (0.80\%)^1 \\ &= 6.4 \times 10^5 \text{ organisms,} \end{aligned}$$

i.e., after the first round of reproduction, the surviving population has increased to 6.4×10^5 organisms.

When the next subpopulation among them has autolyzed, resulting in 3.2×10^5 surviving organisms, these reproduce. With a 20% loss of the original amino acid pool, they will have increased in number to 5.12×10^5 organisms after the second round and so on. Thus, it will take $n = 60$ reproductive rounds before ~ 1.23 organisms of the 8×10^5 are left, meaning that the population will be able to last 60 generations solely by the reintroduction of internal resources into the population. The situation is simplified in terms of both the biochemistry involved as well as the physical circumstances, but it is appropriate here.

This self-sacrificial behaviour is, as described by Hamilton, not entirely altruistic because it is aimed at transmitting the individual organisms' own genes. Thus, organisms with a binary mode of reproduction represent virtually ideal clones, and the genes of such microbial organisms are indeed transmitted to the next generation via an alternative carrier in the form of the sibling, not the individual organism *per se*. Thus, whether an organism reproduces or whether it is its kin that reproduces is not important.

The continuation of the same genes continues in both cases. Thus, a strategy of cooperation and communication, a characteristic of intelligence, will lead to a safer use of the collective internal amino acid pool, thus ensuring a longer collective survival than if the organisms compete against each other (arms race), devouring each other in a hostile manner (arms race), devouring those who perish (chance).

This cooperation does not occur by conscious choice but by natural selection. There will simply be a selection to absorb nourishment from those who randomly die, which implies randomness and a potentially long time between each time the organism autolyses, and for an organism to autolyse at an expected time and place, i.e., other organisms have cues to where and when an amino acid pool is available. There is an intricate connection between the amino acid pool and the gene pool, as an organism ensures that the offspring of its sibling can potentially achieve one more reproductive round in the future by providing its amino acid pool.

In addition, the passage of time has not been taken into account. Thus, how quickly they reproduce and how quickly they metabolize can occur at different rates. Thus, if organisms reproduce slowly and/or metabolize slowly to economize on resources, it applies that even if it were 60 generations, the duration could vary considerably from one scenario to another.

This collaboration can also evolve to further increase the effectiveness of inclusive fitness, since it is important to stretch the available resources as long as possible, while also using them as efficiently as possible. Therefore, saving resources only by lowering the metabolism and reusing the amino acid pool may not be sufficient due to the different situations.

Thus, a collaborative strategy can eventually make stretching the metabolism and reusing the amino acid pool even more effective. Metabolism is the sum of all reactions that occur within the cell and that provide the energy needed for growth and reproduction but also to maintain internal repair after damage. In fact, sublethal injuries may under these conditions have had a higher frequency.¹

Thus, selection must initially have ensured that maintenance of the organisms can occur but also that the resources can be used efficiently for as long as possible. The organisms in a clonal population maintain repair of damage, but there comes a point where it is not worthwhile to invest further in repair due to the extent of damage. Thus, rather than invest further in repairing extensive damage, an organism sacrifices itself, saving collective resources, and at the same time releases the amino acid pool for its kin. In this manner, inclusive fitness can be made more efficient.

In addition, as mentioned, the organisms will eventually be able to evolve to communicate with each other about when it is best to initiate this response. This can gradually lead to an extensive coordinated altruistic response in situations not only specifically with injuries but also generally with limited resources affecting the entire population, to which they react in an intelligent communicative manner by many in the population sacrificing themselves for their siblings. Thus, organisms individually increase the amino acid pool to continue the collective gene pool.

Although the self-sacrificial behaviour in the interests of direct kin seems incredible and contradicting classical Darwinian evolution, this altruistic behaviour does not imply conscious self-sacrifice. What changes in evolution are changes in gene frequencies in gene pools over generations. Even fitness is in accordance with this genetic view of evolution,

¹ It is also known that bacteria can survive extremely long by entering a dormant state. However, the special circumstances the LHB offered must be kept in mind. Thus, there could be an increased frequency of injuries in these circumstances, and a reproductive lifestyle may have been the better option.

whereby the genes programming autolysis for the sake of survival of the kin spread as a result of natural selection, provided that it contributes to the survival of the microbial population. Here, natural selection occurs due to the circumstances described thus far in the LHB.

5.3. The third round II: cooperation

The environmental pressures discussed in the previous section could lead to inclusive fitness potentially arising in the form of organisms adapting to acquire energy and nutrients from cellular detritus from those that voluntarily autolysed. As reviewed, there will be pressure to stretch the available resources as long as possible, but there will also be pressure to evolve adaptations to use the available resources as efficiently as possible.

Thus, it applies that voluntarily giving one's amino acid pool to one's siblings only has maximum benefit when it is one's siblings, and not unrelated members from the competing species, who benefit from this sacrifice. This is the essence of Hamilton's rule (Hamilton, 1964). In the calculation example reviewed in the previous section, 5% of the necromass amino acid pool was wasted. While part of this is due to an unavoidable waste resulting from the circumstances, this could also be partly because, although it is organisms from the same colony here, there is a possibility that the chunk of material that landed with them also contained members from other species or that there were other species where they landed. Thus, members of other species had the opportunity to take some of the available cellular detritus and thus contribute to the 5% disappearing from the population.

As a response to this, the cooperative strategy will evolve further to ensure the most effective recycling of the necromass pool. Through the cooperative strategy in the form of taking up the amino acid pool from its siblings and developing it to give and perceive cues for when this happened, there was already a pressure to evolve. Thus, this could evolve further such that members of the same species can recognize each other and gather together, thus actively isolating themselves from other species, which again is a characteristic of self-awareness (see Figure 2). This isolation strategy evolves from both their collaboration on the internal amino acid pool as well as the external amino acid pool. The rounds will occur repeatedly when new impacts send them to a new spot.

First, when organisms land in a new spot with an external amino acid pool, reproduction will again occur. Organisms are already automatically collected as a necessary side consequence of other features. Thus, in clonal organisms such as bacteria and archaea, the organism will divide into two, and the two into four etc. Thus, a colony of siblings always begins at one point due to reproductive constraints and spreads from that one point.

Second, it applies that a selection of organisms had occurred, which could eventually yield cues as to when autolysis occurs, could read cues as to when it happened, could initiate autolysis at 'agreed' times, and could be ready when this happened.

Thus, after having gone through the third round several times and evolving an altruism strategy, the scenario in the first round will eventually play out differently. When the organisms in the clonal colony are launched again, they may land in a place where there is another species, but rather than the organisms mixing arbitrarily and competing against each other, making adaptations in an arm's race, the organisms in the arriving colony will bring the adaptations for cues that remove the randomness that prevailed in random scattered autolysis regarding where and when they can take up the amino acid pool. The members therefore do not have to move far to gain access to the amino acid pool when there are cues about autolysis in progress. There will thus be a shorter time between release and uptake of the amino acid pool, and as much as possible can be harvested from the necromass pool.

Thus, the scenario in the first round as it occurred the first time will not happen again. Not only have the organisms evolved a strategy to perform better and more efficiently in the second round, but that strategy also leads to a strategy to perform better in the renewed first round. If this is the first time for one particular species, the arriving organisms will have an advantage over them. They are adapted to handle the situation that will inevitably occur in the next round, while the other species is in a race to be fit at the present time; they are essentially gluttonous with the resources. Thus, the isolationist species may be the only ones to reach the second round; they are naturally selected in that manner.

However, as time goes by with many repeated impacts, both species will have evolved these strategies, and both species will isolate themselves from each other, focusing on utilizing the external and internal resources most efficiently to get through the rounds. Even if there are no other organisms where they land, the isolation strategy will still evolve, as the members do not have to move far to gain access to the amino acid pool when there are cues about autolysis in progress.

Thus, gradually, the first round will transition from being a short-term and costly arms race to a long-term isolationist scenario, just as the second round gradually transitioned from being stochastic events to being an evolved strategy. Thus, the impacting dynamics are still the same; in fact, the situation with suitable spots may eventually worsen, but the evolutionary strategy improves and ensures that the organisms can cope for a longer time.

Cooperation among microbial organisms can arise for several different reasons and occur in several forms, for example, swarming motility, collective repairing of holes in biofilm, collective capture of food, collective aggression etc. (Westerhoff et al., 2014). Their cooperation on the internal amino acid pool can also eventually affect their cooperation on the external amino acid pool. Since a new impact can send them to a place with an external amino acid pool available, the cooperative strategy can further evolve to also cooperating in utilizing these resources as best as possible rather than a new competition arising between them.

Thus, a collaboration to find an external amino acid pool could occur.

A cooperative effort to isolate themselves will also maximize the use of the internal amino acid pool, as they physically avoid the presence of other species among them and thus prevent others from gaining access to their collective amino acid pool.

However, eventually, two groups that isolate themselves from each other can also start an arms race against each other to gain access to each other's resources, even if the cost may be higher than the benefit. They can mount a common defence against other species that either seek to devour individuals from their colony or gain access to resources they have collected themselves. Such a common defence against other species can arise quickly, as they obtain not only the amino acid pool but also occasionally the gene pool from those who sacrifice themselves. Thus, if a variant obtains a defence against the other species, this trait can be taken up and distributed by its kin, and a selection in which they quickly manage an arms race occurs. Here, there is also an arms race, not between members of the same species but between species, where one species gradually achieves less cost through their cooperation on a common defence and can thus be selected for further survival.

Among these cooperation strategies, a further strategy could potentially arise. As reviewed, it has been observed that bacteria have their own version of inclusive fitness, where some sacrifice their amino acid pool so that the gene pool of their siblings can continue. However, a hypothesis could be made that it could also be possible under certain circumstances for microbial organisms to display the classic inclusive fitness seen in social insects, where they

actually refrain from reproducing themselves and instead dedicate themselves to assisting their siblings with survival and reproduction.

In the second round, there comes a point where the last organism will not obtain enough from the amino acid pool from the second last organism to be able to reproduce. Here, there is an intermediate stage between many organisms and only one organism. While cues will eventually arise regarding organisms voluntarily autolyzing when it is best to do so, obtaining as much of the amino acid pool as it can, this intermediate stage may be significant enough for a selection with cues for a more profound cooperation to occur.

Thus, a strategy may evolve where, rather than the second last organism voluntarily autolyzing, it may refrain from giving its amino acid pool to the last organism, even though this may be critical under these circumstances.

Of course, in this situation, it is not meaningful to say who is the second last and who is the last, as they both coexist here and one of them will eventually automatically perish sooner or later in the second round and give its amino acid pool to the last organism. However, here, it is said that a strategy could evolve after several rounds in the third round. If this intermediate stage is reached, the organisms can either continue with the first evolved strategy of providing their amino acid pool, or the stage can be so significant that a transition is made, and an assistance strategy is initiated.

Here, either in the renewed first round or the renewed second round, or both, there can actually be a short period during which an organism actively assists its kin if there is a higher chance of survival for the gene pool this way until a new impact sends them to another location. Here, organisms known for their fast, ruthless and complete reproduction by dividing into two organisms will instead decrease their own fitness to increase that of others and, thus, ensure that their genes will live on in their kin. This could potentially take several forms.

If this is in the renewed first round, they can cooperate to destroy the last member of a competing species, and one organism refrains from taking up the achieved amino acid pool in favour of the needy kin.

If this is in the second round, it may provide a synergetic effect that will allow them to survive longer than otherwise expected under these circumstances.

The opposite of cooperating organisms are ‘microbe-cheaters’, meaning that while the colony can gradually evolve cooperation, where they share the internal amino acid pool among themselves, there can be organisms among them that instead acquire a disproportionate share of group-generated resources while making minor contributions themselves. Such ‘microbe cheaters’ can disrupt cooperative systems (Westerhoff et al., 2014).

Such organisms correspond in that way to the organisms in the initial first round and the second round, where each organism fights for itself and for its own survival. Such an organism can, in the same way as the organisms in the cooperative strategy, be expected to be able to endure until the next impact comes and transport them to a new amino acid pool. The fact that new impacts will occur is clear, but the timing is not possible to know, thus, the organisms in the two strategies are on equal footing in this regard.

However, in the subsequent first and second rounds, where the organisms have repeatedly been through third rounds, it will apply that the organisms with the cooperative strategy will not only utilize the amino acid pool more efficiently than the free exchange strategy; it will also mean that a species isolates itself and keeps other species at a distance. It must be remembered that such organisms will disrupt cooperative systems. Thus, as the advantage of the system breaks down, nothing will be able to protect them from potentially being eaten by another species, thereby losing both their amino acid pool and their gene pool.

Thus, there will be an initial modest difference between the two strategies, which over time can slowly win out in favour of the collaborative strategy. However, the difference in how long each strategy has contributed to the survival of organisms may not initially have been that large. This means that life's overall survival through the LHB could have been even harder in that way, as some populations in some spots invariably collapsed in that way, while others managed to keep the free loathers away from them.

Thus, under these circumstances, a selection will essentially occur between Darwinian evolution and Hamiltonian evolution (although Hamiltonian evolution is of course derived from Darwinian evolution).

As the length of the LHB has progressed, the cooperative strategy will have had an edge that led to more survivors and more members being sent off on impact, resulting in a selective advantage.

6. Localized planetary reseedling

It is clear that even these displays of intelligence in the form of association and anticipation, communication and self-awareness will invariably lead to the downfall of the organisms as the number of organisms for each new generation decreases as the necromass recycling that sustains the biological system is used up. Thus, living isolated in a spot is a time-limited way to survive, unless a new impact sends the organisms to an environment with a new amino acid pool.

When an impact occurs, an impact ring will appear, where matter is sent away from the impact site in all directions in the form of an expanding circle. If it is assumed that the impact ring will send matter in ten different directions in a subsequent impact, and one direction is toward an amino acid pool, then this event can be viewed in two ways.

The first way is that if there are ≥ 10 organisms and they are sent in different directions, at least one organism will arrive.

The other way is that if there was only one organism left and it can be sent in ten different directions, the probability of it arriving at an amino acid pool is:

$$\begin{aligned} P(E) &= \left(\frac{1}{10}\right) & (5) \\ &= 0.1 = 10\% \end{aligned}$$

If the organism reaches the amino acid pool, it belongs, so to speak, to the statistically 'lucky' part, where an impact does not actually mean the organisms' (total) destruction, but rather their rescue from staying in a spot. Well placed in the new external amino acid pool, the organism can build up the number of organisms again.

Thus, the impact ring is both a destroyer, an initiator of adaptations, and the renewer of the organisms' possibility of survival by moving them to a new place.

However, even in that manner, overall, there will be a continuous decrease in the possibilities of survival. Because although this organism will quickly be able to build up the number of organisms again, life has only partially been able to rely on being sent to where there were spots with amino acid pools, as there was only a 10% probability of landing somewhere with an amino acid pool. As mentioned, this also includes the fact that some organisms will also perish both when the impact hits and when they land in a new place.

There has thus been an alternating increase and decrease in the number of organisms during this localized planetary reseeded, and although there are many variables, the tendency must have been leading toward an overall decrease in the number of organisms.

In addition, life in many such spots has probably not survived, as the time before a new impact sends one or more of them off can be longer than their resources and the number of generations can be stretched.² As mentioned, it could be expected that an impactor hits a location on Earth every 525.94 minutes, i.e., every 8.76 hours. There are several studies on how long a colony of microbial organisms can survive without the addition of nutrients. A study showed that *E. coli* can be maintained in batch culture at densities of $\sim 10^6$ CFU per ml for more than 5 years, although it was necessary to regularly provide sterile distilled water to maintain the volume and osmolarity (Finkel et al., 2000). However, even with these values in mind, it is uncertain whether an impact would occur before the last organism had disappeared.

In addition, at the impact centre, all material is destroyed, including the cellular detritus, while in the adjacent rings, part of the materials and organisms will be destroyed.

Initially, many areas were untouched by the impacting, and these sterilized impact centres belonged to the minority; however, as the impactors hit an increasing number of areas, their number gradually increased and affected most locations on the planet. Therefore, the number of such spots with amino acid pools has gradually decreased. Thus, the scale of environmental severity has increased and may eventually pose an issue even for life that survives by reuse of the collective amino acid pool.

However, evolutionary strategies occur in an ecological setting. Thus, if the organisms can endure long enough on the internal resources, further ecological scenarios will also come into play, resulting in the possible occurrence of one of the following 3 situations briefly described in Section 4.

In the first situation, it applies that even if the organisms have been placed in an environment where there is no amino acid pool, they may survive long enough on internal resources that individual organisms gradually move out of that environment to potentially fertile marginal areas with amino acid pools.

If such marginal areas exist, life can gradually move to them, as this is how life in well-known ecological settings can spread. Evolution is adaptation to changing local environments, where organisms gradually adapt to changed environments in peripheral areas. This occurs through reproduction, variation and selection, the key mechanisms of Darwinian evolution. However, the situation is initially different from the well-known gradual adaptation in peripheral areas today, as the organisms cannot draw on external resources but must draw on internal ones, at least until they have moved out of the centre.

This situation can also apply to the impact dynamics itself. Thus, the arriving impactors could have different sizes, densities and velocities, meaning that the rings could have different distances, and the impact ring could, e.g., launch the organisms back in the direction they came from, but not the entire distance. If they land at the edge of an amino acid pool, they must move there.

In the second situation with an inverse proportionality between life and environment, it was true that even if an amino acid pool was present where the organisms landed, it could be in a form they are not adapted to use, and they may not have evolved a metabolic pathway to

² Although there may have been many spots where the organisms did not survive long enough to be sent off, fractional genetic transfer may be important (von Hegner, 2020). Even if the last organism did not survive, its components can in principle still have been sent to a place where there are organisms. These organisms may incorporate some of its genes into their own; thus, genes that have previously been selected for altruism and cooperation may give some advantage to the new organisms.

it. However, microbial life can adapt relatively quickly to the use of new amino acid pools. However, the issue is that they change environments abruptly and have no influence over where they land. This is the issue faced by chemostrophs.

They can adapt relatively quickly, however, and the organisms could have adapted to be able to use the amino acid pool present before reaching the last generation and running out of the amino acid pool they reuses. Then, as in the first situation, they will gradually be able to move out into the peripheral areas, gradually adapting to the new conditions here, still drawing on what they are adapted to, but adapting to new conditions. Such an adaptation can be spread in a clonal colony by the fact that when some of the organisms have adapted and some of these organisms subsequently autolyse, their kin, rather than letting their DNA be used up and reused, can incorporate part of it into their own DNA. This ability is quickly spread and fixed in the gene pool. This can be considered decision-making, a characteristic of intelligence.

In the third situation, organisms that land in an environment with virtually the same amino acid pool as the one they came from will of course survive. There are 3 subtle but important subscenarios in this latter scenario.

The first subscenario is that they can land in a completely new place with a new suitable amino acid pool.

The second subscenario is that an impact ring, as mentioned, will send matter away from the impact site in all directions in the form of an expanding circle, which was assumed to be in ten different directions. One direction must be back to where the progenitor of the organisms came from. As mentioned in Section 3, some organisms will remain in the primary ring, while some organisms are launched into the secondary ring. Thus, there could potentially still be an adequate amino acid pool that the organisms can live of.

The third subscenario is that, in retrospect, life must have arisen where there was plenty of the amino acid pool. Thus, if an organism is sent back to the starting point, back to where life originated, a suitable amino acid pool is present there.

Thus, the organisms will potentially be able to survive for a very long time in these 3 scenarios, longer than by relying on internal resources. However, even if the organisms can endure in the 3 situations and thus go beyond the evolutionary strategies described, it applies that the organisms will still be in the same situation as before they were sent away. Thus, under the conditions the LHB offered, sooner or later, the organisms will be sent off again by a new impact. In this manner, the organisms in all 3 situations are in the same overall situation over time. The 3 scenarios therefore do not provide a long-term solution for the organisms.

Thus, there has been an alternating increase and decrease in the number of organisms during this localized planetary reseeded, leading toward an overall decrease in number.

However, life has endured by drawing on internal resources and locally increasing its numbers again and again after landing in places where there were external resources. However, it has also potentially been able to live a long time and be distributed widely according to the 3 scenarios described. Thus, even as there are fewer spots, and the infrequent impact has sent them from place to place, these two general scenarios combined make it possible for life to have survived until the bombardments were over. Thus, bombardment is a double-edged sword. Although it has wreaked havoc by bombarding the planet and the environments in which life exists, it may have also preserved life by moving the organisms around in a localized planetary reseeded. It may actually have contributed to spreading life around the planet from the point where life must have necessarily arisen.

7. Conclusions

In this work, it has been described how intelligent characteristics can make a difference in a world, some of which have been concretely reviewed to show how life could have survived through the LHB, meaning that the LHB did not delay the emergence of intelligent life on the Earth, as intelligent life may have been there all along during this period.

There are other intelligent characteristics than these, and other scenarios could probably also have been used as an illustration. However, it has been sufficient here to demonstrate that the view that microbial life can be common in the galaxy, but that intelligent life is rare, is a misnomer in that macromolecular networks can confer intelligent characteristics.

If a world inhabited by analogous bacteria, archaea and protists is located elsewhere in the galaxy, this does not exclude the existence of intelligent life there; when life on Earth reverts back to consisting solely of bacterial life (due to the sun's changes toward the red giant stage), this does not exclude that intelligent life will still be on the planet. Thus, the conceptual distinction between microbial life and intelligent life should be abandoned, as the very statement hampers the search for intelligent life elsewhere.

While the conceptual distinction between microbial life and intelligent life is not valid, the distinction between intelligent life *per se* and intelligent life able to harness the insight and power of science and philosophy, expressed as, e.g., the ability to send out interstellar communication through technology (which is a premise at institutions such as SETI), seems to be sound.

It is interesting to note here that the presence of technology indicates the existence of intelligence, while the absence of technology does not indicate the absence of intelligence, just as, in light of the discussed scenarios, it is interesting to note that consciousness requires intelligence, while intelligence does not require consciousness, as microbial life do not appear to possess consciousness. However, this is a complex subject that falls outside the scope of the present work. It is sufficient to note that a more precise terminology regarding talking about intelligent life in the search for life elsewhere is needed.

It is debatable whether the LHB was severe enough to drive the evolutionary responses discussed, even with the assumption of impacts occurring at intervals of hours. However, the discussed impact dynamics and the evolutionary strategy are still relevant, as similar scenarios could potentially also occur on other worlds in the galaxy and beyond; for example, LHB-like conditions around Eta Corvi, an F-type main-sequence star, may be present (Lisse et al. 2011).

The emergence of life and the appearance of the LHB appeared to have been unrelated events in this solar system, and it is debatable whether life actually existed during the period when the impacting took place. However, the presented scenario is still relevant for astrobiology, as LHB-like scenarios can not only exist in other solar systems but can also potentially occur later in a world's history than it did for Earth, giving a greater possibility for life to exist when the bombardment starts.

It also applies that although the impact dynamics will mechanically occur in the same way in every world with the same conditions, altruism is only one intelligent response among several. Although environmental pressures push evolution down a certain path in this scenario, contingency still plays a role. Thus, other intelligent responses could potentially be selected for on a world. In fact, there could be competition between strategies of different populations that met, meaning that the very strategies evolve.

The strategies discussed may also be relevant in other situations applicable to space science. The ecological setting has been suggested to be taken into account in the unintentional but potential transport of organisms by spacecraft (von Hegner, 2021). Thus, the inclusive fitness

strategy could also potentially arise from spaceship-mediated transport; here, the external amino acid pool is cut off, but the internal amino acid pool can be used for a long time and thus contribute to the organisms reaching another world in the solar system.

Did these strategies occur? It is not certain that life has survived through this period in that way, and it may not be possible to show that this was the case due to the Earth having had much of its early history erased. Science proceeds in two ways: one is, as in the physical sciences, to test predictions despite issues with potential auxiliary assumptions, and the other is, as in the historical sciences, to look for a smoking gun that distinguishes between two or more hypotheses, albeit there is overlap between both of these paths (Cleland, 2001; 2013). The Earth has had much of its early history erased, making it difficult to find clues regarding whether these responses have occurred; however, it can be shown to be theoretically plausible, as has been done here.

Thus, it is fruitful to bring together fields that are otherwise so different, i.e., evolutionary theory and physical dynamics, in a common framework to understand what could have been going on at a time in the history of the Earth, and possibly life, in which little was known. This is obviously more of a retrodiction than it is a prediction.

However, evolutionary responses can be described and predicted, as can impact dynamics. Natural selection is the differential survival of genes in gene pools. It acts on the available variants and is driven in certain directions both by selective pressure between organisms and pressure from the environment. There were certain environmental conditions here in the form of impacts and reimpacts and between spots with limited amino acid pools. The impacting dynamics themselves act as selectors of organisms.

Evolution is fundamentally variation. It starts as a lump of variation that spreads outward in all directions. There is no specific direction and no measure for the spread of the variation, and most of the variants disappear again in competition with each other and against the pressure of the environment. However, a few survive, and become a point from which variation spreads outward in all directions. In that sense, the LHB is an extension of this. The impactors act as initiators for certain evolutionary strategies that can allow life to react even to such celestial onslaughts.

The Copernican and Darwinian revolutions belong to the great thresholds in history that adjusted humanity's understanding of the cosmos.

The Copernican revolution removed the Earth from the centre of the universe, indeed, the entire solar system from the centre of the universe, opening up the possibility of the existence of other worlds and, ultimately, for life on other worlds.

The Darwinian revolution removed any particular species from the centre of nature; indeed, it removed any inherent direction from the centre of nature, ultimately revealing that special characteristics are not monopolized by single species on any world.

That macromolecular networks in microbial life confer intelligent characteristics and may even be a precursor to the intelligence seen in many multicellular organisms, simultaneously their descendants and cousins, should not be surprising. Thus, perhaps it is time to embrace both revolutions equally fully and not view intelligence as seen from the human perspective, or even view intelligence as flowing from a particular organ.

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The Nuances of Responsibility of Artificial Intelligence for Irresponsible Space Activity

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The article examines various aspects of responsibility for irresponsible space activities related to the use of artificial intelligence. It is stated that the existing legal instruments for regulating AI do not allow us to fully make space law effective and compatible with this technology, as well as the risks that this technology can bring. An analysis of the Convention on International Liability for Damage Caused by Space Objects (1971) is carried out, an interim conclusion is made that its norms apply to spacecraft that used AI technology. It is found that the “problem of many hands” inherent in space activity leads to difficulties in tracing the causal relationship between the action of a particular person in the chain of creation, maintenance, use of AI, etc. and the damage caused by an autonomous spacecraft. The article reveals the key contradictions of the current norms of AI responsibility for irresponsible space activities and suggests ways to solve them by developing and adopting comprehensive rules of conduct in space activities.

Keywords: responsibility, artificial intelligence, space activity, intent, guilt, inaction, harm, Liability Convention.

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Introduction

For objective circumstances, space activities have always been considered and are considered extremely dangerous. Therefore, it is clear that the issues of causing damage, its compensation and procedures for bringing to justice for improper or illegal space activities are relevant.

The concept of responsible behavior has a preventive accent, aims to mitigate misperception and miscalculations, and is oriented on the political mechanisms of space governance. The concept of liability deals with consequences (damage, unlawful act, failure of the objective standard of care).

The AI makes difference less visible according to characteristics of complexity, vulnerability, openness, and opacity. In the vulnerable digital system, the autonomy of machine learning, and “many hands engaged in operation” characteristics could be tended to regulation based on the responsibility concept.

According to the Liability Convention, liability depends on where the damage occurred. A launching state is absolutely liable for damage caused on the Earth’s surface or to aircraft in flight while, damage caused in outer space is based on fault (Convention, 1971). However, in both cases the mechanism is the same. The launching state bears liability for damage caused by its space object. Therefore, we could answer the question about coverage under the Liability Convention by means of analyzing the concepts “damage,” “space object” and “launching state” within the light of threat of AI usage.

Indeed, any unregulated activity carries risks, and even more so if such activities are related to outer space and artificial intelligence. Let’s briefly define these risks:

1. Commercial space activities, which account for about 70% of space-related activities (Inter-Agency, 2018), have increased ubiquitous impact on Earth and the benefits that space products and technologies provide in solving the problems and needs of humankind (Soroka, 2020; Gal et al., 2020).
2. New actors, together with emerging new technologies such as AI, develop new global business models driven by demand, such as satellite constellations, tourism, asteroid and lunar mining, in-situ resource utilization (ISRU), 5G, in-orbit servicing (IoS), 3D printing of satellite parts (e.g., solar panels, etc.), and commercial space station (Gal et al., 2020).
3. The use of AI is realized without a global regulator and global rules (Soroka et al., 2022).

All of the above determines the relevance and prospects of studying the legal aspects and risks of using IS in the space sector.

Theoretical prerequisites for the application of responsibility in the space sphere

The international debate over the establishment of a comprehensive regime of responsibility for inappropriate activities in outer space was a direct consequence of the space race between the United States and the USSR. Unfortunately, disagreements between the two great space nations and Cold War-era enemies prevented any agreement to establish an international regime of responsibility in space.

The beginning of the global regulation of space activities was the resolution 1963 (XVIII) of the UN General Assembly (Declaration, 1963), which proclaimed the legal principles of states’ activities in the exploration and use of outer space, it was also a declaration that included the principle of responsibility (paragraph 8). It was the forerunner of the first space treaty – Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Treaty, 1966), which was signed almost a decade after the launch of the first satellite in 1957 and the Convention on International Liability for Damage Caused by Space Objects (Convention, 1971). The latest document was the result of a consensus among countries that took place after the adoption of the 1963 resolution. The Liability Convention entered into force in September 1972 as *lex specialis* to Article VII of the Outer Space Treaty for those states that are states parties to the convention (Schmalenbach, 2023).

Taking into account the negotiation process in which the Outer Space Treaty and the Liability Convention were adopted, it is necessary to note their organic unity. But taking into account the current realities of space activities, they require certain clarifications.

Article 1 of the Liability Convention (Convention, 1971) prescribes that the term “damage” means “loss of life, personal injury or other impairment of health or loss of or damage to property” of States or persons, natural or juridical, or property of international intergovernmental organizations in turn, the Treaty on Outer Space (Treaty, 1966) also specifies the obligation of states to bear responsibility for damage caused by their space objects. A comparison of the adverse effects highlighted by both international acts lets us make the conclusion that they protect the same values, i.e., life, health, and property. However, neither the Tallinn Manual (The Tallinn, 2013), which is a piece of “soft law,” nor any source of international law have the mechanisms of imposing liability on as many States as the Liability Convention. Therefore, we can conclude that the consequences of irresponsible behavior of AI are covered by the term “damage” in the Liability Convention.

According to the Liability Convention, the “injurer” and “target” are the space objects. So, to answer the question about the applicability of the Liability Convention for the cases of -irresponsible behavior of AI it is necessary to understand if software is covered by the term “space object.” At the forefront, we need to take into consideration Article 31 of the Vienna Convention on the Law of Treaties, which sets out that a “treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose” (Vienna, 1969). The term “space object” in the Liability Convention is not clear as to what is and what isn’t covered by this term.

The development of space activity and its consequences call for applying the norms of the Liability Convention through evaluative interpretation to the new cases that did not exist at the time of its adoption. For instance, there is a very common position that every piece of space debris is considered as a space object according to the Liability Convention (Kerrest, 2001). This includes functional or nonfunctional debris, including component parts of space objects as well as its launch vehicle and other parts. There is also a position that it is necessary to include into the legal category of “space objects” the objects having a movable or immovable character, directly constructed or manufactured in outer space during deep space exploration or space mining activity (Skopowska, 2017).

It should be noted that the boundary between evaluative interpretation and creating the new norm through interpretation is thin. The authors of the Cologne Commentary on Space Law (Cologne, 2013) argue that the term “space object” does not leave room for damage resulting from non-material origin. They argue that an interpretation based on the ordinary meaning of the relevant provision supports the view that the Liability Convention rather envisages the damages caused by impact, than the damage inflicted through activity, where satellite signals are related by complementary technology and equipment (Cologne, 2013: 12). That is concerning electromagnetic interference or interruption in satellite radio signals caused by means located beyond the satellites. On the one side, AI also has a non-material origin, but on the other side, what would have been left from the modern satellite if the software were not there?

According to the ordinary meaning the terms of the Liability Convention in their context and in light of its object and purpose, a space object is acknowledged as a man-made object that is launched or intended to be launched into outer space that needs to be protected from another space object. Since the adoption of the Liability Convention, space objects and mechanisms of their control have greatly changed, but regardless of this transformation of

technologies, the term “space object” has included the component parts of a space object, and nowadays software is an integral part.

Artificial intelligence adds its share of risks to the concept of responsibility for inappropriate behavior in space activities to the above problems. Since the irresponsible behavior of artificial intelligence can lead to the seizure of control over a space object and without causing direct damage. But, in the future, this behavior of artificial intelligence to seize control of a space object can lead to a deliberate collision with another space object. In this case, we cannot deny the application of the Liability Convention, but the problem of proving guilt in consequences in this aspect has become a very significant issue.

Content and types of liability

James Goudkamp conducted a very meaningful analysis of liability in tort law in his work “Rethinking fault liability and strict liability in the law of torts” (Goudkamp, 2023). He believes that most torts are a mixture of two forms of liability (intentional and negligent), as they usually have several elements of behavior, and only a few of these elements are combined with a claim of guilt. He also defined the following:

1. Liability is shifting loss from the person who originally suffered the damage (the victim) to a person who caused the damage (the tortfeasor).
2. Fault liability – in the base is wiliness of tortfeasor in the form of intent or negligence.
3. Vicarious liability – based on the generally ‘unfit’ nature in terms of personality or skills, or on the fact that someone failed to meet an objective standard of care.
4. Strict liability – do not require any kind of defect or mal-performance or wiliness of tortfeasor but based on causation (Goudkamp, 2023).

The challenges of AI in outer space – are determine and enforce a “meaningful human control” (MHR) over the entire technological cycle and system functioning.

The strict liability rules are often complemented with the extension of current tortious liability doctrines to tackle compensation gaps in accidents provoked by AI systems. Doctrines of tort law include duties of care and theories of agency, as well as procedural standards on burdens of proof, presumptions, etc.

The HLEG’s report on “liability for AI and other emerging technologies,” one of these ways regards the implementation of compensation schemes: “compensation funds may be used to protect” (Liability, 2019).

Scientists constate difficulties in attributing liability on the fault-based regime as well as exoneration based on the “gross-negligence” that is generally “associated to an action or omission part of a human activity under the Liability Convention. It is necessary to pay attention to the concept of a source of increased danger, which provides for liability without fault for the functioning of things that a person does not control, but which he or she has set in motion and must supervise.

Another author, Christian Wendehorst (Wendehorst, 2022), analyzing the various potential risks associated with artificial intelligence, examines liability issues in two main areas: security risks and fundamental rights risks. Based on this, the author claims that AI challenges existing modes of responsibility, and we agree with this.

Sources of increased danger in space law

It is necessary to pay attention to the concept of a source of increased danger, which implies responsibility without fault for the functioning of things that a person does not control, but which he has set in motion and should control.

Thus, the Montreal Declaration of 2018 defines the following principle of responsibility: “Only human beings can be held responsible for decisions stemming from recommendations made by AI, and the actions that proceed therefrom (§ 1); When damage or harm has been inflicted by an AIS, and the AIS is proven to be reliable and to have been used as intended, it is not reasonable to place blame on the people involved in its development or use (§5)” (Montréal, 2018).

That is, from the above norms, AI acts as a source of increased danger, for which procedures and rules for regulating liability in the event of harm have long existed at the national level.

As an example of the operation of this norm at the national level, we can cite Article 1187 of the Civil Code of Ukraine, which lists the circumstances that determine the specifics of liability for damage caused by a source of increased danger, they are: 1) the intent of the victim excludes the responsibility of the causer of harm; 2) gross negligence of the victim divides responsibility between the causer and the victim; 3) illegal possession of the source of increased danger by a third party (Civil, 2003).

Multiplication of the source of irresponsible behavior of AI:

- a) Multiple Launching States;
- b) Lack of requirement for authorization that proves the irresponsible behavior of AI components;
- c) Threats could have the origin of malfunctioning electronics; no resilient to cyberthreat and malfunctioning of digital ecosystems (supply chain confidence for protection of the backdoors); opacity and autonomy of the AI (“black box effect” – there is no explanation why an AI behaved in a particular manner in a given situation).

Thus, the reason for changes made in program settings often arises outside of the space objects, so the launching State could not be liable for such damage because it probably has no fault for the malfunctioning of the space object.

In this case, the Liability Convention is unlikely to be applied, but according to international space law, the States are not only liable for damage caused by their space objects or space objects of entities under their jurisdiction but also bear national responsibility for national activity in outer space.

Conclusions

Existing solidary tort liability is not the best solution, since this type of liability does not comply with either Article XVIII or any other provision of the Liability Convention, which substantive law is used to resolve the issue on the merits and to resolve the issue of compensation for damage. Thus, it is necessary to create universal global rules for the field and technologies that are constantly changing and characterized by spontaneity, while the developed and adopted legal norms should ensure a regulatory balance in the interaction of robotic and virtual technologies with people in space missions.

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The Extraterrestrial Hypothesis: A Case for Scientific Openness to an Interstellar Explanation for Unidentified Anomalous Phenomena

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Over the past several years the question of unidentified anomalous phenomena (UAP) has commanded increasing interest. Attention has generally focused on two main classes of hypotheses: a conventional terrestrial explanation (e.g., human technology), and a more extraordinary extraterrestrial explanation (i.e., an intelligent civilization from elsewhere in the cosmos). However, while some authorities seem open to the latter (e.g., elements of the military and intelligence communities), on the whole scientists appear reluctant to consider it. This may be because such ideas have long been relegated to the “paranormal” and dismissed as a legitimate focus of enquiry. However, work has nevertheless flourished on adjacent ideas, such as the possibility of extraterrestrial life per se and the viability of interstellar space travel. As such, given these adjacent ideas, together with new evidence concerning UAP that seems to elude conventional understanding, this paper argues that the scientific community should engage with the extraterrestrial hypothesis as a real and genuine possibility.

Keywords: extraterrestrial, intelligence, UAP, interstellar

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Introduction

In the modern era, UAP have been a topic of public interest since at least the 1940s. However, for the most part, authorities have tended to downplay their significance, at least in public, with the general message from various institutions – including scientific, political, military, intelligence, and media communities – being that UAP have a conventional prosaic explanation. As such, any suggestions otherwise, e.g., an extraterrestrial origin, have tended to be dismissed. Over the past few years though, various developments have meant some

authorities have begun to visibly take the topic more seriously, including being more open to an extraterrestrial explanation. However, overall, this openness has not yet permeated the scientific community. As such, this paper argues the community should engage more seriously with this possibility.

The paper begins with a brief overview of the UAP topic, then looks at how scientists have tended to default to a prosaic explanation for UAP, and how this skepticism still dominates even today. These sections mostly focus on the US context, partly because this region arguably has historically had the most UAP activity, and also because this is the author's own context and area of familiarity. However, it should also be emphasized that, contrary to misconceptions, this is a genuinely worldwide phenomenon. In Latin America, for instance, The Washington Post reports that at least four countries (Uruguay, Argentina, Chile, and Peru) have dedicated government programs that for decades have assessed UAP activity (McCoy, 2023), while others such as Brazil likewise have an extensive history of sightings and investigations (Vernet, 2023). There are variations in how countries have approached the issue; authorities in Latin America appear to have historically been more open compared to counterparts in the US. Nevertheless, in terms of the *scientific* response, many of the reactions discussed here seem relatively widespread. Having articulated this background context, the paper then makes the case for openness to an extraterrestrial hypothesis based on work around, (a) the likelihood of extraterrestrial intelligence existing per se, and (b) the viability of interstellar travel.

The UAP Issue

For centuries, people worldwide have observed aerial phenomena that seemed “anomalous” in some way, some of which crucially we now – with our more advanced technologies and scientific understanding – might still regard as extraordinary even today (Vallée, 2008; Lomas & Case, 2023). In recent decades these have attracted the label Unidentified Flying Object (UFO), and more recently UAP, with the latter expanding even further lately to denote unidentified *anomalous* phenomena (with a realization that some UAP travel underwater and are not only aerial). Indeed, there have been many sightings over the years: the Mutual UFO Network for instance has collected over 200,000 public reports since its founding in 1969 (Mellon, 2022). However, these have generally not been taken seriously by authorities, tending to be dismissed as perceptual or cognitive error, hallucination, delusion, or fraud. As such, the topic has generally been downplayed by authorities, in public at least. Private concern may be another matter. Indeed, Rear Admiral Hillenkoetter – the first Director of the CIA, from 1947 to 1950 – admitted as such, with an article in The New York Times (1960) quoting him as saying “Behind the scenes, high-ranking Air Force officers are soberly concerned about the UFO’s. But through official secrecy and ridicule, many citizens are led to believe the unknown flying objects are nonsense.” Similarly, he was reported by Griffen (1960) as having “recently declared ... about the flying saucers” that: “the unknown objects are under intelligent control. It is imperative that we learn where the UFO’s (Unidentified Flying Objects) come from and what their purpose is.” Griffen further notes that, regarding “the years of World War II and the years immediately following,” Hillenkoetter said, “I know that neither Russia nor this country had anything even approaching such high speeds and maneuvers.”

However, at least in public, any evidence and concern authorities may have had about UAP has tended to be denied or at least downplayed. But this began to change in 2017 in the US, when footage of three military encounters with UAP was published online, bringing

the topic to wider attention, especially following a New York Times article, “Glowing Auras and ‘Black Money’: The Pentagon’s Mysterious U.F.O. Program” (Cooper et al., 2017). The military angle was especially significant, since reports emanating from the military are more credible for many reasons: they involve observers who have excelled in occupations that require the highest skill and training in visual perception and processing, meaning they are regarded as high quality witnesses; moreover, their testimony is often triangulated with other information sources (e.g., radar). As a result, authorities began to take a more public and open stance. In April 2020 the Department of Defense (2020) confirmed the footage was genuine. Soon after, the US established a UAP Task Force to investigate such incidents (Office of the Director of National Intelligence, 2021, 2023a, 2023b), which since November 2021 has been known as the All-domain Anomaly Resolution Office (AARO). Even though it has very limited scope – mostly restricted to events since 2019 and focusing on military encounters in US airspace and littoral waters – its findings are notable.

In its initial 2021 report, of 144 events studied – spanning 2004 to 2021, but mostly from 2019 onwards – in 143 cases it determined that we “lack sufficient information in our dataset to attribute incidents to specific explanations.” Its 2022 report (released in January 2023) considered a further 366 events, of which 177 similarly eluded definitive conclusions, and “demonstrated unusual flight characteristics or performance capabilities, and require further analysis.” Its most recent report in October 2023 – focusing on events up until April 2023 – added a further 291 cases, bringing the total to 801, noting “many reports from military witnesses do present safety of flight concerns, and there are some cases where reported UAP have potentially exhibited one or more concerning performance characteristics such as high-speed travel or unusual maneuverability.” Furthermore, the report suggests these cannot be attributed to the US (“AARO has de-conflicted these cases with potential US programs”) or its adversaries (“none of these UAP reports have been positively attributed to foreign activities”). Speaking about the cases under review in May 2023, Dr Sean Kirkpatrick, the Director of AARO, said that he suspected most *did* have conventional explanations, and only remained unidentified through lack of good data. However, around two to five percent – roughly 15-40 – were “possibly really anomalous” (Wendling, 2023). Moreover, it is worth noting that critics believe AARO may be deliberately downplaying or obscuring the significance of the topic and the extraordinary nature of some evidence, following a trend with comparable previous investigations, such as Projects Sign and Grudge, as discussed below. Journalist Josh Boswell (2022), for instance, reported that a source in the Office of the Director of National Intelligence had told him, “They’re patting themselves on the back that they’ve resolved over half of them... But we don’t give a crap about the ones they’ve resolved. Yeah, there’s balloons up there, and balloons are sometimes mistaken for UAP. But there are s***loads of classified videos that are pretty profound and pretty clear. They don’t want to talk about this stuff, because they really, really don’t know what the hell they are. That’s the truth.”

Nevertheless, even if such claims have validity, the reports still contain many intriguing details. The latest for example includes a glossary featuring phrases which seem significant but oddly are not used in the unclassified report – such as “UAP engagement,” defined as “Bringing UAP under kinetic or non-kinetic fire, to deny, disrupt, or destroy the phenomenon and/or its object(s)” – which makes one wonder if they *are* discussed in the classified version. Also notable is that the most populous category of identifiable sightings is small “orbs” (25% of reports), compared to irregular shapes (6%), ambiguous sensor contact (5%), oval (4%), rectangle (2%), disk (2%), oval (1%) and triangle (1%), with 53% not reported. These orbs

are usually either, white, silver, metallic, or translucent (with the latter frequently featuring a dark cube inside), and despite lacking wings, apparent forms of propulsion, or thermal exhaust, are seemingly capable of unusual manoeuvres and flying at velocities up to twice the speed of sound. Indeed, similar orbs have been observed for decades (Hanks, 2023). A New York Times article in 1944, for example, titled “Floating mystery ball is new Nazi air weapon,” told how “Airmen of the American Air Force report that they are encountering silver colored spheres in the air over German territory,” and that “The spheres are encountered either singly or in clusters. Sometimes they are semi-translucent.” At night, the spherical objects appeared as red or orange spheres that flew around, or directly alongside, military aircraft. American aviators described these as “foo fighters” – with “foo” thought to be an adaptation of the French *feu* (meaning fire) that came to prominence in a US context in a cartoon about a mishap-prone firefighter (Joseph, 2018). An article in The Indianapolis Star, for instance, reported how “these balls of fire appear suddenly and accompany the plane for miles,” keeping up at 300 mph, and yet – contrary to initial military fears of these being a new Nazi weapon – one pilot noted how “they don’t explode or attack us. They just seem to follow us like will-o-the-wisps” (Wilson, 1945).

There has been much speculation as to the nature of such UAP, ranging from the mysterious and little-understood phenomenon of “ball lightning” (Canan, 2023) to “stealth-driven extraterrestrial probes imbued with artificial intelligence... and a complex camouflage system” (Bower & Redmond, 2023). Significantly, while much of the Task Force’s work is still classified, comments from key figures indicate the possibility of some UAP being truly extraordinary – rather than having a conventional human explanation – is being taken seriously. Barack Obama, for example, said in 2021, “There’s footage and records of objects in the skies that we don’t know exactly what they are. We can’t explain how they moved, their trajectory. They did not have an easily explainable pattern” (Von Rennenkampff, 2023a). Similarly, John Ratcliffe, former Director of National Intelligence, said “we are talking about objects that have been seen by Navy or Air Force pilots, or have been picked up by satellite imagery, that frankly engage in actions that are difficult to explain, movements that are hard to replicate, that we don’t have the technology for” (Lewis-Kraus, 2021). Indeed, even more concerningly from a security perspective, he suggested these UAP demonstrate technologies “frankly, that we are not capable of defending against.” Moreover, despite recent efforts to investigate such phenomena, some are still perplexing authorities. Speaking in August 2023, General Mark Milley, Chairman of the Joint Chiefs of Staff, said the military “can explain a lot of it [i.e., UAP], but there is some that’s really kind of weird and unexplainable” (Wolfgang, 2023). To that point, commentators read significance into the news in August that Deputy Defense Secretary Kathleen Hicks had moved to personally oversee AARO, implying the issue was being taken increasingly seriously (Vincent, 2023).

Importantly, following decades of denial, obfuscation, and derision, the official discourse regarding UAP has undergone a striking evolution in recent years, with many senior figures talking openly about an extraterrestrial hypothesis (ETH). NASA Administrator Bill Nelson, who received UAP briefings from naval aviators while serving as a senator, was asked to speculate about the nature of UAP, and said obliquely but significantly, “Who am I to say that planet Earth is the only location of a life form that is civilized and organized like ours?” (Von Rennenkampff, 2021b). Likewise, ex-CIA director John Brennan called it “presumptuous and arrogant for us to believe that there’s no other form of life anywhere in the entire universe,” adding cryptically, “I think some of the phenomena we’re going to be seeing continues to be unexplained and might, in fact, be some type of phenomenon that is the

result of something that we don't yet understand and that could involve some type of activity that some might say constitutes a different form of life" (Ciaccia, 2020). Similarly, when asked about UAP, former presidents Obama and Clinton no longer reflexively dismiss such questions with humour: questioned about the phenomenon in 2021 on Live Kelly and Ryan (2021), Clinton spoke about the vastness of the cosmos and the probability of life existing elsewhere in the universe, while interviewed by Ezra Klein (2021) Obama expressed interest in learning more about UAP and speculated about the implications of the ETH. Perhaps even more significantly, Avril Haines, current Director of National Intelligence, refused to rule out an ETH, which is unprecedented for a sitting high-level national security official and exemplifies the remarkable shift in tone and substance of UAP-related discussions by senior government officials (Von Rennenkampff, 2021a).

Evidently, authorities are perplexed and moreover concerned about UAP. These phenomena therefore constitute a real empirical mystery. In that respect, an extraterrestrial hypothesis (ETH) is very much on the table, as noted above, and as articulated by Christopher Mellon (2023), former Deputy Assistant Secretary of Defense for Intelligence in the Clinton and George W. Bush administrations, who is closely connected to the UAP topic. Interviewed in October by Chris Cuomo, he said the UAP are "doing things that are way beyond anything that we could do, even in our most cutting edge programs," such as "descending in a vertical line in a couple of seconds from 80,000 feet to 20,000 feet, hovering, then instantly accelerating to hypervelocity, to hypersonic speeds, without friction, without plasma, without breaking the sound barrier." Crucially, he states these abilities far exceed the most advanced technology possessed by the government or aerospace companies: "I have friends who worked at the Lockheed Martin Skunk Works for decades... and they're like, 'There's no way, you know, we could do one or two of those things ... [but there's] a lot of stuff that is utterly baffling and so far beyond what we're capable of.'" Although this doesn't necessarily mean an extraterrestrial explanation, Mellon urges us to be open to this possibility: "I've not taken a position that any of these ... specific cases are necessarily of extraterrestrial origin, but there are cases like the Nimitz where I don't know how else to explain it, and my main point is that we need to keep an open mind and not rule that out." Indeed, he notes that "Of course there's a possibility that somebody else's space program has found us in an infinite universe. This universe is so strange and so bizarre and so immense, why would we be surprised if we encountered intelligent machines from somewhere else." However, for the most part, mainstream science has not been characterized by this kind of open-minded curiosity, and instead has generally assumed that UAP must have a conventional origin, as we consider next.

The "Prosaic" Turn

In the modern era, UAP have been a topic of interest and concern ever since the orb and foo fighter encounters in World War II noted above. Initially, authorities mainly feared these represented new technologies developed by their international adversaries. However, by the late 1940s there was already serious consideration of a yet more extraordinary ETH, especially after UAP sightings began occurring across the mainland US, beginning in June 24th 1947, when pilot Kenneth Arnold saw what he famously called nine "saucer-like things... flying like geese in a diagonal chainlike line" at speeds exceeding 1,000 mph. near Mount Rainier in Washington State (Roos, 2020). The authorities appear to have swiftly concluded such sightings could not merely be dismissed as misidentification of prosaic objects, as articulated in a famous memo in September 1947 by Lieutenant General Nathan Twining (1947), the

Army Chief of Staff, who stated, “the phenomenon reported is of something real and not visionary or fictitious,” that the objects appeared to be disc-shaped, “as large as man-made aircraft,” and “controlled either manually, automatically or remotely” (Zabel, 2021). As such, at his urging, in early 1948 the Air Force established Project Sign, an intelligence operation based at Wright-Patterson Air Force Base in Dayton, Ohio, to examine the issue. It was subsequently reported – initially by Air Force UFO investigator Edward Ruppelt (1956) – that later in 1948 the project submitted an Estimate of the Situation, classified Top Secret, that UAP were extraterrestrial in origin. However, the report was reportedly rejected by the Air Force Chief of Staff, General Hoyt Vandenberg, ostensibly for lack of proof. However, Swords (2000) also suggests that “elements of very high rank in the Pentagon” would not actually *accept* an ETH for UAP. Whatever the motives and reasons, Project Sign was wound up that very same year.

In its place, the Air Force launched Project Grudge in 1949. Its ethos was later revealed by astronomer J. Allen Hynek (1977), who was consultant to both Sign and Grudge, and who recalls there being two schools of thought in the Air Force regarding UAP. Although one school believed UAP were genuinely extraordinary and most likely extraterrestrial, the second, which constituted a majority at the Pentagon, regarded the topic as “nonsense,” as Swords (2000) puts it (p.43). Crucially, the Air Force’s elite Scientific Advisory Board sided with the latter, as did Hynek himself at that point, who said, “It may be that my interim reports helped the transformation of Project Sign into the extremely negative Project Grudge, which took as its premise that UFOs simply *could not be*. I tried hard to find astronomical explanations for as many cases as I could, and in those that I couldn’t I reached to draw out as many natural explanations as possible. Sometimes, I stretched too far. Clearly, I, too, thought at the time that UFOs were just a lot of nonsense. I enjoyed the role of debunker” (p.17, italics in original). Thus, Project Grudge appears to have been designed, as Haines (1999) puts it, “to alleviate public anxiety over UFOs via a public relations campaign designed to persuade the public that UFOs constituted nothing unusual or extraordinary.” Similarly, although the CIA noted that “since there is a remote possibility that they may be interplanetary aircraft, it is necessary to investigate each sighting,” it recommended it conceal its interest from the public and the media “in view of their probable alarmist tendencies.” Comparable reactions occurred in the UK; in documents released by the National Archives in 2010, a wartime report claimed that Winston Churchill ordered that a significant UAP sighting witnessed by an RAF crew be kept secret because he believed “it would cause mass panic and it would shatter people’s religious views” (BBC, 2010). Thus, from the early-1950s onwards, as far as the public was concerned, political and military authorities had declared the UAP question a non-issue.

Most relevantly here, such conclusions permeated the scientific community too, especially following the Condon report in the late 1960s. Following a wave of UAP sightings in the early-mid 1960s, the Air Force commissioned an authoritative panel to thoroughly assess the situation, led by physicist Edward Condon (1969). Intriguingly, a substantial minority of sightings resisted prosaic explanations, and the report actually leaned towards an ETH for some UAP. One of its detailed case studies, for instance, was the “Lakenheath-Bentwaters” incident, involving a series of radar and visual contacts with UAP over airbases in eastern England on the night of 13-14 August 1956. Of this, the report concludes, “although conventional or natural explanations certainly cannot be ruled out, the probability of such seems low in this case and the probability that at least one genuine UFO was involved appears to be fairly high.” Crucially though, despite such anomalies, the report’s overall conclusion

implied that UAP were prosaic in origin and moreover were of no scientific interest: “Our general conclusion is that nothing has come from the study of UFOs in the past 21 years that has added to scientific knowledge.” Most relevantly here, this message was embraced by the scientific establishment. The National Academy of Sciences noted that, although “there remain UFO sightings that are not easily explained,” there are “so many reasonable and possible directions in which an explanation may eventually be found, that there seems to be no reason to attribute them to an extraterrestrial source without evidence that is much more convincing (Clemence et al., 1969, p.6). Similarly, an article in *Science* was entitled, “Condon group finds no evidence of visits from outer space” (Boffey, 1969), while a *Nature* (1969) editorial was particularly scornful, declaring it “a monumental achievement, but one of perhaps misapplied ingenuity. It would doubtless be inapt to compare it with earlier centuries’ attempts to calculate how many angels could balance on the point of a pin; it is more like taking a sledgehammer to crack a nut, except that the nuts will be quite immune to its impact.”

Critics of course took issue with the report’s dismissive conclusions, with Hynek (1972) deriding its summary as “singularly slanted,” not least in that it “avoided mentioning... that the committee had been unable to furnish adequate explanations for more than a quarter of the cases examined.” Nevertheless, it essentially shelved the topic from serious scientific consideration. As Hynek put it, Condon “was the coup de grace to the UFO era. Science had spoken. UFOs didn’t exist, and the thousands of people who had reported strange sightings ... could all be discounted as deluded, hoaxers, or mentally unbalanced” (cited in Coulthart, 2021, p.66). Of course, science is not a monolith, and scientists differ on many topics. Even so, it is certainly permissible to speak of a scientific *consensus* regarding a given phenomenon. In that respect, “normal” is whatever the consensus has established is real, and “paranormal” is whatever falls outside that demarcation. Most relevantly here, since Condon, UAP have generally been placed in the paranormal camp, alongside all manner of unusual phenomena similarly dismissed with ridicule. This attitude is encapsulated, for example, by figures who have embraced the role of “debunker,” as exemplified in a New York Times obituary for James Randi, headlined the “magician who debunked paranormal claims,” in which he is eulogized as turning his “formidable savvy to investigating claims of spoon bending, mind reading, fortunetelling, ghost whispering, water dowsing, faith healing, U.F.O. spotting and sundry varieties of bamboozlement” (Fox, 2020). This quote neatly encapsulates the status of UAP over recent decades: placed amongst a host of extraordinary phenomena likewise dismissed as unreal by the scientific consensus and relegated out of bounds.

Contemporary Skepticism

Significantly, the UAP topic generally remains off limits for the scientific community today, most of whom still appear to situate it in the discreditable paranormal category. This was evident for example in responses to a dramatic Congressional hearing into UAP on July 26, 2023 (available at C-Span, 2023). There were three witnesses testifying under oath, including two former Navy pilots who have been vocal about UAP encounters they and their colleagues have experienced, as well as David Grusch, an intelligence community whistleblower who alleges that authorities and private aerospace companies have for decades actually maintained a secret UAP “crash retrieval” and “reverse engineering” program (Kean & Blumenthal, 2023). At the time of writing there is no way of knowing the validity of his claims. However, Shellenberger et al. (2023) reported in September that over the recent months “at least 30 other whistleblowers working for the federal government or government

contractors have given testimony” to the Office of the Intelligence Community Inspector General, the Defense Department Inspector General, or to Congress, while a further 30-50 have offered similar testimony to AARO. Indeed, in October, James Lacatski – who between 2008 and 2010 headed a prior US government investigation into UAP – published a book, which was significantly cleared for release by the Pentagon, in which he stated “the United States was in possession of a craft of unknown origin” (Lacatski et al., 2023). Asked about this on the *Weaponized* (2023) podcast, Jeremy Corbell queried, “You told us, because you were *allowed* to tell, us that our government has a UFO in its possession and has been able to access the inside of it, right?,” and Lacatski responded: “Yes, I was allowed to tell you.” Commenting on these disclosures, Sharp (2023b) highlighted the significance of the phrase “unknown origin,” noting that this same phrase features in proposed new government legislation that appears to be taking these kinds of claims seriously.

That is, in July 2023, Chuck Schumer, Majority Leader of the Senate, introduced bipartisan proposals for an “Unidentified Anomalous Phenomena Disclosure Act” (U.S.C. S.2226, 2023). As reported in *The New York Times*, this would create “a commission with broad authority to declassify government documents about U.F.O.s and extraterrestrial matters, in an attempt to force the government to share all that it knows about unidentified phenomena” (Barnes, 2023). Importantly, the legislation essentially reiterates Grusch’s allegations, including defining “legacy program” (i.e., efforts to “collect, exploit, or reverse engineer technologies of unknown origin”), describing “biological evidence of non-human intelligence,” and mandating government seizure of UAP materials held by private entities. It is a near-impossibility that the Senate Majority Leader would propose such remarkable legislation absent highly credible corroborating evidence or testimony. Indeed, a press release from the Senate Democrats (2023) announcing the legislation describes how a sweeping congressional investigation “uncovered a vast web individuals and groups with stories to share” about UFOs. According to Schumer, “The American public has a right to learn about technologies of unknown origins, non-human intelligence, and unexplainable phenomena.”

However, despite such developments, many scientists have been vocal on social media in their disdain for the topic. While not everyone has been dismissive, well-known figures appear to be not merely skeptical but outright scornful, even – perhaps especially – those with expertise in the very fields related to the phenomenon. These include Brian Cox (2023), Neil DeGrasse Tyson (2023), and perhaps most strikingly Seth Shostak (2023), senior astronomer at the SETI Institute, who wrote an article mocking the Congressional hearing, wondering, “Where is the evidence?” This of course is a reasonable question. However, he simply said, “It’s MIA. Neither Grusch nor anyone else claiming to have knowledge of secret government UAP programs has ever been able to publicly produce convincing photos showing alien hardware splayed across the landscape... For reasons that are always unclear, the critical evidence that would convince anyone of alien presence in our ‘hood is classified. It can’t be made public.” This reasoning overlooks the basic context of Grusch’s allegations, including that this evidence is classified, for reasons surely even skeptics should appreciate. Moreover, he reportedly *has* given details to the Inspector General of the Intelligence Community, and in the hearing explicitly said he could also give details to committee members in a “SCIF” (Sensitive Compartmented Information Facility). When asked by Rep. Ocasio-Cortez, “If you were me, where would you look [i.e., for evidence regarding UAP] – titles, programs, departments, regions...?,” he replied, “I’d be happy to give you that in a closed environment. I could tell you specifically.” Given this exchange, either Shostak did not watch the whole hearing or did not appreciate the significance of this moment. Nevertheless, he maintained

his scornful tone in other forums, including an interview with the LA Times, in which he joked about interstellar travel (Petri, 2023): ““It’s very expensive to do that ... And aliens probably don’t have “unlimited amounts of alien money,” he added with a chuckle.”

It is perhaps one thing for the public to have these kinds of dismissive reactions. Indeed, several articles highlighted the extent to which many people seemed uninterested in the hearing, such as a Forbes piece titled “Nobody cares about David’s Grusch’s revelations” (Di Placido, 2023). However, coming from figures like Shostak, such dismissals are striking. To be clear, skepticism regarding the hearing, and the topic generally, is not only reasonable but essential from a scientific perspective. However, these responses go beyond skepticism into dismissal and disinterest, which is arguably *anti*-scientific. Perhaps the most charitable explanation for such reactions is that extraterrestrial explanations for UAP are still firmly situated in the paranormal box in which they have been confined since the Condon report, and so people like Shostak have long been accustomed to disregarding the kinds of sensational claims aired at the hearing. However, the key question now is whether such ideas *still* deserve to be dismissed as paranormal, or conversely whether, in light of the developments above, they should be taken seriously. Indeed, numerous eminent figures have argued just that, like Harvard’s Avi Loeb (discussed below). Moreover, although the UAP topic itself has long been dismissed, there is a long, reputable tradition of more open and legitimised scientific interest in topics that are UAP-*adjacent*. Crucially, such work suggests it may well be feasible for UAP to be extraterrestrial in origin.

Before considering this, we should note this is not the *only* hypothesis on offer besides a conventional prosaic explanation. Indeed, the linguistic nuance around this topic is intriguing, particularly the emphasis on “non-human intelligence” (NHI) in the Disclosure Act, where it appears 22 times and is defined as “any sentient intelligent non-human lifeform regardless of nature or ultimate origin that may be presumed responsible for unidentified anomalous phenomena or of which the Federal Government has become aware” (p.6). This wording implies that if UAP genuinely are extraordinary, the ETH is not the only possible explanation. In fact, key figures have made this very point. For example, Grusch was interviewed by Ross Coulthart on News Nation (2023), and when asked if the government had been “concealing the existence on this planet of alien life,” clarified, “I would couch it as “non-human intelligence”... [because] I don’t necessarily want to denote origin. I don’t think we have all the data to say, “Oh, they’re coming from a certain location.”” As such, there is an emerging debate around other possibilities, which can be grouped together under the label of “ultraterrestrial” hypotheses (Lomas, 2023). This is a broad category of conjecture involving the idea that UAP may represent the activities of NHIs *already* present in the Earth’s environment in some sense, hence *ultra*-terrestrial. In that respect, Puthoff (2022) offers a taxonomy of such hypotheses, including “extradimensional, crypto-terrestrial, demonic/djinn, proto/ancient human, [and] time-travelers” (p. 20001), which he defines as “sequestered terrestrial cultures... existing alongside us in distinct stealth.”

Clearly, these are extraordinary hypotheses that scientists may struggle to seriously consider. However, such is the deeply strange nature of UAP that people seem compelled to consider these alternatives. Take for instance Garry Nolan, an immunologist with an endowed chair at Stanford, who has for the past decade been involved in UAP research (Nolan et al., 2022). In a recent interview on Spotlight (2022) with Nolan, Coulthart posed a similar question to the one he asked Grusch, and received a comparably ambiguous answer: “You believe, on the evidence, that there is a non-human intelligence, of advanced technology, on this planet?” Nolan replied: “Advanced capabilities. No, I don’t know whether it’s a technology per se,

because I'm leaving open the idea that it's some form of consciousness that is non-material. And I know, say to my colleagues out there, this sounds absolutely crazy. But if you've seen the things that I've seen, you would only be able to come to a similar conclusion." Thus, some UAP are seemingly so extraordinary that people are forced to think outside the box and consider ultraterrestrial possibilities. One such theory, which Nolan was perhaps alluding to, is the "interdimensional" hypothesis, which suggests UAP may involve beings from dimensions that coexist alongside the four dimensions of spacetime we usually perceive (Lomas, 2023). Another is time-travellers, which is now being given serious consideration by scholars, most notably Masters (2019, 2022). However, when it comes to "extraordinary" explanations for UAP, the main hypothesis on the table is the extraterrestrial one, which is our focus here. In that respect, the first consideration in assessing this possibility is the likelihood of there being forms of extraterrestrial intelligence per se.

Extraterrestrial Intelligence

Before considering the possibility that extraterrestrial NHI could have actually engaged with Earth – hence being responsible for UAP – the first question is whether such NHI might exist at all. This question itself has two parts, namely, the possibility of (a) extraterrestrial life, and (b) such life being intelligent. Interestingly, before the 20th Century, the scientific consensus arguably leaned towards both being true, before swinging the other way as understanding developed, only for it subsequently to revert to its original position in recent years. In the 19th Century, the existence not merely of life elsewhere but intelligent forms held sway, as exemplified by an 1831 astronomy textbook, *The Young Astronomer*, which explained, "To the people who live on Mars, this earth probably appears larger than Mars does to us" (cited in Library of Congress, 2023). This view was solidified by the apparent observations of "canals" on Mars, a network of long straight lines in the equatorial regions (Laskow, 2016). These were first described by Italian astronomer Giovanni Schiaparelli in 1877, though significantly he called these simply *canali* ("channels"), which was mis-translated as "canals," with the latter implying technological craftsmanship. Nevertheless, the idea was embraced by scientists, perhaps most notably renowned astronomer Percival Lowell, who published three books on the topic: *Mars* (1895), *Mars and its Canals* (1906), and *Mars as the Abode of Life* (1908). However, by the early 20th century, the consensus had turned against the idea of constructed canals, instead regarding these as merely optical illusions. The issue was then completely settled in 1965 when photographs taken by NASA's Mariner IV found no canals at all, not even something that could be misinterpreted as such.

Given such findings, by this point the scientific community had come to regard both (a) and (b) as highly improbable, not least because planetary systems were thought to be very rare. Indeed, only in 1995 was the first extrasolar planet – orbiting 51 Pegasi, about 50 light-years away – discovered by Mayor and Queloz (1995). However, as technologies continued to develop, endowing the field with better data and knowledge, the consensus began shifting again, with both (a) and even (b) now regarded as not only possible but a near *certainty* by most experts. This epistemological evolution is captured, for instance, in the fact that The Royal Society (2010) in the UK – the world's oldest and arguably most prestigious scientific academy – convened a meeting in 2010 on "The detection of extraterrestrial life and the consequences for science and society." As its abstract stated, "Astronomers are now able to detect planets orbiting stars other than the Sun where life may exist, and living generations could see the signatures of extraterrestrial life being detected. Should it turn out that we are not alone in the Universe, it will fundamentally affect how humanity understands itself – and

we need to be prepared for the consequences.” Here we shall consider (a) and (b) in turn, but both essentially are founded on the sheer unfathomable size of the universe, and especially on the near infinity – in practical terms – of stars. Although estimates vary, NASA (2023) calculates our Milky Way contains at least 100 billion stars and the observable universe at least 2 trillion galaxies (NASA, 2016). This means – if galaxies are all roughly similar size – there may be 200 sextillion (200 billion trillion) stars in the observable universe. The next question is planets. Although the number of confirmed exoplanets in our galaxy is now above 5,000, NASA has suggested that *every* star could potentially host an exoplanet – with some stars, like our own, having more than one – meaning the actual number could be far higher than 100 billion (Waichulis, 2023). Extrapolating across the whole cosmos, the number of planets may well thus exceed the 200 sextillion stars.

Not all exoplanets may be *habitable* of course. This has traditionally been thought to require highly specific conditions, first in terms of the planet itself (e.g., rocky terrain capable of supporting liquid water on its surface), and moreover in its relationship with its star, being in a “Goldilocks’ zone” where conditions are “just right” (e.g., neither too near or far from the star, thus being neither too hot nor cold). Even accounting for these parameters though, such planets are thought relatively common, with estimates just for our galaxy ranging from 300 million (Bryson et al., 2020) to 6 billion (Westby & Conselice, 2020) up to possible even *every* star, which could mean up to 100 billion (Ojha et al., 2022). Then, in terms of proximity, Madau (2023) has calculated there may be as many as 11,000 “temperate terrestrial planets” – Earth-size planets in the habitable zone – within 100 parsecs of our Sun (with 1 parsec being 3.26 light-years, and our galaxy 30,000 parsecs across). Fundamentally, whichever calculation one adopts, if galaxies potentially run into the *trillions*, the number of habitable planets is incalculably large. Furthermore, even these expansive calculations are now being recalibrated to be even more generous in light of research such as analyses of “extremophiles,” which shows that terrestrial life can grow and reproduce in intensely inhospitable conditions, including temperatures as low as -15 °C and as high as 122°C (McKay, 2014). Moreover, in terms of atmospheric biosignature gases necessary for life, the oxygen-rich environment of Earth may not be essential, and a hydrogen-dominated atmosphere – as for instance found on Jupiter, Saturn, Uranus, and Neptune – can potentially support life (Seager et al., 2020). Such discoveries suggest the parameters of the Goldilocks zone may be wider than hitherto suspected.

However, just because a planet is habitable, this doesn’t mean it *does* actually have life. Here we run into deep questions around how and why life emerged on Earth, which are themselves still unresolved and much debated. Arguably the current dominant view is that life emerged out of self-replicating RNA (ribonucleic acid) molecules (Bernhardt, 2012). However, they are themselves complex, so the question arises of how *they* emerged, with suggestions that very specific conditions needed to be in place (Le Vay & Mutschler, 2019), such as prebiotic polymers (Guseva et al., 2017). Details aside, the key point is that even if a planet is in a Goldilocks zone, this may only be a necessary but not sufficient condition for life to arise, and highly particular conditions may have been required to allow life to emerge on Earth. The question then becomes whether Earth is *singular* in that way, or whether such conditions obtain elsewhere. Although currently unanswerable regarding habitable planets outside our own solar system, based simply on the sheer number of planets, many observers consider it unlikely that Earth *is* singular (Bean et al., 2017). Moreover, emboldened by research on extremophiles, scholars are increasingly confident that life may be relatively tenacious, prolific, and widespread. Madau (2023) for example suggests that at least 1% of

habitable planets may give rise to microbial life. Indeed, researchers have found potential signatures of organic life just within our own solar system, including Venus (Lea, 2023), Mars (Sharma et al., 2023), and Enceladus (one of Saturn's 146 moons) (Postberg et al., 2023). Relatedly, the recent NASA mission to collect and study samples from the 4.5-billion-year-old asteroid Bennu indicates that it may contain "building blocks of life on Earth," including "high-carbon content and water" (Donaldson, 2023).

Moreover, even more striking findings may await discovery. For example, analysing "official NASA Mars photographs" from the Curiosity Rover, Joseph and Schild (2023) published images of what they interpret as "the wreckage and debris from extraterrestrial spacecraft, partially buried bones, the body of a "humanoid" stretched out on a "cushion;" the head of a "humanoid" still wearing a metal device on the front of its "face" adjacent to a *cratered* debris field, two "humanoid" skulls including one that is atop what may be a raised elongated burial mound, UAPs/UFOs photographed in the skies of Mars and a silver-saucer shaped structure upon the ground" (p.54). Caution is needed in interpreting such data of course, particularly given our cognitive habit of "pareidolia": the tendency to perceive a specific, often meaningful, image in a random or ambiguous visual pattern. This is the prevailing scientific interpretation of the famous "Face on Mars," a mile-wide facial likeness obtained by NASA's Viking 1 in 1976 (Martinez-Conde & Macknik, 2012). However, we must also be wary of simply *assuming* any apparently anomalous object is pareidolia, especially in cases like Joseph and Schild's paper, given these strange objects are situated in close proximity, and moreover – if they do potentially represent a UAP crash – have a plausible theory linking them together. Moreover, we should note that even if we cannot *currently* find life on places like Mars, it could still have been there in the past, with evidence subsequently lost to time. As Avi Loeb (2022) put it, "Planets like Mars or Earth could have given multiple births to technological civilizations that were a billion years apart and hence were not aware of each other. Like stable parents, the planets recovered from the environmental impact of these civilizations over time."

Furthermore, through developments like the James Webb telescope we may also be near to finding life outside the solar system too. For instance, NASA (2023) reported that K2-18 b – an exoplanet 8.6 times as massive as Earth, situated in a habitable zone of the cool dwarf star K2-18, about 20 light-years from Earth in the constellation Leo – appears to have carbon-bearing molecules, including methane and carbon dioxide, suggesting it "could be a Hycean exoplanet, one which has the potential to possess a hydrogen-rich atmosphere and a water ocean-covered surface." Moreover, NASA suggests these findings may be indicative of life, noting the "possible detection of a molecule called dimethyl sulfide (DMS)," of which they state that "On Earth, this is only produced by life." Indeed, it is worth emphasizing just how rapidly our understanding of the cosmos is being challenged and revised by new technologies; for instance, just in October came evidence from the Keck Cosmic Web Imager of a "cosmic web" of "filaments connecting galaxies across vast distances" (Physics-Astronomy.com, 2023), from James Webb indications of free-floating Jupiter-sized "planets" unconnected to any star (Amos, 2023), as well as a study suggesting that a massive seismic tremor detected on Mars last year by NASA's Insight Mars lander was caused by plate tectonics, contradicting the assumption that it is geologically a "dead planet" (Fernando et al., 2023).

Of course, even if life may be widespread, the question of intelligent forms is another matter entirely. Calculating its likelihood is difficult, as attested to by years of debates around the Drake Equation – regarding the number of detectable/contactable civilizations in the

Milky Way (Drake et al., 2015) – and estimates vary wildly, depending on assumptions (Sandberg et al., 2018). Snyder-Beattie et al. (2021), for example, suggest intelligent life on Earth required a “series of evolutionary transitions” – including abiogenesis, eukaryogenesis, sexual reproduction, multicellularity, and intelligence itself – which may be “extraordinarily improbable, even in conducive environments” (p.265). However, their verdict is that intelligent life elsewhere is “rare” rather than non-existent. That said, some scholars still question this assumption, given that, apparent UAP sightings aside, we officially have not *detected* any signs of such life. This seeming lack of contact has been called the Fermi paradox, after the physicist Enrico Fermi queried in 1950 why, if there are so many potential habitable planets, we have received no signs of intelligent life. However, scholars have pointed out this is only a paradox if one should *expect* to see such signs if intelligent life does exist elsewhere, and there are reasons why we should not necessarily expect that. Renowned science fiction writer Ciuxin Liu (2015), for example, has proposed a theory called the “Dark Forest” which theorists have found persuasive (Yu, 2015). It echoes the philosophy expressed by Thomas Hobbes (1651) in *Leviathan*, where nature is characterised by “continuell feare, and danger of violent death” (p.62). On this view, the assumption at the heart of Liu’s novels is that the universe is indeed teeming with intelligent civilizations, but everyone is *hiding*, given that to reveal themselves is to invite attack and destruction: “Every civilization is a hunter with gun in hand and he sneaks in the forest. He must be careful enough as there are other hunters in the forest. If he discovered other lives, he can only do one thing: shoot it. In this forest, other lives are hell and constant threats. Any life that will expose his existence will be killed soon. This is the picture of universe civilizations.”

Moreover, even if another civilization *were* broadcasting their whereabouts, we are unlikely to have found it. Wright et al. (2018) calculated that only a miniscule fraction of the radio parameter space has so far been covered by SETI, and compared any dismissals of the possibility of intelligent life on that basis to searching unsuccessfully for dolphins in a small pool’s worth of ocean water and then concluding the ocean was dolphin-free. Thus, based on the probabilities, most experts have concluded there most likely are intelligent civilizations elsewhere. As noted above, Bill Nelson, for example, said in 2021, “My personal opinion is that the universe is so big, and now, there are even theories that there might be other universes. If that’s the case, who am I to say that planet Earth is the only location of a life form that is civilized and organized like ours?” (Todd, 2021). Moreover, many observers suggest there are likely to be numerous instances even just within our own galaxy: Westby and Conselice (2020) estimated the number of “Communicating Extraterrestrial Intelligent” civilizations in the Milky Way according to various assumptions, and even under the strictest criteria suggest there may well be dozens. Even if so though, this does not mean such civilizations could actually visit Earth. Yet this possibility too is regarded as increasingly feasible, as we consider next.

Interstellar Travel

Even if extraterrestrial civilizations exist, the scientific consensus is that it would still be exceedingly difficult for them to travel to Earth – hence being responsible for UAP – given the vast size of the universe. However, recent advances in science and technology are making scholars revisit these assumptions. Let’s use our nearest stars, Alpha Centauri A and B, 4.35 light years away, as an example. Our current fastest means of travel is Gravity Assist, which uses the relative movement and gravity of planets to alter a craft’s path and speed, this being the method by which Voyager 1 used Saturn and Jupiter for gravitational slingshots to attain its current velocity of 60,000 km/hr. At this rate, it would take 76,000 years (over

2,500 generations) to reach these stars (Williams, 2016). However, these calculations are only based on *current* technological capacities and knowledge, which will likely be radically revised in future. Indeed, even now at the frontiers of science are proposals for exponentially faster methods, some of which have already begun to receive experimental testing. For example, an aerospace company (Pulsar Fusion) has begun construction of a nuclear fusion rocket engine – due for completion in 2027 – predicted to create exhaust speeds of over 500,000 MPH (Sampson, 2023). Moreover, even faster methods are being developed. For example, NASA suggests a “laser sail” – ultrathin mirrors driven by focused energy beams – measuring 965 km in diameter could accelerate to half the speed of light in less than a decade. Work on this idea is already underway, including Project Starshot, which plans to use it to send a small sensory package to Alpha Centauri at 1/5 the speed of light (Parkin, 2018).

Moreover, these are just endeavours of which information is known publicly. There have long been suspicions that authorities have been secretly working on far faster methods, possibly – though this is of course unproven – through reverse engineering UAP, as alleged by Grusch. Scientists have wondered, for example, about the viability of breakthrough technologies such as an Alcubierre warp drive that could allow faster-than-light travel by effectively “stretching the fabric of spacetime” (Williams, 2017, paragraph 5). As Lue Elizondo, an intelligence veteran with close connections to the UAP topic, explains, “a significant amount of mass or energy warps space-time... It’s a scientific fact, not fiction. The question now is how we can manipulate this physics for technological advancement. Potentially, we could warp space-time in a way that allows us to travel from point A to point B more quickly” (Verma, 2023). Strikingly, scientists are allegedly already working on such craft, with numerous rumours surrounding Salvatore Pais for instance, an aerospace engineer at the Naval Air Warfare Center Aircraft Division. Leaked documents disclosed by The War Zone (Tingley, 2020) suggested he has not only obtained numerous patents for highly advanced forms of technology – including a “hybrid aerospace-underwater craft” (Pais, 2019) that would apparently be capable of “altering the fabric of time and space” – but the Navy had actually conducted experiments on some of these.

Needless to say, this work remains highly secretive. However, what little is publicly available is very intriguing. Ross Coulthart’s (2021) book, *In Plain Sight: An Investigation into UFOs and Impossible Science*, for example, devotes an entire chapter to “Dr. Salvatore Pais’s Puzzling Patents.” It begins by noting the momentous detection of gravitational waves in 2015, a discovery – almost a century after these had been predicted by Einstein as part of his theory of relativity in 1916 – that earned the scientists involved a Nobel Prize in 2017. He notes that “within just eight weeks of the announcement of this momentous breakthrough, in April 2016, an unknown US Navy aerospace engineer named Dr Salvatore Pais filed a patent for a revolutionary spacecraft driven by gravity waves that was straight out of *Star Trek*.” Moreover, he notes that “Oddly, he still got his patent, largely because the Navy vouched for his discovery,” and that “most incredibly of all, his navy boss alleged that the gravity wave propulsion system in Pais’s invention would soon become a *reality*” (italics in original). Indeed, although rather elusive, Pais has given several interviews, including one in which he explained the thorough process required to receive his patents (Pais, 2022). Thus, even with the secrecy surrounding his work, it appears that cutting edge research is at least suggestive of the feasibility of interstellar travel.

Furthermore, even if such technologies are currently beyond *our* capacity, they may not be beyond more advanced NHI civilizations. After all, we have reached the point of such possibilities being in our grasp after mere centuries of scientific development. Imagine what

a civilization could achieve after several thousand years of scientific progress, let alone longer. Indeed, such possibilities may exceed even the extraordinary ideas above, including exploiting “traversable wormholes” – speculative structures, predicted by the theory of general relativity, that link disparate points in spacetime – to take a “short-cut” through spacetime (Frolov et al., 2023). Moreover, even if an interstellar voyage did take thousands of years, while impossible for biological organisms as we understand them, it would most certainly be feasible if craft were piloted instead by AI. To that point, Avi Loeb – director of the Galileo Project, which is systematically searching for “extraterrestrial technological artifacts” – suggests this would be the most likely scenario if some UAP really were extraterrestrial (Loeb & Kirkpatrick, 2023). A related idea also gaining currency is the possibility of UAP being piloted by “biological robots” that are wholly or partially synthetic, as suggested for example by Garry Nolan, who argued that such entities might be designed to act as an “intermediary” between their creators and humans (Verma, 2023a). This is why, he speculated, reports of alien encounters usually involve entities with surprisingly similar physiognomy to humans, which one might not necessarily expect given the myriad of evolutionary pathways that intelligent life might take in the cosmos. Indeed, Grusch (2023) made a similar point, suggesting that an NHI could be “engineering beings to look like us for ease of contact.” On a similar note, philosopher Bernard Kastrup (2023) argued it was “plausible that a more technologically advanced alien civilisation would have vast control of their own genotypes and phenotypes, thereby designing themselves” for their various purposes, including space travel, “which could benefit greatly from DNA manipulation.” Indeed, it has been pointed out – for example by investigative journalist Annie Jacobsen (2016, 2019) – that we have already made progress along these lines, with organizations like the Defense Advanced Research Projects Agency (DARPA) having created numerous “biohybrids” that are functional combinations of “animal and machine.”

Intriguingly, allegations along the lines of Nolan’s and Grusch’s ideas surfaced recently on social media, causing a stir among UAP commentators, when an anonymous Reddit user called “EBOscientistA” (2023) filed an incredibly detailed post claiming that from the late 2000s to the mid-2010s he/she “worked as a molecular biologist for a national security contractor in a program to study Exo-Biospheric-Organisms (EBO)” at the Battelle National Biodefense Institute. The post claimed the institute actually possessed four EBO bodies (with other EBO entities held elsewhere), and that the program aimed to “elucidate the genome and proteome basis of these organisms.” Most relevantly here, their account aligned with Nolan’s suppositions: “we’ve discovered that the EBO genome is a chimera of genomes from our biosphere and from an unknown one. They are artificial, ephemeral and disposable organisms created for a purpose that still partially eludes us.” There is no way to know the validity of these claims at present of course. However, most commentators leaned towards these at least being plausible and worth investigating, including Nolan (2023) himself, who wrote, “This is a challenge to the [UAP] community to determine if they can come together and analyze this logically.” Moreover, their plausibility was lent further credibility by the UAP Disclosure Act, which specifically refers to the possibility that authorities actually have EBOs in their possession, referring to “biological evidence of living or deceased non-human intelligence” (p.6). Furthermore, in terms of the suggestion of synthetic biological entities, it may be significant that in Grusch’s testimony to the Congressional UAP hearing he used the specific and unusual term “biologics” to refer to EBOs in the government’s possession. In subsequent speculation as to the precise meaning of this term, some commentators pointed to Pasulka’s (2018) chapter on “The spectrum of human techno-hybridity,” where she writes that “Biologics is a category of bioengineered living tissue” (p.182).

Moreover, aside from dramatic claims about secret UAP “crash retrievals,” even in the public domain are tentative indications that some UAP may be extraterrestrial in origin. Avi Loeb for instance has studied two such potential artifacts. One is an object dubbed Oumuamua – a Hawaiian term meaning “scout” – that passed through our galaxy in 2017 (Bialy & Loeb, 2018). This seemed to have various properties that “defied easy natural explanation” (Billings, 2021), including being shaped like a 100-meter-long cigar, being at least 10 times more reflective than typical space rocks and, after passing by the sun, accelerating faster than could be explained by the star’s waning gravitational grip alone. To Loeb, the most likely hypothesis is that this was a laser sail, perhaps “a derelict from some long-expired galactic culture,” although others have disputed his conclusions (Wright et al., 2023). Moreover, Loeb made headlines recently regarding a second potential interstellar artifact, with his Galileo Project embarking on an expedition to recover the remains of an unusual meteor which fell into the Pacific Ocean in 2014. Based on its speed and other apparent properties (e.g., toughness), it was formally recognized as having an interstellar origin at “the 99.999% confidence [level] in an official letter from the US Space Command under DoD to NASA” (Loeb, 2023c). Their search was seemingly successful (Loeb et al., 2023), retrieving more than 700 “sphericals” from the object’s apparent crash-landing path. As summarized by Loeb (2023d), his team are confident that some of these sphericles have a “composition pattern of elements from outside the solar system, never seen before,” specifically being “heavily enriched by factors of hundreds in Beryllium (Be), Lanthanum (La), and Uranium (U), relative to the solar-system standard composition of CI chondrites.” Somewhat similarly, Garry Nolan has analysed pieces of “molten metal” that appear to have been “dropped off” by UAP, and has concluded that these appear to be technological creations (as shown in Yes Theory, 2023); for example, one had “magnesium ratios that were so far off Earth normal [that] the only way you could interpret them, frankly, is that they were engineered, or they were part of an industrial process.”

As to the origin of the sphericles retrieved by Loeb, there are various hypotheses. One is they came from a “highly differentiated crust of an exoplanet with an iron core.” Another more “exotic possibility” is that they “may reflect an extraterrestrial technological origin” – produced by an extraterrestrial civilization – though establishing this would require finding the intact object itself (rather than the sphericles, which are thought to be molten droplets from its surface), which he hopes to recover in a future mission. If they are indeed technological artefacts, Loeb has offered various suggestions for their engagement with Earth, from probes being deliberately sent here (e.g., piloted by AI), to discarded “space trash” from other civilizations. Regarding the first theory, Loeb recently wrote a paper – significantly co-authored with Dr Kirkpatrick, director of AARO – that aimed to articulate a set of “physical constraints” based on “standard physics and known forms of matter and radiation” that would help in identifying genuinely anomalous UAP (Loeb & Kirkpatrick, 2023, p.1). Kirkpatrick’s mere involvement in this paper is itself significant: given he is leading the UAP investigation for the US government, the very fact he hypothesizing extraterrestrial origins for UAP is an extraordinary development. Specifically, they suggest that Oumuamua – or any large artificial interstellar object – might function as a “parent craft that releases small probes during its close passage to Earth” akin to “dandelion seeds.” Although the entity recovered by Loeb in 2023 preceded Oumuamua, six months prior to the latter’s closest approach to Earth, a meter-sized object also recognized as interstellar collided with Earth, which Loeb and Kirkpatrick suggested could be one such “seed.”

Another idea proposed by Loeb (2023a) is that such artefacts may constitute “space trash”: “Over the past ten billion years, other technological civilizations could have littered the volume of the Milky Way disk with numerous dysfunctional devices. This trash may have accumulated in interstellar space like plastics in the ocean.” On that note, returning to the statistical likelihood of intelligent civilizations elsewhere, Loeb suggested that while “many scientists regard an encounter with a relic from another technological civilization as extraordinarily unlikely,” he regards it as “common sense to search for space trash of the type that we produce since there are *billions of Earth-like planets in the Milky-Way*” (my italics). On that note, Freitas Jr. (1983) has argued for a systematic Search for Extraterrestrial Artifacts – SETA, modelled after SETI – and has proposed various likely candidate regions in our solar system for such a search. In any case, while scholars may not necessarily endorse all Loeb’s or Nolan’s findings and conclusions, it is nevertheless significant to see figures of their stature talking openly about interstellar travel.

A final point to note regarding potential UAP “crash retrievals” is the observation – made by skeptics like DeGrasse Tyson (1996) – that it seems implausible for an NHI to be capable of interstellar travel only to “bungle their arrival by crash-landing on Earth.” On first glance, this is a reasonable question. However, some commentators suggest that one potential explanation involves our use of nuclear weapons; indeed, there has been a close connection between UAP and nuclear activity and installations over the decades (Hastings, 2015) – as for example shown in documents recently released by the Department of Energy about UAP incidents near their facilities between 2018 and 2021 (Hanks, 2023) – with strong indications that UAP have a particular “interest” in our use of this technology. This interest could extend to the possibility that such weapons may have the ability to interfere with UAP themselves, especially in the way a detonation can create an electromagnetic pulse (EMP) – a brief but extremely powerful magnetic field – that could somehow destabilise a UAP, as discussed by the likes of NASA Mission Specialist Bob Oechsler (2014), and more recently DeLonge (2017), Elizondo (2021a), and Coulthart (2023). Thus, even if an NHI and their technology were exponentially further advanced than us human beings, we could still cause them trouble with our more primitive capabilities, just as a pre-historic caveman could bring down an aeroplane by throwing a rock into its engine.

Attention has focused for example on a series of high-altitude nuclear tests conducted over the Pacific in 1962, known as the “Fishbowl” series (Department of Energy, 2000). The first weapon was “Bluegill,” a sub-megaton nuclear warhead with an estimated nuclear yield of 400 kilotons, which had four attempts: Bluegill (June 2), Bluegill Prime (July 26), Bluegill Double Prime (October 16), and Bluegill Triple Prime (October 26). Of these, the fourth was successful, detonating at just over 48 kilometres. Most relevantly, footage of this test seems to show an object tumbling out of the nuclear fireball, as analysed on the Reddit r/UFOB forum (e.g., by Harry_is_white_hot, 2023), which some observers have suggested is a UAP. Likewise, there are rumours that something similar happened with the more powerful Starfish Prime test on July 9, 1962, a 1.4 megaton nuclear warhead that detonated roughly 240 miles above the Pacific (Plait, 2012). Elizondo (2021a) for example was asked about Starfish Prime, and said, “there may be some truth that an electromagnetic pulse of energy can interfere with whatever this technology is and its propulsion. Like a bubble. And if it interferes with it, you [have] ... a very interesting scenario where whatever is keeping these things up in the sky no longer does that.” Moreover, Oechsler, DeLonge, and Coulthart have suggested this may not simply have been an accident, but could have been a reason *for* these tests. As Coulthart put it, “I’m increasingly led to the view by sources that the United States

has been involved in targeted kinetic engagements with UAPs using EMP weaponry to try and bring them down, and they've done so successfully."

While we of course cannot know the veracity of such allegations and explanations, they do give one pause in immediately dismissing the possibility of extraterrestrial UAP based on objections around the apparent unlikelihood of such craft "crashing." Moreover, this is not the only viable interpretation of any such crashes, with various other potentials discussed for example by Jesse Mischel (2023), creator and host of the American Alchemy podcast (who over the summer was granted an exclusive interview by David Grusch). One idea, raised by the likes of Vallée, is that retrieved UAP could be some kind of "gift" from a NHI, perhaps because they want us to develop technologically and prosper. Another option could simply be that UAP are expendable, in the same way humans fly drones into volcanoes. Ultimately though, any motives and actions of such NHI are likely to be fundamentally inscrutable: such might be the cognitive chasm between us and them that Mischel likens us to "an ant colony ... wondering why humans do certain things, we're just so epistemologically limited." Nevertheless, such speculations at least open several avenues of plausibility for how authorities may potentially have come to acquire interstellar UAP.

Conclusion

The starting point for this paper was the observation that although UAP have been a topic of public interest and concern for over 75 years, authorities have tended to downplay their significance, at least in public. However, recent developments have meant some institutions – notably military, intelligence, and political communities – have begun to take the topic more seriously, including being open to an ETH. Significantly though, this openness has generally not yet permeated the scientific community, which till tends to dismiss extraterrestrial explanations for UAP as "paranormal." However, this paper has argued for taking such hypotheses seriously, particularly given work around, (a) the likelihood of extraterrestrial intelligent civilizations existing per se, and (b) the viability of interstellar travel. As such, hopefully we shall see greater scientific engagement with this important and mysterious topic over the years ahead. Indeed, we may find that scientists will be called on soon to help with this task. When Grusch (2023b) was asked in July what would happen next in relation to his allegations, he replied that first "some intel officers and other people in and out of government ... are about to file complaints similar to what I did," including people who actually worked on crash retrieval programs themselves ("literally the dudes touching the stuff"). Then, he said, by "February of 2024 we should have a presidential panel on UAP disclosure, looking at the crash retrieval issue and everything. And then within 300 days of the enactment of the [Disclosure] Act, we're going to get some kind of, I think, government statement next year on this topic. The tsunami wave is building, and I don't think we're going to totally backpedal anymore... I think 2024 is going to be, knock on wood, potentially wild, in a good way." Of course, these events and consequences may yet still not come to pass. Reporting by the likes of Sharp (2023a) and Shellenberger et al. (2023) suggest some powerful senior officials within the intelligence and military communities are actively working to prevent or at least stall this kind of "disclosure," possibly because some also have conflicts of interests in their connections to private aerospace companies. However, if Grusch's predictions are even remotely accurate, the scientific community will soon need to play its part in helping to explore this existentially important topic, which may include the revelation that humans are – as many people have long wondered, feared, hoped, or believed – not alone in the universe.

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Ontological Prerequisites for the Emergence of Scientific Cosmology in the Context of the Emergence and Development of the Scientific Thinking

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The article argues that scientific cosmology, the study of the Universe's origin, evolution, and structure, remains an essential and integral part of scientific thinking. The article traces the roots of scientific thinking back to ancient Greek philosophy, particularly the work of Plato and Aristotle. These philosophers were the first to provide a clear justification for scientific knowledge, laying the foundation for its development in subsequent centuries. However, modern science no longer accepts their justifications as definitive. This raises the question: how can scientific thinking function without the traditional foundations laid by the Greeks? The article proposes a solution: general concepts can

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objectively exist as a property of the inherent uniformity and isotropy of space and time. This is not limited to just geometric and physical forms but extends to social, cultural, and other realms. Space can be understood as having dimensions, sets of characteristics used to define an object. These “spaces” are abstract constructs humans create to solve specific problems. The same object can occupy homogenous or heterogeneous spaces, depending on the problem being tackled. Time, unlike space, is irreversible and intrinsically anisotropic. However, it can be considered quasi-isotropic and quasi-homogeneous in some specific cases. The development of these concepts of homogeneity and heterogeneity in both physical (geometric) space and time constitutes the foundation of scientific cosmology.

Keywords: cosmology, logic, scientific thinking, the general, the particular, sphericity, existence, homogeneity, space, time.

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Introduction

Modern cosmology is perhaps one of the most significant and foundational scientific disciplines. In terms of its potential to shape our worldview, it is inseparable from science itself. In a sense, it is the very embodiment of scientific knowledge, as it provides us with a comprehensive understanding of the Universe as a whole. Inherently, modern scientific cosmology concentrates on all the features of science and the scientific way of thinking. It can be considered a kind of “exemplary model of scientificity” on the one hand, and on the other hand, it can be used to study the general laws of the development of scientific knowledge. This is the focus of this work.

A special way of thinking – scientific thinking – is an integral part of science in general or any science, although science is not limited only to the specificity of thinking. Science, although it has existed for a very long time, arises later than civilization itself, which implies the institutions of state and law. However, it is also important to note that science arises not only later but also very locally. The emergence of the scientific way of thinking, and therefore the foundations of science in its modern understanding, we associate primarily with Aristotle, who is considered the “father of science.”

Undoubtedly, the set of knowledge that formed the substantive basis of scientific knowledge arose much earlier than the period of classical ancient Greece, and most importantly, this knowledge also appeared in other cultures of the ancient world. This is most clearly manifested in cosmological knowledge, which will be discussed below. However, each of them individually, as well as in total, cannot be considered scientific knowledge. They differ fundamentally from Aristotle’s approach, both in terms of content and methodology. Logic is the foundation of the methodology of theoretical scientific knowledge construction. Aristotle explicitly formulated the basis of logic in his “Analytics” (Aristotle, 2009; 2007), which is the only collection of works on logic in the ancient world that explicitly addresses logic issues, with the exception of works written by ancient Indian authors.

In other ancient cultures, too, we can reconstruct the logic of their authors by analysing their texts, at least those that deal with scientific topics. Of course, this requires extensive research, knowledge of multiple ancient languages, and a deep understanding of the cultures in question. These requirements are beyond the scope of this work, which is limited. Therefore, we will refer only to some of the well-known works of ancient authors, which represent the highly developed cultures of the ancient world. The main object of consideration will be

astronomical texts and their cosmological interpretation in the context of the stated approach to the methodological identity of cosmology and science. We will also touch on texts in other areas that, in relation to cosmology, act as a methodological tool – mathematics and logic – without which, as scientific knowledge, cosmological knowledge would be impossible.

1. Ancient Chinese and Indian texts on mathematics and logic

One of such works is the ancient Chinese mathematical treatise “The Nine Chapters on the Mathematical Art.” It is a classic work that encompasses the knowledge of ancient Chinese mathematicians. It is a loosely coordinated compilation of earlier works by different authors, written from the 10th century BC to the 2nd century BC. It presents a series of problems (246 in total) in a question-and-answer format. A lot of specialized literature has been devoted to its analysis (see, e.g., Dauben, 2013). Of course, within the framework of this work, it is not possible to analyse it in detail as a specific “marker” for the topic of this article. It is worth paying attention to the part of “The Nine Chapters on the Mathematical Art” that is associated with the theorem of the equality of the sum of the squares of the legs to the square of the hypotenuse in a right triangle. In Chinese mathematics, it is called the Gou-Gu theorem, and in European mathematics, it is called the Pythagorean theorem. In European mathematics, this theorem is formulated in general for any values of the legs, and the general theorem is applied to solve the corresponding specific problems. In “The Nine Chapters on the Mathematical Art,” the author calculates and proves this statement for the Pythagorean triple of numbers 3, 4, and 5. The authors of this treatise then go on to find other triples of Pythagorean integers by analogy with the first triple, taking it (the first triple) as a model or standard. The example does not capture the heightened level of formal abstract thinking evident in Chinese culture compared to that of ancient Greece. Thus, Joseph W. Dauben points out: “Above all, why did Chinese mathematics develop as it did, as far as it did, but never in the abstract, axiomatic way that it did in Greece?... why the Chinese did not develop a more abstract, deductive sort of mathematics along Greek lines...” (Dauben, 1992: 134). In another passage, he emphasizes: “Compare these developments of the Gou-Gu theorem in the Chinese mathematical tradition with what is to be found in Euclid’s *Elements*. The most striking difference is certainly the axiomatic framework of Euclid’s work and its abstract, formal character” (Dauben, 1998: 1341). And further: “It is sometimes asked, why did the Chinese not go on to develop a Euclidean axiomatic mathematics? Why not a more abstract proof, for example, of the Gou-Gu theorem? However, this is surely the wrong question. The real question is why should the Greeks have departed from virtually all other cultures in this respect, namely in their preoccupation with axiomatic, deductive proofs? However, this clearly is a very different problem from determining the origin and nature of Chinese mathematics” (Dauben, 1998: 1346). Thus, we can assert that Greek scientific thinking differs from the types of scientific thinking in other cultures of the ancient world and that this thinking was characterized by a high degree of abstraction and therefore generality.

Continuing this thought, we will now turn to the culture of ancient India. In this culture, like in ancient Greece, logical norms, rules, and principles were explicitly formulated. Driven by the need to defend their views and refute opposing arguments, Indian philosophers engaged in vigorous debates, leading to the blossoming of logic as a discipline. In general, three periods of development of Indian logic can be distinguished in various variations: the first period (early Buddhist logic) – 6th–5th centuries BC – 2nd century AD; the second period (primarily the activity of the Nyaya school) – 3rd–5th centuries; the third period (the flowering of Buddhist logic) – 6th–8th centuries. Indian logic reached its greatest development in the late

second and third periods, and the most outstanding personalities of this time were Dignāga and Dharmakīrti. A complete and in-depth analysis of Indian logic, at least within the framework of this work, is an impossible task due to the volume of the relevant literature and the need to know the original language in which these and other Indian authors wrote (Sanskrit). Therefore, in the context of the problem posed in this article, namely the search for the ontological foundations of the style of thinking that we understand as scientific, we will turn to some experts in Indian logic. Thus, Vincent Eltschinger points out: “Like that of Dignāga, Dharmakīrti’s theory is nominalist in the sense that only self-identical and mutually distinct individuals exist. But unlike that of Dignāga, Dharmakīrti’s theory provides a causal account of how ultimately erroneous conceptual schemes are linked to the existing world. In other words, Dharmakīrti devised a theory aimed at bridging the gap between a conceptual scheme and the world without being in any way committed to real universals. ... §5b. According to Dharmakīrti, ultimate reality is reducible to non-interpreted particulars (svalakṣaṇa). These particulars are momentary (kṣaṇika, see §12b) and owe their transient existence to causal complexes (hetusāmagrī) that entail no relations at all, the mere co-presence of the different factors being enough to account for the rise of an effect” (Eltchinger, 2010: 402). And further, he continues: “§7. The general framework of Dharmakīrti’s epistemology is formed by this theory of *apoha* and its account of the Buddhist two truths. This can be seen in the following excerpt (PV 3.1 ac¹ and 2–3): “The means of valid cognition are [only] two [in number, viz. perception and inference], because the [kinds of] objects are [only] two [in number, and this for the following four reasons: first,] because [objects can be either] capable or incapable of causal efficacy; [second,] because [objects can be either] common [to many] or [absolutely] singular; [third,] because [objects can be] referred to by words or not; [fourth,] because the cognition [we have of them] occurs or does not occur when [causal] factors other [than themselves] are present. In the [present system], that which is capable of causal efficacy, [singular, not the object of words and whose cognition does not occur when it itself is lacking] is ultimately real; [as for] the other, [we] declare [it] to be [only] conventionally real. These are [respectively] the particular and the universal.” To wit: perception (see §9) alone provides reliable and vivid cognitions regarding individuals, i.e., self-identical and ineffable real entities endowed with functionalities; inference (see §10) is a reliable source of information concerning universals, i.e., pseudo-entities that are causally inefficacious, (apparently) shared by others and verbally expressible. But as Dharmakīrti insists, although these two reliable sources of information may well display two different intentional objects (ālambanaviṣaya), still they bear only upon the real entity (vastuviṣaya) that is their “functional object” (vyāpāraviṣaya), inasmuch as only the real entity is capable of performing a function and hence is of interest to human beings (see §6)” (Eltchinger, 2010: 406).

In turn, Shcherbatskoy F.I. asserts that “Dharmakīrti (NB, 12.13 and NBT, 12.14-15) argues that the senses apprehend the *individual* essence of an object, while thought apprehends the *universal essence*. The individual essence of an object is that which belongs to it alone (sva) and does not belong to *any other* (asādhāraṇa). This is the *true essence* (paramārthasat) of the object, *not imaginary* (anāropita), *not artificial* (akṛtrima) (NBT. 13. 11).

The general essence of an object, which does not belong to that object in particular but to many objects in common, is opposed to it (sādhāranarh rūpam) (NBT, 14. 8). This general essence of the object is not true, but its *imaginary* (samāropyamāna) (NBT, 14. 6 and 14. 9) essence. As a general and imaginary entity, an object can be known in a clear and distinct representation (avaśīyamāno hy arthaḥ), because in this form it is known through

the abstract cognition of thought (vikalpavijñāna) (NBT. 14. 5). The general essence of an object, therefore, is known by thinking, not by the senses” (Shcherbatskoy, 1995: 149). And further: “The general essence of an object is not its true, not its *actual* (arthakriyākāri) form because it is created by thought through the synthesis of individual moments. Through the realization of indivisibility in the chain of moments or through the imaginary unity between successive moments, the imaginary general form of the object is created (see NBTT, 35. 12). Consciousness thus creates a lasting object (sthitam artham santānarūpeṇa niṣcinoti, NBTT, 35. 16) by synthesizing moments. Thinking, which cognizes the general essence of an object, i.e., cognizes it in representation, also has its immediate and final object. But their order is the opposite of that which characterizes sensory perception: it goes from the general to the particular. The immediate object of all thinking is general representation. But since its *function* (pravṛtti, vyapārā, NBT. 12. 21) consists in the attribution of a general representation to a singular object, then the final result of the thinking process, as understood by Dharmattara, will always be the assimilation in consciousness of the imaginary, i.e., a non-real general representation constructed by the imagination, as one that possesses its singular essence (svalakṣaṇatvena). Thus, the *unreal object* (anarthah), i.e., the representation, which is the immediate *object* of thought, is *cognized* by us *as real* (arthādhyavasāyena). This is the order of action (pravṛtti) of thought” (Shcherbatskoy, 1995: 152).

Of course, we can get more opinions from experts. However, the above quotations already make it clear that the specificity of Indian logic, in its most developed forms, lies in the fact that it denies the objective existence of the universal as an ontological foundation. According to the above quotations, only the particular and even the individual, has true existence, true being, while the universal is a logical construct that has no ontological significance. From this point of view, Indian logic is a logic of the particular. Therefore, we can formulate the hypothesis that the recognition of the objective existence of the general, universal, and abstract is a characteristic feature of the scientific way of thinking. The appearance of this style of thought, together with specific, rigorous, and systematic knowledge, means the emergence of science as such. We can test this hypothesis on cosmological knowledge.

2. Astronomical texts of ancient Mesopotamia

The substantive origins of astronomy, and on its basis, cosmology as a science, lie in the culture of ancient Mesopotamia. Bartel L. van der Waerden’s work “Awakening Science II. The Birth of astronomy” is considered a classic analysis of astronomical knowledge in ancient Mesopotamia. The oldest texts we have come down to with astronomical and astrological content date back to the Old Babylonian period (23rd – 17th centuries BC). The beginnings of scientific astronomy, as a systematic description of the Universe, probably date back to the second half of the second millennium BC. Van der Waerden associates its appearance with three texts written in the Akkadian-Sumerian dialect:

1. The Hilprecht HS 229 text from Nippur.
2. Star lists from Elam, Akkad, and Amurru.
3. So-called “astrolabes” are lists of 36 “stars” associated with the 12 months of the year (Van der Waerden, 1974).

The original Assyrian title of the text is “Three Stars Each.” More information about these texts can be found in the above-mentioned work by van der Waerden. The third text is the most important from the perspective of the topic being discussed, as it is the latest and therefore demonstrates the level of generalization of astronomical knowledge of this culture. In modern terminology, this text is an incomplete list of planets and a star catalogue with the

distribution of stars, grouped into constellations, by sections of the sky. Objects of the sky (stars, groups of stars, and planets) were divided into three groups: objects of Ea, objects of Anu, and objects of Enlil. Objects of Anu were selected from areas adjacent to the equator, objects of Ea from areas south of the equator, and objects of Enlil from areas north of it. The text also contains comments on the relative position of these objects, their sunrises and sunsets, and their significance for agriculture and mythology.

The development of the “star” catalogue “Astrolabe” (also known as “Three Stars in Each”) took place in the catalogue “MUL.APIN,” which means “Star/The Plough.” It is a three-tablet catalogue, one of which is still missing. The contents of this catalogue can be considered a comprehensive collection of astronomical knowledge from this culture. There are seven copies of this catalogue, the oldest of which is dated to around 687 BC. However, we can assume that this copy is a later copy of earlier originals, so it is likely that this text represents the full extent of astronomical knowledge at the beginning of the first millennium BC. The catalogue “MUL.APIN” is based on the catalogue “Astrolabe,” but it also differs from it in that “... the rigid scheme of “twelve times three stars” is replaced by two separate lists: on the one hand, a list of the stars of Enlil, Anu, and Ea; on the other hand, a list of heliacal risings” (Van der Waerden, 1974: 71). There are many analytical works on the content of this text, including the work by Van der Waerden. The translation of “MUL.APIN” can also be found in (Hunger & Steele, 2019; Schaefer, 2006; Watson & Horowitz, 2011), other original texts are presented here, for example (Simpson, 2009).

In the context of the question at hand, the important thing is not what is in MUL.APIN, but what is not. MUL.APIN is a catalogue of stars and planets, but it does not provide a picture of the Universe as a whole. Indirectly, including by relying on the text of Hilprecht HS 229 from Nippur, we can judge that the Babylonian astronomers used a “spherical coordinate system.” However, they could not or did not want to explicitly formulate the concept of a spherical universe, and therefore of a spherical Earth, from which observations are made. “Spherical coordinates” were used by them as a mathematical technique. The spherical universe model, which was first known to European science from antiquity until the time of Copernicus, was explicitly formed only within the Pythagorean school, possibly under the guidance of the school’s own teacher: “[Pythagoras] is said to have been the first to call the heaven “the cosmos” and to have said that the earth is spherical” (Diogenes Laërtius 2018: 48–49). It is likely that this Pythagorean model was a summary of the knowledge presented in the MUL.APIN. At least, Greek astronomers were somewhat familiar with the content of Mesopotamian astronomical texts. Evidence of this is the significant coincidence in the names and locations of the Babylonian and Greek constellations. Depending on the interpretation of the translation, out of the 48 classical constellations (from the catalogue of Ptolemy’s “Almagest”), known to the Greeks, up to 30 were borrowed from the East (Thompson, 2010).

The culture of ancient Greece, like the Pythagorean theorem and mathematics in general, was able to abstract and generalize astronomical knowledge. The ability to abstract and generalize has been essential for the advancement of science. In this system, the idea of the sphericity of the cosmos (cosmos is a term also introduced by the Pythagorean school, denoting an ordered, harmonized space) occupies a special place. A sphere is an absolutely symmetrical geometric figure; in a certain sense, it is the geometric embodiment of the idea of symmetry. From Pythagorean cosmology to Copernican cosmology, the Universe was identified in its geometric embodiment with a sphere, and all astronomical objects had a spherical shape. With the discovery of Kepler’s laws, other conic sections were included

in the considerations of astronomical science. However, spherical symmetry served as the fundamental framework for understanding both individual astronomical objects and the cosmos as a whole. This emphasis remained dominant until the 21st century, when certain empirical data, such as observations of the large-scale cosmic microwave background, spurred the development of alternative cosmological models with non-spherical topologies. Among these, toroidal-shaped universes have received particular attention (see, e.g., Aurich R. et al., 2021). Thus, the idea of the sphericity of the world and world objects arose in ancient Greece as a generalization of astronomical data from the cultures of ancient Mesopotamia. This idea was one of the main scientific ideas for understanding the world from the pre-scientific stage of knowledge to the present day. Only recently has scientific thought gone beyond it.

Scientific cosmology is an indispensable part of the scientific method, and cosmological knowledge only earns scientific standing when it conforms to the established methods, approaches, and principles applied to the study of the Universe as a whole. Yet, it is crucial to investigate the underlying logic and ontology of scientific thinking in order to understand how cosmological knowledge transitions from non-scientific to scientific.

3. Ontology of Plato and Aristotle. Aristotle's logic

In all cultures of the ancient world, except for the Indian and Greek, logic as a system of thinking methods was not formulated explicitly. However, the absence of generalizations, whether in relation to the Pythagorean theorem or to the entire system of geometry, or to the world (Universe) as a whole, suggests that the basis of theoretical cognitive activity in non-Greek cultures of the ancient world was the logic of the particular, not the logic of the general. Generality was also likely seen in these cultures as subjective constructs that do not have ontological status and therefore do not attract the attention of researchers. Properly speaking, such an ontological position is based primarily on common sense, it is inherent in everyday thinking, and provides practical activity in everyday life, which is the guarantee of the existence of man and society.

Greek culture and the Greek style of thinking are unique in this sense. A full analysis of them goes far beyond the scope of this work. The question of the genesis of this specificity remains open and requires further serious and in-depth research. In the context of this work, it is possible to focus on two representatives of Greek classical philosophy: Plato and Aristotle. Their contribution to the emergence and development of science and scientific thinking cannot be overstated, with Aristotle often revered as the “father of science.” Together, these philosophers established a crucial path for developing a distinct mode of thought. While both Plato and Aristotle believed in universals as expressed in general concepts, they differed in their understanding of their existence. Plato envisioned a realm of perfect, unchanging Forms that existed independently of the physical world. These Forms act as blueprints for things, imbuing them with their essential nature. A table is a table because it participates in the Form of Table. Plato believed that the human soul, or psyche, had pre-existing knowledge of these Forms. After death, the soul briefly returns to the realm of Forms, and reacquires this knowledge before being reincarnated into a new body. However, the primary form of existence for these Forms remains their independent reality beyond the sphere of the fixed stars, where they exist eternally and unchangingly. Aristotle disagrees with Plato's Theory of Forms. By engaging in a critical dialogue with Plato's concept, Aristotle reinterprets it and builds upon it, presenting his own nuanced version. He expounds this idea most comprehensively in “*Metaphysics*” (Aristotle, 2009), with elements also explored in “*Physics*” (Aristotle, 1991) and “*On the Heavens*” (Aristotle, 1922).

Just like Plato, Aristotle holds that universals objectively exist in the form of general, universal concepts. However, unlike Plato, these universals do not exist in and of themselves, in a “separate place” (beyond the sphere of the fixed stars). Their primary form of existence is concrete, individual things that we perceive through our senses. It is the presence of these concepts as an objective given in things that makes these things the things that they are. For Aristotle, the fundamental reality consists of individual objects, which he calls “primary substances” or simply “substances.” These exist independently of our minds and are distinct from general concepts, which he refers to as “secondary substances.” Each primary substance is composed of two essential aspects: matter, the material it is made of, and form, the unique essence that defines its type and properties. Take, for example, a specific, ordinary wooden pencil. By examining it, we can see that its physical composition consists of wood and graphite, while its shape and design conform to the conceptual definition of a “pencil,” which includes all the characteristic features and functions associated with pencils in general.

Aristotle’s approach offers powerful opportunities for understanding the world, particularly in the realm of scientific knowledge. It emphasizes the essential link between theoretical and empirical knowledge, laying the foundation for scientific advancements by establishing a rigorous method for developing theoretical knowledge through formal logic. The deductive method is a key element of this logic. It is the main method of scientific theoretical cognition and is one of the main factors in the heuristic potential of science. The emergence of the deductive method and its use marked the beginning of science in the modern sense. The Greeks’ pioneering of science in the Ancient World was fundamentally enabled by the presence of such a systematic method of inquiry. This method, lacking in other cultures, limited their ability to achieve comparable levels of scientific generalization.

To illustrate this thought, let us analyse the following example: let us imagine that there is an alive and cheerful Socrates in front of us. Our task is to prove that he will die sooner or later and that he is mortal. It can be done empirically, and it means killing Socrates. However, it is immoral and criminal. It is also possible to watch Socrates for many years and decades until he dies a natural death, but this method is too long. Therefore, the best option is to prove it theoretically. This can be done quickly and without causing any harm to Socrates. Based on the above, it can be assumed that in the context of the culture of ancient China, evidence would sound as follows:

The Emperor, Son of Heaven, King Hui of Zhou, is mortal because he’s already died.

Socrates is the son of the stonecutter.

If the “Son of Heaven” dies, then the stonecutter’s son will also die.

That means Socrates will die.

This is the classical analogy where the particular properties (Socrates’ mortality) are inferred from the particular properties (the mortality of King Hui of Zhou). Similarly, we can talk about logical proof within the framework of Indian logic. For lack of space in this work, we did not consider the structure of logical syllogisms in Indian logic. Here, we only note that, unlike Aristotelian syllogisms, the Indian syllogism has a five-member rather than three-member form. In application to this example, it will be as follows:

Thesis: Socrates is mortal.

Premise: Because he is a human being.

Example: All human beings are mortal, as is Vardhamana Mahavira.

Application: Socrates is a human being.

Conclusion: Therefore, Socrates is mortal.

It is important to note that the conclusion, like the thesis, in Indian logic is of a particular nature, i.e., it refers to a specific case in which Socrates is one of the people, whereas in Aristotelian formal logic it is of a general nature but refers to a set that consists of one element – Socrates himself.

And finally, Aristotle constructs the following syllogism:

All men are mortal.

Socrates is a man.

Therefore, Socrates is mortal.

At least for people who are familiar with Western culture, Aristotle's method of proof is often seen as the most convincing. This is because it is a classic deductive argument in the form of a syllogism, where all the premises and the conclusion are general statements. Given the specific relevance of the premise to the topic at hand and the fact that the conclusion's truth depends entirely on the premises being true, it becomes crucial to question the justification for the truth of the major premise. The statement that "All people are mortal" cannot be empirically justified because it applies to all people, including those who are dead, alive, and yet to be born. The truth of the statement "All people are mortal" can be questioned. It is at least impossible to prove it with certainty, and therefore the conclusion that "Socrates is mortal" may also be questionable. However, Aristotle's ontological approach provides a solution. If the concept of "human" exists objectively as a real thing, then it includes the property of being mortal. The major premise of the syllogism simply identifies this property as an objective reality. Immortals are not human, and since Socrates is human, he must be mortal.

The given example illustrates the heuristic nature of Aristotle's concept of the objective existence of general, universal concepts and the effectiveness of their use as the basis of scientific thinking. General concepts are used to form statements that link general concepts. These statements are themselves general (affirmative or negative), because the logical subjects in these statements are general, universal, and comprehensive. These statements represent the formulation of general laws (in particular, laws of nature), which is the central objective of scientific exploration. In addition, the presence of general statements allows the use of the deductive method. It is all this that is a specific and unique achievement of the culture of ancient Greece. The genesis of these achievements was a rather complex and lengthy process, the study of which is very interesting, and which culminated in the formulation of general provisions of formal logic by Aristotle. In all other cultures of the Ancient World, such as ancient China, ancient India, ancient Mesopotamia, ancient Egypt, and others, this process did not occur. Given that there are many such cultures, and ancient Greece is only one, we can infer that the logic of the particular, which is characteristic of all other cultures, is a more natural way of thinking than the Aristotelian logic of the general, which is the logic of the scientific way of thinking. The logic of the particular is based on everyday experience and common sense, which tell us that any generalization is always incomplete. There are always exceptions to any generalization, and therefore general statements about large and infinite sets are meaningless because they are always false. We can only make statements about the world in the form of particular judgements. It is possible that the rejection of general judgments in all other ancient cultures, because they were seen as false and meaningless, and the focus on only particular judgements, prevented these cultures from developing the foundations of scientific thinking and thus science itself. The Greeks' unique recognition of the potential for truth in general statements and their subsequent integration into their culture set them apart as pioneers of scientific thought and laid the groundwork for the development of science itself.

4. The existence of the universal through the categories of space and time

The acceptance of this hypothesis raises a natural and fundamental question: how does science work from the perspective of its ontology? This question is prompted by a number of factors. First, common sense about everyday reality has not been disproven. In fact, any generalization is always incomplete, and there are always exceptions to any generalization. Our everyday empirical experience tells us this. From our vantage point in the early 21st century, it's clear that the arguments for the existence of universal concepts put forth by Plato and Aristotle don't remain persuasive anymore. The idea of a separate Platonic world of Forms, sitting beyond the "sphere of fixed stars" as a distinct region, falls apart. This is because the very notion of such a celestial boundary between the physical world we perceive through our senses and the "realm of contemplation" is outdated and inaccurate. Already Aristotle challenged the existence of the world of Forms. You can find his arguments in his "Metaphysics." Aristotle criticized Plato's theory of Forms by developing his own doctrine of matter and form. In this doctrine, general concepts (forms) exist as objective reality. However, today we understand that the nature of concepts is different. They do not exist in things, but in our consciousness. They are generated by consciousness and change with it. Their bearer is not an object but a subject, and they cannot exist outside the subject's consciousness. They are elements of our thinking first and foremost, and they exist as such elements. But in this case, the logic of the general is impossible. Every subject and their consciousness are private, and we return to simple common sense and its logic of the private, within which science is impossible. It is undeniable that science is the most powerful and fundamental force driving the development and structure of modern society. Then effectively utilising it as a tool for solving social problems requires a solid ontological foundation for the existence of general concepts. From the time of Aristotle to the end of the 19th century, during the period of the formation and development of classical science, Aristotle's ontology served as an implicit justification, albeit in a heavily modified and transformed form.

However, science underwent significant transformations in the 20th century. In light of these changes, we can say that the ontological foundations of scientific thought, such as the doctrine of substance and the objective existence of general concepts, no longer work in modern science. Different hypotheses can be put forward about the form in which general concepts exist as objective reality. One of such hypotheses could be the following: general concepts exist objectively as a property of the homogeneity and isotropy of space and time in a broad sense, as a set of objects of one nature. When we talk about geometric space, we are talking about a continuous set of points. When we talk about physical space, we are talking about a set of physical objects. In addition to these, we can talk about social (a set of people in a social sense), cultural (a set of cultural objects and carriers of their meanings), biological (a set of biota), phase sets in physics and mathematics (a set of states of objects), and other spaces. Objects grouped in these spaces have both common and private properties, and common properties or their combinations can be called the properties of homogeneity and isotropy of these spaces. Of course, these spaces are abstract and ideal. We create them to organize and systematize our perception of reality. However, even abstract objects can be either homogeneous and isotropic or heterogeneous and anisotropic. By identifying general concepts with the properties of homogeneity and isotropy of the spaces they belong to, we resolve the difficult problem of how these concepts exist objectively. Homogeneity and isotropy are not absolute properties. They are conventions that depend on

the measure, the semantics of the problem, and the number or scale. The same system can be both homogeneous and heterogeneous, depending on the semantics or measure (scale). For example, the Universe, or the cosmos, is heterogeneous on scales from the Solar System to galaxy clusters. On scales of several billion light-years, it is homogeneous. However, according to the multiverse theory (Deutsch, 1998), on scales much larger than the size of our “bubble,” our world is significantly heterogeneous. The properties of homogeneity and isotropy are also manifestations of symmetry. Our consciousness perceives symmetry as a measure of the orderliness of space as a set. In this sense, symmetry acts as an ontological category.

To put it simply, the measure or scale of any space as a set is defined by the knowing subject himself, depending on the tasks he is trying to solve and the data he has available. For example, to solve one problem, we might assume that “All people are equal” (social space is homogeneous). This assumption could be a useful starting point for solving a certain problem. In another case, when solving a different problem with different empirical data, we can assert that “All people are different” (social space is heterogeneous). This assertion can serve as the basis for solving a specific problem. In other words, homogeneity and isotropy are not universal properties of objective reality in any space. They are tools that are attached to humans and simplify the solution of problems that arise before humans and society. Accordingly, general concepts and general statements, from which they are built, are also such tools. If existing general concepts and existing general statements are not enough to solve a scientific problem, then we have encountered a non-uniformity of space, a violation of symmetry. So, we need to change the semantics of general concepts, introduce new, more general ones, i.e., move to other “scales,” or, in other words, search for a new symmetry. This is approximately how, according to A. Einstein, science develops: “Science concerns the totality of the primary concepts, i.e., concepts directly connected with sense experiences, and theorems connecting them. In its first stage of development, science does not contain anything else. Our everyday thinking is satisfied on the whole with this level. Such a state of affairs cannot, however, satisfy a spirit which is really scientifically minded; because, the totality of concepts and relations obtained in this manner is utterly lacking in logical unity. In order to supplement this deficiency, one invents a system poorer in concepts and relations, a system retaining the primary concepts and relations of the first layer as logically derived concepts and relations. This new secondary system pays for its higher logical unity by having, as its own elementary concepts (concepts of the second layer), only those which are no longer directly connected with complexes of sense experiences. Further striving for logical unity brings us to a tertiary system, still poorer in concepts and relations, for the deduction of the concepts and relations of the secondary (and so indirectly of the primary) layer. Thus, the story goes on until we have arrived at a system of the greatest conceivable unity, and of the greatest poverty of concepts of the logical foundations, which are still compatible with the observation made by our senses” (Einstein, 1936: 352-353).

While we can theoretically assume any space to be non-uniform and direction-dependent, for some situations, it’s helpful to simplify things by assuming homogeneity and isotropy. This makes it much easier to understand and analyse. However, it’s crucial to remember that all space, by its very nature, exists in multiple dimensions. In a broad sense, the dimension of a space can be understood as some parameters or characteristics of an object, independent or dependent on each other. In a geometric or physical space, these are coordinates; in a phase space, they are state parameters; in a social space, they are characteristics of people and social groups; in a biological space, they are characteristics of biological systems,

etc. Objects of reality have many characteristics. This multiplicity allows us to vary these characteristics, constructing corresponding spaces for a certain quantity. These spaces can be truly homogeneous or quasi-homogeneous, and isotropic or quasi-isotropic. This allows us to formulate general, universal laws.

Conclusions

In conclusion, I would like to say a few words about the homogeneity and isotropy of time. In general, we can understand time as an ordered sequence of events that occur in the corresponding spaces. Physical time is a sequence of physical events; social time is a sequence of social events; and so on. Unlike space, time is one-dimensional. Time progresses one-way, from past to future, and this movement cannot be reversed. The past and future are always distinct and unchanging. The irreversibility of time is fundamental. For closed systems, irreversibility is determined by the growth of entropy, i.e., the second law of thermodynamics. For open systems, it is determined by the process of energy dissipation, i.e., the use of energy to maintain and develop the complex organization of the system, which is also irreversible. Thus, time is always anisotropic. Due to the one-dimensional nature of time, unlike space, we have fewer opportunities to vary and construct systems with homogeneous time. The only parameter that allows us to do this is quantitative measurement, i.e., scale. On a certain time scale, for any system, we can neglect the property of anisotropy. This means that this system does not actually change over these time scales. If we also select for it a corresponding homogeneous and isotropic space, then we can speak of the objective existence of general and universal concepts and the laws constructed from them. However, these patterns will only work in certain time scales and certain spaces. Outside of these limits, they will be unproductive. The constructions of space and time scales, in turn, are tied to the subject or to the social group. They change as the subject or social group interacts with reality, when new problems and tasks of this interaction arise. The process of constructing subject spaces and time scales is a dynamic process, and it is this dynamic that can serve as the ontological basis of the modern scientific way of thinking, giving it the features and qualities described in the concept of fallibilism.

Projecting all of the above in terms of scientific cosmology, we can say that the principle of homogeneity is what gives cosmological knowledge its scientific nature and develops it as scientific knowledge. By introducing the world as a spatially homogeneous and isotropic geometric sphere, the scientific foundations for understanding the world as a whole were laid. In ancient scientific cosmology, the spherical Universe of Plato and Aristotle was unchanging over time; that is, it was homogeneous in the temporal dimension. In the cosmology of the modern era, with the rejection of the spherical universe model, the principles of spatial homogeneity and isotropy were preserved. It was also unchanging, i.e., homogeneous in time. The emergence of relativistic cosmology disrupts this trend with respect to time, overcoming the inertia of thought (a well-known fact about “Einstein’s biggest blunder” in the form of the introduction of the λ term to preserve the stationarity of the Universe). However, this trend persists in relation to space. The principle of spatial homogeneity and isotropy is the main methodological principle of relativistic cosmology. In the subsequent development of scientific cosmological knowledge, limitingly large scales of geometric space are violated in the concept of the quantum birth of the Universe and in the theory of the multiverse. Partial anisotropy is assumed in the above-mentioned model of the toroidal Universe. All these assumptions and suppositions are quite logical. The “narrowing” and “changes” of the scales of spatial and temporal homogeneity give rise to new scientific general concepts

describing the Universe and our world, and together with them, new models and new scientific knowledge about it.

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Section Two

NATURE AND CIVILIZATION

The Postmodern Paradigm: Shaping the Philosophy for the Future Landscape of Public Administration

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This article delves into the profound impact of postmodernism on the trajectory and evolution of future public administration. The 20th century witnessed radical changes in worldview, marking the transition from modernity to postmodernity. The basic principles of postmodernism, encompassing deconstruction, fragmentation, future shock, and cultural relativism, have instigated a paradigm shift challenging traditional administrative frameworks (M. Foucault, J.-F. Lyotard, A. Toffler, etc.). The article explores how these postmodern tenets influence administrative practices, power structures, and the very nature of governance. Postmodernity is characterized by a unique attitude towards truth, acknowledging its relativity, and by decentration, the absence of a single center, replaced by multipolarity and globalization. "Post-truth" replaces truth, posing new challenges to the future of public administration. The public administration of the future will be shaped by existing trends, including Public-Private Partnerships (PPP), Non-Governmental Organizations (NGOs), Corporate Social Responsibility (CSR), etc. It will also depend on modern technologies such as artificial intelligence, blockchain, data analysis, and data-driven decision-making, as underscored by the need for digitalization in response to the pandemic (according to EIB). However, alongside advantages, there are also challenges, such as issues of liability in the use of AI for future public administration. These risks can be mitigated through collaborative and participatory governance models, adaptive leadership, an emphasis on inclusivity, diversity, and social equity, addressing environmental concerns, advanced training courses, and other strategic measures.

Keywords: Philosophy, Postmodernism, Public Administration, Future Governance, Technological Impact.

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Introduction

The relevance of the article lies in the fact that extremely dynamic and unstable modernity, we are talking about socio-political, cultural, social and other aspects of human existence, is faced with a rapidly approaching future. Phenomena such as accelerating change, culture shock, paradigm shift, fundamental change, post-industrial society, psychosocial crisis and others, largely determine modern society and the society of tomorrow. "Previously, men studied the past to shed light on the present. I have turned the time-mirror around, convinced that a coherent image of the future can also shower us with valuable insights into today. We shall find it increasingly difficult to understand our personal and public problems without making use of the future as an intellectual tool" (Toffler, 2022). *Future Shock* (1970) stands as a seminal work by the American futurist Alvin Toffler, delving into the profound effects of rapid technological and cultural changes on both individuals and societies. Coined by Toffler himself, the term "future shock" aptly describes the disorientation and stress experienced by individuals as they grapple to keep pace with the swift changes in their environment. In this book, Toffler extensively explores the escalating speed of technological advancements and the consequential challenges it imposes on individuals and societies alike. A key aspect of his discussion revolves around the overwhelming impact of information overload, a concept remarkably prescient in anticipating the struggles associated with coping with copious information in the digital age. A significant thematic focus of the work is the imperative for individuals and societies to adapt to the evolving cultural norms and values accompanying these rapid changes. Mentioned book underscores the need for proactive adaptation as an essential strategy to navigate the complexities arising from swift technological and cultural transformations.

The research methodology is intricately linked to the subject matter, with a specific focus on multidisciplinary and qualitative research. The selected methods are tailored to capture the intricate and nuanced interactions between postmodernism and public administration. One

of the pivotal methodologies employed is a critical literary method, facilitating the in-depth analysis of main ideas across a diverse spectrum of literature. Additionally, content analysis and case studies are integral components of the research approach. A key facet of the methodology involves conducting a comparative analysis between public administrations that have embraced postmodern principles and those adhering to more traditional models. This comparative approach extends to evaluating key performance indicators, innovation outcomes, and stakeholder satisfaction. The aim is to discern potential advantages or disadvantages associated with the adoption of postmodern approaches in the realm of public administration. By employing these methods, the research endeavors to provide a comprehensive understanding of the complex dynamics between postmodernism and public administration.

Postmodern paradigms: navigating the transformative currents in public administration

Postmodernism, as a philosophical and cultural movement, has exerted a profound influence on various fields, and public administration is no exception. This article explores the transformative role of postmodernism in reshaping both the theoretical underpinnings and practical applications of public administration, challenging traditional paradigms and fostering new approaches to governance. Postmodernism emerged as a reaction to the modernist ideals that dominated the early to mid-20th century. Modernism emphasized objective truths, grand narratives, and a belief in progress through rationality. In contrast, postmodernism questions these certainties, advocating for a more nuanced understanding of truth and a recognition of diverse perspectives. According to Jay D. White and Guy B. Adams: “Modernity has had the effect of narrowing the concept of reason to the point of rendering it inadequate to the needs of research and theory. Postmodernity, at least in its starker versions, threatens to discard reason altogether. We want to argue here that a more broadly construed concept of reason – one consonant with its understanding through most of human history – can still serve as a foundation for research and theory in public administration” (White & Adams, 1995: 1). In public administration, this has led to a reevaluation of foundational concepts. The future of public administration is likely to be shaped by various dynamic factors, reflecting the evolving needs of societies, technological advancements, and changing governance paradigms. While predicting the future with certainty is challenging, several trends and possibilities can be identified.

Postmodernism emerged as a replacement for modernism, questioning its belief in the absolute authority of reason. The profound impact of devastating world wars revealed the shortcomings of unquestioning reliance on human reason. The conviction in progress and the omnipotence of reason played a substantial role in shaping the field of public administration. However, a purely rational approach to understanding the complexities of the human condition proved inadequate. As a result, philosophers, political scientists, economists, cultural experts, and public administrators have intensified their examination of emerging phenomena, seeking to offer forward-looking assessments. Jean-François Lyotard, a prominent postmodern philosopher, introduced the concept of “metanarratives” in his influential work *The Postmodern Condition: A Report on Knowledge* (1979). Metanarratives, also known as grand or master narratives, are overarching, comprehensive stories or theories that attempt to explain the historical development, purpose, and direction of societies. He was critical of these metanarratives, arguing that they no longer effectively legitimized knowledge in the postmodern era. According to philosopher, traditional metanarratives, such as those provided by religion, philosophy, or science, had lost their credibility and explanatory power. He contended that in a diverse and pluralistic world, no single narrative could claim universality or provide a comprehensive explanation for all

aspects of human experience. French philosopher identified the decline of grand narratives as a characteristic feature of the postmodern condition. He argued that skepticism toward overarching explanations emerged due to the increasing awareness of cultural, social, and linguistic diversity. In a postmodern society, people became more attuned to the existence of multiple, often conflicting, narratives. "Our working hypothesis is that the status of knowledge is altered as societies enter what is known as the postindustrial age and cultures enter what is known as the postmodern age" (Lyotard, 1984: 3). Later he adds: "Transformation in the nature of knowledge, then, could well have repercussions on the existing public powers, forcing them to reconsider their relations (both *de jure* and *de facto*) with the large corporations and, more generally, with civil society (Lyotard, 1984: 6). Traditional notions of bureaucracy, with their hierarchical structures and rigid procedures, have been reconsidered in light of postmodern thought. Postmodernism challenges the idea of a universal, one-size-fits-all administrative model, acknowledging the importance of context-specific approaches and cultural diversity. The shift is towards embracing complexity, acknowledging multiple truths, and recognizing the limitations of grand narratives in understanding the intricacies of governance.

Postmodernism's impact on public administration extends beyond theoretical discussions to tangible changes in administrative practices. Administrative processes are no longer viewed as linear and predictable; instead, they are seen as dynamic and context-dependent. The emphasis is on adaptive governance that responds to the complexities of a rapidly changing world. In 2016, the Oxford Dictionaries selected "post-truth" as the "Word of the Year". Post-truth is defined as a concept where objective data takes a backseat, yielding precedence to emotions and personal beliefs. This example vividly illustrates the profound transformations occurring in society and the realm of public administration. Given that public administration extends beyond academia to encompass practical dimensions, political scientists worldwide have grappled with comprehending and elucidating this emerging reality, where the concept of truth has become relative.

Hannah Arendt argues that in order to accept a new phenomenon, it is necessary to give it a term in order to understand it: understanding itself is a kind of balance of old and new, and in the example of "post-truth", in order to understand it, it is necessary to have an idea of the truth: "Understanding is unending and therefore cannot produce final results" (Arendt & Kohn, 2005: 308). Postmodernism indicates the end of modernism, and with it such ideas as "truth", "culture", "society", "state". A logical and very important question arises: how is public administration possible in "post-truth" conditions? "It is customary to attribute to postmodernism the rejection of a single objective truth in favor of a multitude of subjective and relative truths, and the argument that there is no single true scientific theory and no single meta-narrative, but rather a multitude of theories and narratives that are created from a variety of perspectives, none of which take precedence over the other" (Brahms, 2020: 11). The absence of a singular objective truth signifies the breakdown of fundamental principles and any form of centrism. How does the absence of centrism impact public administration? This phenomenon is attributed to the trends prevalent in contemporary society.

Decentrism, in the context of postmodernism, refers to a rejection of centralized or absolute perspectives. It aligns with the idea that there is no single, fixed point of view or source of authority. Instead, postmodern thinking emphasizes the multiplicity of voices, perspectives, and interpretations. The absence of a central, authoritative narrative allows for a more diverse and inclusive understanding of reality: "The chief characteristic of the new global economy is the speed at which it has reshaped international power relations to become more concentrated and focused on common development goals. Rather than promoting the concepts of

interdependence and mutuality, globalisation has constructed a ‘one-world’ model that utilises global communications to forge a single market culture” (McCann & McCloskey, 2015: 236).

In the context of globalization, the conventional polarity is dismantled; there are no longer one or two dominant centers around which ideologies and regimes emerge. The world is evolving into a multipolar structure. A significant transformation involves the shift towards decentralization and participatory decision-making. Postmodernism disrupts the traditional top-down governance approach, advocating for the incorporation of diverse voices in shaping policies. This change is noticeable in initiatives that foster community engagement, collaborative resolution of issues, and the acknowledgment of local knowledge and values. “For us here, globalization means not only the worldwide capitalist system called ‘neoliberalism,’ but also the full range of forces and factors that are sweeping across the globe totally unhindered, or barely hindered, by the boundaries and policies of the nation-state” (Dator et al., 2006: 13).

Globalization challenges the theory of public administration by extending its influence beyond traditional boundaries. In the contemporary world, advanced technologies diminish the significance of geographical space, leading to a gradual blurring of boundaries. As Michel Foucault mentioned: “A whole history remains to be written of spaces – which would at the same time be the history of powers...” (Foucault, 1980: 149). The interconnections between countries have become so substantial that it is impractical to overlook them: “To advance Public Administration theory building, we need to examine issues across national and ethnodemographic divisions in order to better understand and explain context-specific phenomena” (Hou et al., 2010).

Moreover, postmodernism has left its imprint on the discourse concerning ethics and accountability in public administration. Conventional ethical frameworks rooted in universal principles are under scrutiny, paving the way for a more relativistic understanding of ethics. The acknowledgment that ethical considerations may vary across diverse cultural contexts has prompted a reassessment of administrative practices to ensure cultural sensitivity and inclusivity. The role of language and discourse in public administration is also subject to reevaluation through a postmodern lens. The influence of language, the framing of issues, and the construction of narratives are recognized as pivotal aspects of governance. Public administrators are increasingly attentive to how language shapes perceptions and are aware of the potential for multiple interpretations.

The evolving landscape and future horizons of public administration

Postmodernism has profoundly shaped the type and style of contemporary human thinking, rooted deeply in modernity, and its influence on the future is undeniably significant. The crucial consideration lies in exploring the prognostic assessments and visions of the future that already exist and addressing how postmodernism, and perhaps post-postmodernism, has contributed to this. The preceding section of the article delved into the formation and evolution of postmodernism and its correlation with public administration. In this segment, various scenarios for the future’s development will be examined, attempting to identify the essential characteristics of these phenomena and discern traces of postmodern tendencies.

Public administration and private administration are two distinct spheres with different objectives, principles, and functions. Public administration involves managing and implementing policies, programs, and services on behalf of the government or public institutions. It focuses on serving the public interest, ensuring equity, and addressing societal needs. On the other hand, private administration pertains to the management and operations of

businesses and organizations in the private sector. The primary goal of private administration is often profit maximization and serving the interests of private stakeholders. “A better starting point for understanding the meaning of public administration is to distinguish it from private administration” (Kettl & Fessler, 2009: 140).

In the postmodern era, the distinction between public and private administration has become more complex and fluid, reflecting the broader societal shifts characteristic of this period. The boundaries between these sectors have blurred, evidenced by the rise of public-private partnerships (PPPs) and collaborations where entities from both sectors work together on various projects and initiatives. Marta Marsilio, Giulia Cappellaro and Corrado Cuccurullo in the article *The Intellectual Structure Of Research Into PPPs* (2011) detail the increased interest: “Nowadays, among scholars and practitioners of PPPs, there is an emerging awareness of the need to re-examine the different meanings and definitions given to PPPs in order to analyse the domain of PPPs and their intellectual structure...” (Marsilio et al., 2011: 764).

Collaboration, networking, and cooperation with various stakeholders, including citizens, NGOs, and businesses, have become increasingly emphasized in both public and private administrations. Postmodern principles have encouraged a departure from rigid structures, promoting flexibility and adaptability in organizational culture. Researchers agree that these modern phenomena also need definition and detailed study: “More and more, social workers, like other helping professionals, are being asked to address global issues. But social work’s contributions to international social development, policy formulation, services provision, and advocacy have not, as yet, been well defined... In general, services NGOs commonly provide health, family planning, and educational programs in situations in which the beneficiaries are expected to participate in program implementation. Participatory NGOs use community organization models, assisting local people to identify their own needs and to help with planning and implementation” (Claiborne, 2004: 207-208).

Central themes influenced by postmodernism include diversity, inclusivity, and recognition of multiple perspectives. In public administration, initiatives to involve citizens in decision-making processes align with these principles, while private administration places emphasis on workplace diversity and consumer inclusivity. Both sectors leverage technological advancements to enhance efficiency, communication, and service delivery. The adoption of digital platforms, data analytics, and innovative solutions caters to the demands of the postmodern era. Organizational cultures are shifting towards prioritizing employee well-being, work-life balance, and empowerment, moving away from traditional bureaucratic structures. Narratives and identities take center stage, manifesting as storytelling approaches in public administration communication and a focus on brand narratives and corporate identity in private administration.

Both public and private administrations recognize the importance of contributing to public value and practicing Corporate Social Responsibility (CSR). Researches discuss the complexity of defining CSR. It is considered complex due to the intricate and interconnected nature of ecological, societal, and economic systems. The challenges arise from the inherent ambiguity of the issues involved, such as determining which industry-generated harms should be addressed and whose perspectives should prevail. Benedict Sheehy in *Defining CSR: Problems and Solutions* (2014) describes this situation: “It is complex because of the nature and context of the problems. The ecology, society and the economic system are highly complex dynamic systems and CSR is intimately involved in each” (Sheehy, 2014: 625). Public administration aims to address societal challenges, while private administration aligns business strategies with social and environmental responsibilities. Postmodernism challenges hierarchical structures, leading

to flatter organizational structures, fostering collaboration, and empowering employees in both sectors. The ongoing impact of postmodern principles continues to shape the evolving nature of governance and organizational management in the public and private spheres.

Postmodern society is often perceived as a complex and multifaceted landscape characterized by both positive and negative aspects. It is neither strictly utopian nor dystopian, and the characterization of postmodern society falls within the realm of subjectivity and perspective. This prompts a natural question: is it conceivable in the future to configure public administration in a manner that aligns with utopian prospects? “The link with utopia is the mostly implicit, sometimes explicit, normative dimension of public administration. The purpose of studying and researching the scientific field of Public Administration is to improve its research object of public administration, which is the public sector and its activities for service delivery, and its policies. Public Administration is not just scientifically studying governance, public administration or public policy, it is also about trying to improve and promote “good” governance, public administration and public policy” (Bouckaert, 2020). However, at its core, postmodern society doesn’t neatly fit into a utopian or dystopian framework. It is a dynamic and evolving context with elements that can be both promising and challenging, depending on one’s perspective and values.

It is challenging to pinpoint the precise challenges that public administration will encounter in the future due to various uncertainties. However, by examining current societal trends, a scientific forecast can be formulated. While this forecast remains inherently subjective, it is substantiated by research conducted by scientists across diverse fields. To address the inquiry regarding the future prospects of public administration, an analysis of these trends is imperative.

The integration of advanced technologies, including artificial intelligence, blockchain, and data analytics, is anticipated to play a pivotal role in shaping the future of public administration. These technologies offer the potential to enhance efficiency, transparency, and decision-making processes within government institutions. Artificial intelligence can automate routine tasks and improve data analysis, while blockchain ensures secure and transparent transactions. Data analytics enables informed decision-making based on comprehensive insights. Embracing these technologies may lead to more streamlined and effective public administration systems in the future: “Digital transformation has become a prevalent feature of the twenty-first century, extending from business to all aspects of social life. Public administration has also been affected by this trend. However, no country undergoing a transition economy has been capable of matching the level of digitalization reached by developed nations” (Karpenko et al., 2023: 569). Despite the pervasive nature of this digital shift, the observation is made that countries in transition economies have not been able to achieve the same level of digitalization as developed nations. It suggests a discrepancy in the pace or extent of adopting digital technologies in public administration between developed and transitioning economies.

The COVID-19 pandemic was influenced by globalization in various ways. The interconnectedness of the globalized world facilitated the rapid spread of the virus. Increased international travel allowed the virus to cross borders swiftly, leading to its global dissemination. Global supply chains and trade connections played a role in transmitting the virus, impacting economic activities worldwide. Additionally, the sharing of information and scientific collaboration, key aspects of globalization, contributed to both understanding the virus and developing vaccines. However, the pandemic also revealed vulnerabilities in global systems, such as unequal access to resources and healthcare, highlighting the complex relationship between globalization and global health crises. The pandemic caused a lockdown, which in turn created the conditions for the need for remote work, digitalization, and the use of modern

technologies. According to the EIB Investment Report 2021/2022: “55% of firms see a greater need for digitalisation because of the pandemic. An increasing number of firms, 45%, think that a lack of digital infrastructure in some parts of Europe is constraining investment. While EU firms have been digitalising as a response to the COVID-19 crisis, they have been less active than their US peers. 46% of EU firms have responded to the pandemic by becoming more digital, vs. 58% in the United States” (EIB Investment Report, 2021-2022).

The increasing availability of data has the potential to empower public administrators by providing them with a wealth of information to make more informed decisions. With access to comprehensive and real-time data, administrators can gain insights into various aspects of public services, policy effectiveness, and citizen needs. Data-driven decision-making enables administrators to identify trends, assess the impact of policies, and allocate resources more efficiently. Furthermore, data analytics tools can aid in predictive modeling and scenario analysis, helping administrators anticipate future challenges and plan accordingly. The use of data can enhance transparency, accountability, and evidence-based policymaking, fostering governance that is more effective. However, it is essential to consider challenges such as data privacy, security, and the need for skilled professionals to interpret and utilize the data effectively. Additionally, administrators must ensure that data-driven decision-making aligns with ethical standards and addresses potential biases in the data. Many researches have great results in this studding, they want: “to extend the theoretical/ conceptual and practical boundaries of AI research in the public sector to better governmental decision-making and governance, thus enhancing public value creation” (Vincent et al., 2022).

The integration of artificial intelligence (AI) in public administration gives rise to various philosophical quandaries, necessitating thoughtful examination. Ethical considerations are paramount, including concerns about fairness, bias, transparency, and the potential for discriminatory outcomes. Issues of accountability and responsibility come to the forefront, with challenges in identifying decision-making authority and determining liability for AI-related errors.

The challenges associated with the implementation of artificial intelligence and questions of responsibility are currently subjects of active research by scientists worldwide: “The notion of “responsibility gap” with artificial intelligence (AI) was originally introduced in the philosophical debate to indicate the concern that “learning automata” may make more difficult or impossible to attribute moral culpability to persons for untoward events. Building on literature in moral and legal philosophy, and ethics of technology, the paper proposes a broader and more comprehensive analysis of the responsibility gap” (Santoni de Sio & Mecacci, 2021: 1057).

Privacy concerns are significant as AI’s reliance on extensive data processing raises worries about privacy infringement and potential misuse, leading to increased surveillance and impacting individual privacy rights. Questions of autonomy and control emerge, requiring a delicate balance between AI autonomy and the need for human oversight in public administration decision-making.

Social impacts are a critical consideration, with the potential for job displacement due to widespread AI use and concerns about exacerbating social inequalities. Additionally, discussions on citizen participation and the challenges AI poses to traditional democratic notions become essential in the context of public administration. Existential risks are also considered, acknowledging the unpredictable nature of AI systems and the potential for unintended or catastrophic outcomes. Environmental impact becomes a growing concern due to the resource consumption associated with running AI systems, prompting discussions on sustainability and responsible technology use. Addressing these philosophical challenges requires collaborative

efforts across disciplines, involving ethicists, policymakers, technologists, and the public. This ensures that the integration of AI in public administration aligns with ethical principles, human values, and societal goals.

The future of e-government initiatives and public administration is expected to be marked by continued advancements in digital technologies. The increasing integration of artificial intelligence, data analytics, and blockchain is likely to enhance the efficiency, transparency, and accessibility of public services. E-government initiatives will likely evolve to provide more personalized and user-centric services, catering to the diverse needs of citizens. Cybersecurity measures will become even more crucial to safeguard sensitive data in the digital realm. Overall, the future holds the promise of a more technologically-driven, streamlined, and citizen-friendly approach to public administration through e-government initiatives.

The future of public administration may indeed witness a shift towards more collaborative and participatory governance models. The increasing connectivity and digitalization of societies enable greater engagement between governments and citizens. Collaborative governance involves partnerships and cooperation among various stakeholders, including government agencies, non-profit organizations, businesses, and citizens, to address complex issues collectively. According to researchers Chris Ansell and Alison Gash: “Over the last two decades, a new strategy of governing called “collaborative governance” has developed. This mode of governance brings multiple stakeholders together in common forums with public agencies to engage in consensus-oriented decision making” (Ansell & Gash, 2008: 543). Participatory governance emphasizes involving citizens directly in decision-making processes, allowing them to contribute to policy development and public initiatives. This shift towards collaboration and participation is driven by the desire for more inclusive, responsive, and accountable governance. Through digital platforms, citizens can provide feedback, participate in consultations, and co-create solutions, fostering a more democratic and transparent public administration.

The future for Adaptive Leadership as a part of public administration appears promising as organizations and governments navigate complex and rapidly changing environments. Adaptive Leadership is a leadership approach that emphasizes the ability to respond effectively to challenges, learn from experience, and lead in uncertain conditions. As the global landscape becomes more complex and interconnected, public administrators will need adaptive leadership skills to understand and respond to intricate challenges, such as economic shifts, technological advancements, and social changes. Adaptive Leadership is particularly relevant in times of change: “The public still wants an easy solution from the leader, but if she is honest and courageous, the leader will demonstrate the need for a redefinition of the problem, changed responsibilities, and possibly greater sacrifice from affected parties. This is a circumstance calling for fully adaptive leadership” (Burke, 2007: 420). Public administrators will need to lead organizational transformations, policy shifts, and innovation initiatives, requiring the ability to guide teams through uncertainty and ambiguity.

The future of public administration is anticipated to place a heightened emphasis on inclusivity, diversity, and social equity. Changing demographics, ongoing social justice movements, globalization, evolving legal and policy frameworks, and increasing citizen expectations drive this shift. In response to these dynamics, public administrators are likely to adopt more inclusive governance models that engage citizens in decision-making processes. Additionally, efforts to foster a diverse workforce, improve equitable service delivery, leverage technology for inclusivity, and enhance education and training on cultural competence will contribute to creating responsive and representative government systems. Overall, the evolving

landscape of public administration is poised to prioritize principles that address systemic inequalities and promote a more just and inclusive society.

The future of public administration is expected to witness a growing emphasis on environmental issues. With the increasing recognition of climate change, sustainability, and ecological concerns, public administrators are likely to play a pivotal role in formulating and implementing policies that address environmental challenges. This shift is driven by global initiatives, public awareness, and the need for responsible and sustainable governance: “In order to define the direct and indirect environmental aspects of public administrations, it is necessary to take into account: the different levels of administrations: local, regional, national, European; the specific thematic focus and competences – especially in the case of regional and national administrations; the structure and allocation of competences between the national, regional and local level (political framework)” (Canfora et al., 2019: 33).

Public administrators may focus on integrating environmentally friendly practices into governmental operations, developing policies to combat climate change, and fostering partnerships with various stakeholders to achieve sustainable development goals. The incorporation of green technologies, renewable energy sources, and eco-friendly practices into public administration processes is anticipated to be a key aspect of the future. Additionally, environmental justice and equitable access to resources are likely to become integral considerations in public administration, ensuring that policies and initiatives benefit all communities and promote a harmonious relationship between governance and the environment. In summary, the future of public administration is expected to be closely intertwined with proactive efforts to address and mitigate environmental issues on a local, national, and global scale.

Resilience planning is poised to be a crucial aspect of the future of public administration. In an era marked by complex challenges, including pandemics, climate change, and geopolitical uncertainties, the ability of governments to build resilience becomes paramount. Resilience planning in public administration involves anticipating, preparing for, responding to, and recovering from various shocks and stressors. Governments will increasingly invest in resilience planning to prepare for and respond to unexpected crises, including natural disasters, cyber threats, and public health emergencies. “The International Health Regulations (IHR) have been the governing framework for global health security for the past decade and are a nearly universally recognized World Health Organization (WHO) treaty, with 196 States Parties. The IHR is one of the six leadership priorities of the WHO programme of work, the purpose of which is to promote health and well-being” (Wilder-Smith & Osman, 2020). Robust contingency plans and crisis management strategies will be prioritized.

Continuous learning and professional development are indispensable elements in the realm of public administration, serving as vital contributors to the efficiency, adaptability, and endurance of government institutions. Their significance is underscored by various key aspects that highlight their role in shaping effective governance (Volkova, 2023). In the ever-changing landscape of public administration, characterized by evolving societal needs, technological advancements, and shifting governance paradigms, continuous learning is instrumental in keeping public administrators abreast of these changes. This, in turn, cultivates adaptability and proactive responses to emerging challenges. Professional development not only enhances the problem-solving skills of public administrators but also equips them with the ability to analyze complex issues, devise innovative solutions, and navigate intricate policy landscapes. This adaptability is crucial in addressing the dynamic and multifaceted nature of governance issues. Staying informed about the latest developments

in their respective fields is imperative for public administrators. Continuous learning ensures that practitioners possess up-to-date knowledge, enabling them to make informed decisions and formulate policies that align with current legal frameworks. Technological proficiency is increasingly vital in the field of public administration. Continuous learning facilitates the acquisition of necessary technological skills, enabling administrators to leverage innovations for improved service delivery, data management, and communication. Leadership roles in public administration demand a diverse skill set. Professional development programs contribute to leadership development by focusing on areas such as decision-making, strategic planning, and effective communication. Ethical considerations are integral to public administration. Continuous learning emphasizes ethical principles, fostering a strong ethical foundation for administrators, which is essential for maintaining public trust and upholding the integrity of governance. Public administrators often engage with various sectors, necessitating cross-sectoral collaboration. Continuous learning encourages an understanding of different perspectives, goals, and methodologies, fostering effective collaboration. Investing in continuous learning signals to employees that their growth and development are valued, thereby boosting morale, job satisfaction, and overall productivity within public administration agencies. Learning from global best practices and experiences is crucial for public administrators. Exposure to international perspectives fosters a broader understanding of governance challenges and solutions, contributing to improved decision-making.

Conclusions

In conclusion, this article has comprehensively explored the profound impact of postmodernism on the trajectory and future evolution of public administration. The 20th century witnessed a pivotal shift from modernity to postmodernity, marked by radical changes in worldview. The foundational principles of postmodernism, including deconstruction, fragmentation, future shock, and cultural relativism, have initiated a paradigm shift challenging established administrative frameworks, as advocated by influential figures like M. Foucault, J.-F. Lyotard, A. Toffler, among others.

The exploration within the article has elucidated how these postmodern tenets exert influence on administrative practices, power structures, and the fundamental nature of governance itself. Postmodernity, characterized by a distinctive attitude toward truth recognizing its relativity, along with the concept of decentration – replacing a single center with multipolarity and globalization – ushers in the era of “post-truth”, presenting novel challenges to the future of public administration.

Anticipating the trajectory of future public administration, the article identifies key trends such as Public-Private Partnerships (PPP), Non-Governmental Organizations (NGOs), and Corporate Social Responsibility (CSR). Additionally, the reliance on modern technologies, including artificial intelligence, blockchain, data analysis, and data-driven decision-making, becomes imperative for digitalization in response to the pandemic, as emphasized by the EIB.

However, amidst the myriad advantages, the article recognizes challenges, particularly in addressing liability issues associated with the use of AI in future public administration. To effectively navigate these challenges, the article proposes strategic measures, including the adoption of collaborative and participatory governance models, the cultivation of adaptive leadership, and a strong emphasis on inclusivity, diversity, and social equity. Addressing environmental concerns and implementing advanced training courses are crucial components of a multifaceted approach to shaping a resilient and responsive future for public administration amid dynamic societal, technological, and governance changes.

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Practical Turn in Cosmological Discourse: Ethical and Educational Interventions

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The practical turn in cosmological discourse is explicated in the contexts of actual post-secular tendencies with their searching for new worldview orientations in research practices of cosmology and self-understanding of human as active and passive actor in space explorations. The interdependence of cosmological and ethical discourse within their educational possibilities is analyzed on materials of universal and suffering ethics emphasizing of imperatives of responsibility and reverence for life. The educational potential of cosmological studies is explicated with their contribution to new planetary spiritual culture required for preventing of planetary ecological crisis. The distinction between astronomy and astrology is showed on the borders of cosmological discourse and in educational practices.

Key words: cosmology, practice, ethics, education, human, heaven, universe, Earth, ecology

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Introduction

The cosmological discourse developed since the Modernity is mostly representing as a theoretical one with hidden practical ambitions. As well scientism and non-scientism were motivated within their activities by endeavors to draw the borders between theology, philosophy and natural sciences. However, those attempts were never completely successful what might be caused by their hidden epistemic problems in cosmological studies. The interdisciplinary approach in cosmology makes it possible to gain different experiences on this field, which can be systemized only on axiomatically fundamental assumptions that require verification with every new fact received by cosmic space exploration immediately or indirectly. This is why the theory development in cosmology includes astronomy, physics and other natural sciences as well as philosophical, theological and moral elements. Their combining, embedding and dis-embedding in a corpus of cosmological theories can be contingent and the matter of conviction or belief with the same grade of probability.

These combinations within cosmological theories with different epistemic cultures begin to play a more important role in the post-secular contexts, what can be explained by the increasing instability of human being in globalized risk societies. This tendency is especially clear evident in the extremely situation of the Ukrainian war reality which might be described using complementary the ambivalent of heaven's attributive semantics: salvation and death. The practical turn in the cosmological discourse – what should be showed below – makes the cosmological studies open for discussion also in the fields of ethics, policy and education. The purpose of this article is to explicate the functional possibilities of ethical and educational components in cosmological discourse making its practical turn.

This article can be regarded as further considering of some problem lines which were analyzed in former article of the authors however opening perspective of interpenetrating of cosmological, ethical and educational semantics (Kultaieva et al., 2021). There proposed some reflections upon the possible answers to the question how the practical philosophy can be useful for building of cosmological theories in actual socio-cultural contexts. In spite of the interdisciplinary character of the cosmology it also shows the tendency of referring to Edmund Husserl's concept of regional ontologies as a jointly methodological basis of natural and humanitarian sciences which are involved in structuring of the practically oriented cosmological discourse as “pieces of those sciences” with the regional meta-concept (Husserl, 1986: 74). It makes possible to link also cosmological and ethical discourses and to show the educational, moral and cultural consequences of this linking.

Very fruitful explorations in this direction were made by Karl-Otto Apel and other representatives of the planetary and discourse ethics. It must be mentioned also the publications of Oleg Basaluk, who had systemized the philosophical cosmology in its historical dimension, including the works of West-European and Ukrainian cosmists, especially those of Henry Bergson, Dmytro Chyzhevsky, Pierre Teilhard de Chardin, Anatoliy Yermolenko, etc. Some ideas of American philosopher Edward Slowik became here a further development. His proposal of “moving to the deeper metaphysics” and searching for “the third-way spatial ontologies” emphasize the necessity to give them ontologies more practical acceptance combining holistic approach with Husserl's concept of regional ontologies (Slowik, 2017:

210-211).¹ The article proposed the rethinking of ideas of Buckminster Fuller and Teilhard Pierre de Chardin in new socio-cultural contexts.

Cosmos and human being: a holistic approach and regional ontologies

The concept of the cosmos is used in different contexts and shows flexibility in its application in theoretical and practical philosophy. Whereas the theoretical philosophy is focused generally on the cosmos as a natural or metaphysical phenomenon, the practical philosophical explorations on this field are moving from the relationship “God-Human-World” to ethical, cultural, communicative and educational aspects of this relationship. This relationship was reduced in Late Modernity to “the human place in the cosmos”² but thereafter restored in the Post-secularity.

From the standpoint of methodological holism, the human is regarded on the most abstract level of philosophical reflection represented as the unity of nature and spirit. However, Husserl’s phenomenological approach with its methodological requirement of reduction is necessary to achieving intuition for essence, presumes for the analytic aims turning to regional ontologies which have semantic connotations to cosmic space and its structures. The cosmic space and time in mathematics or astrophysics are not the same as in philosophical anthropology, science fiction, or pseudoscience, such as astrology. The general ontology of cosmology which is focused on cosmos itself is a construct based on Albert Einstein’s theory of general relativity. However, considering the same topics on a section of the cosmos and human being provokes to make their rethinking in *modus responsibility*.

Cosmos and human beings are weaved narrow in regional ontologies. The diversity of human being representations in cosmological discourse can be regarded in connection with practical acts of space exploration aboard spaceships with laboratories and technical instruments and personal. The description of the laboratory life made by Bruno Latour can be also served as a model for life-world aboard spaceships making their discoveries. It includes all the things taking place in the relative hermetic laboratories with the particular laboratory culture (Latour, 2013: 53-54). This approach to explanation of cosmic objects is connected with human present but it has validity also for the Earth. Besides these anthropological-technical implications it must be mentioned identifying of the Earth with the spaceship (Fuller, 2008: 57). The start position of this type of mega-ship is unknown; the orbit is given with the relative restricted recourses and habitants drifting in galaxy. All these facts can be considered as surviving of the well-known idea of existing predestination of Earth and human being. The idea of freedom and unlimited possibilities of human self-realization and perfectionism are therefore transferred into regional ontologies of anthropology and pedagogy.

The crossing of Earth’s and human fates opens two possibilities of reaction on these facts, namely an optimistic and realistic one. The optimistic or rather utopian position is founded on the so-called axiom of believing in non-limited human’s abilities and the progress of Earth’s

¹ In the actual cosmological discourse, which is focused on “the post-seventeenth century evolution” describing the universe structure, can be recognized except for ontology also ethics as the methodological guide discipline see: (Zaibert, 2017:46-48). On Husserl’ foundation of “regional ontologies” see: (Husserl, 1986: 28-29, 74).

² See Max Scheler (2008). *The Human Place in the Cosmos*. Evanston, Illinois: Northwestern University Press. 104 p. The first edition: 1928. More on the historical aspect of the relationship of human, God and world see: Karl Löwith (2022). *Gott, Mensch und Welt in der Metaphysik von Descartes bis zu Nietzsche*. In: *Sämtliche Schriften*. Bd. 9. Berlin-Heidelberg: J.B. Metzler. S. 1-194.

civilization. In the secular age and in the post-secularity the theory and practice of the space exploration become justification both from philosophy of cosmism and political economy of the space. The intuitions of the noosphere of Volodymyr Vernadsky and Pier Teilhard de Chardin also continue today producing the enthusiastically energy for space exploration. The political economy of space is connected with geopolitics and operates with concepts of appropriation of cosmic recourses and “colonizing our solar system, galaxy and beyond” (Vending, 2020: 5).

The practical turn in the actual cosmological discourse is a reaction on politicization of the human being and domination of economical rationality. Ecological problems, especially chaotic state of climate take an important place in the practically oriented cosmology. Human intervention into the nature order, conquering it were regarded during a long time as efficient economic and social strategies, which had a leading position during a long time in Modernity. But today they have catastrophic consequences. The topic on ecological crisis is present in all discourses connected with the perspective of mankind’s survive. The change from nature wasting to the renewable sources might be a new stage in the development of Earth’s civilization. Therefore, the analyze of communications which are devoted to ecological crisis management shows that all they have predominantly the appellative character of anti-crisis strategies. The ecology of the space waste there is always replaced on the background of ecological debates. The space contaminations caused by all the satellites on earth orbits serving for needs of postindustrial technologies are as the rule a blind spot in ecological communications. The advantages of informatics technologies including gadgets using for everyday needs have also their negative aspects, which are connected with their unknown long-term effect on space structuring and energy balance in the galaxy. The same keeps also validity for studies in cosmos with involving the artificial intelligence by searching for others celestial bodies that can probably throw off the galaxy from its ecological balance. There is taking generally no care of this argument as the warning signal³.

The other problem lays on the level of interpretation and evaluating of space discoveries. The domination of the economy rationality both in industrial and postindustrial societies has provoked last years’ increasing popularity of mysticism and pseudo-scientifically explorations in cosmology. In the contemporary cosmological discourse are most discussed the following direction of cosmos and nature mystic: mystic of world creation, mystic of cosmos, mystic of human’s vocation (Mierzwa, 2020: 269-271). The mystic of world creation generally was and stays a prerogative of theology. However, the secular versions of this mystical explanation can make a concurrence to their religious antipodes. The theory of natural origin of galaxies are operating with metaphors with hidden mysterious senses: black holes, bottom-up theories, galaxy merger, aliens etc. An assumption of extra-terrestrial civilizations, their appearances on Earth are commuting between so-called “strong science” and mystically colorized science fiction. The methodological program of the enactivism theory which is practically orientated can explain this kind of disenchanted miracle⁴. The mystic of human vocation as godlike creation has a long tradition both in theology and philosophy and belongs to so-called eternal or “open questions” arising with every new change in cultural or social life.

³ Some resolute statements of Buckminster Fuller which were made by him in the 60th are still very actually today. His advice addressed to mankind has a form of hidden imperative: “There is no energy crisis, only crisis of ignorance” and can be conquered only by accumulation of relevant knowledge (Fuller, 2008: 45-46). His own position and subjectivity are characterized by himself in the book with speaking title “I seem to be a verb”. It illustrates his self-understanding as an actor of evolutionary process and shows at the same time integral function of the universe by creating human (Fuller, 1970).

⁴ This theory deals with embodied mind which is at the same time also extended, embedded and enactive (Fingerhut & Hufendiek, 2017:17; Clark, 2015: 76).

Conceptualizing of human being within actual cosmological discourse takes into account the experience both of space explorations and cosmos immanent spirituality. In the European post-secular context arise the demand on Teilhard's cosmic Christology with its mystically attempt of "universalizing of Christ and christifying the universe" (Vallina, 2009: 2-3).⁵ As the axiom of faith there is taking an assumption that the person of Christ generates the energy for evolution therefore can be identified with the cosmo-genesis. The human ability to transcendence is explicated by mystically oriented cosmologist from extrasensory position. Theoretically this ability cannot be realized without taking into account the assumption about the sacral nature of discoveries and persons making that. This assumption is represented as an axiom in cosmological mystics, is connected with image of human god-likeness with some corresponded functions, such as creation, foreseeing, healing. However, the perspective of irreversible global ecological crisis is very probably. Its symptoms appear in different forms and regions on the planet, which also can cause a misbalance in the solar system. Bruno Latour searching for an exit of this situation examines two strategies: migration to others planets or radical changing the human relation to nature: respect instead conquest of it. Albert Schweizer's idea of reverence for life is transformed by Latour in the following question: "Do we continue nourish dream of escaping or we start seeking a territory that we and our children can inhabit?" (Latour, 2018: 5). He completes this rhetoric question also with imperative "down to Earth".⁶ This imperative means more than only changing the intentionality and, therefore, can be considered as an appeal addressed to the contra-factuality of mankind. From the methodological standpoint, the concept of mankind has a relatively wide range of meanings: reaching from the meta-subject of the Earth's civilization including its historical dimension to the anthropological foundation of inter-subjectivity in phenomenological approach.

In the cosmological discourse, this concept is generally used in opposition to extraterrestrials, which probably should be widespread among the Earth's habitants. This assumption belongs traditionally to the theological stereotype of the devil's appearance among the people. Establishing contacts with extraterrestrial civilizations can open a new perspective for the theory and praxis of communication with galaxies on the scientific basis. The mass culture with its mass-media possibilities sill overtakes scientific research producing a lot of fantastic pictures and narratives making performance of these exotic communications and other's forms for contacts with aliens. Therefore, the symbolic meaning of heaven as God's and paradise places had become from the mass-culture a negative connotation with star or sky wars and other threats for human being. The answer of philosophical cosmology on all requests of space exploration can be regarded as a contribution to arising of a new culture of spiritual life with significant moral content both in the secular and religious versions⁷. However, the projects of new spiritual culture or "new culture of the consciousness"⁸, despite of their declaration to support responsible policy of space explorations, are developed mostly in the appellative mood. The subject or agent of those desirable changes needs revision of stereotypical views on human being in relation to comic nature and concrete space objects. For that must be examined the self-consciousness of contemporary human and communities with ambitions to be God manager with unrestricted powers.

⁵ See also the original text of Teilhard de Chardin (Chardin, 2003). The review of secular versions of evolution theories see: (Bazaluk, 2018; Bazaluk, 2023).

⁶ He puts also this imperative in the title of his essay see (Latour, 2018).

⁷ More about this tendency and possible communication models between heaven and human see: (Sloterdijk, 2022).

⁸ See: (Metzinger, 2023: 160, 169).

The powers of Saints versus Self-glorifying of Human

The post-secular restoration of the power of God and Saints has nothing to do with archaic reverence for them. It deals rather with a new attempt to economize the supra-natural powers. The time of the romantic discoveries is in the past. However sometimes the ethics of utilities is hidden in appeals to universal values. The personality of the self-glorifying human became new feathers in the socio-cultural contexts of post-industrialism.

The self-glorifying of human has a long tradition in the European culture. The competition human with Gods was one of the favorite topics in ancient mythology and literature. Celestial journeys of human (Icarus) and even demigods (Phaethon) attempt to do it were finished with disaster. The Christianity seems to learn from these competitions and has respect for God apartments. The modern transfer of God's rage into field of morality gives cause for self-aggrandizement of man in the frames of Christian ethics with its universal values and reverence for heaven territory.

In the secular version of this agreement, the human became from God an unlimited potential which can be realized in the creative actions without any borders and taboos however with moral law and responsibility for the fate of mankind. The addition to human main definitions is added also "a pontifical creature" in the sense "bridge-making-Man" which had actualized the old dream of the mankind of the self-fulfillment through travelling from the Earth to extra-terrestrial spaces (Sloterdijk, 2009: 45). The widening of human being areal and increasing his power over nature should be regulated by international law, whose authors are searching for convincing ethics argumentation to be implemented in the legislative praxis.

New ethics intuitions in cosmological discourse and upholding of spirituality culture as an educational mission

The concept of spiritual culture is relatively new and connected with the concept of freedom culture. It means conditions for the free and responsible choice of the worldview principles in agreement and concordance with the choices of others which might be critically examined on coexisting potential (Metzinger, 2023:160). The old European idea of the tolerance as an universal moral principle becomes here a supplement in the form of the request for an active subjectivity. Thereupon it deals first of all with the "intellectual honesty, self-respect and dignity" as human qualities needed for coming out from the ecological crisis and returning respect for cosmic space (Metzinger, 2023: 23, 48-49)⁹. The ideas of unreligious Christianity or the "Christianity for Future" which probably can change setting of spiritual priorities and make them more altruistic and responsible for all God's creation is very popular in mainstream of cosmic-ethical discourse. Roland Mierzwa summarizes propositions for ethical innovations with practical turn: "The praxis of responsibility cannot be directed by ready-made value hierarchies. The moral culture cannot also be defined only by ethic experts" (Mierzwa, 2020: 4). The illusion of democratizing of creating moral principles through elimination from this process experts is very dangerous because the long-time decisions basing on ethical principle needs be systematically verified on validity. It applies also to the moral culture of the concrete societies. Therefore, the struggle for space recourses can provoke denying of law and order principles breaking agreements. With ethics

⁹ Sloterdijk has made an attempt to analyze in the frames of the new spiritual culture the semantics of sky and heaven with the recourse on J.W. Goethe's theory of colours. Grey, so Sloterdijk, is most suitable to serve as a background for "the existential meteorology" and "weather forecast for the soul" (Sloterdijk, 2022: 10-11).

exist the same problems because following to its principles depends of ideas that determine image of the human being. Not only the universal ethics need evaluating of its practices by experts, the same must be addressed to ecological ethics and ethical norms of human behavior strategies in the cosmic space. The universe is the living organism. Its communication with Earth habitants can be only in form of symbolic messages.¹⁰

The decoding of messages from the universe is as well theoretical and practical process. The reception of those messages can be regarded as a challenge for secular societies in which the ethics substitutes religion. The social consensus on leading moral principles is a necessary condition for the mutually and adequate reaction on information coming from cosmic space. However, the social stratification of the postindustrial societies makes additional burdens for it. Thus, the appearance of precariat, especially of its educated group, can cause irritation in the moral system basing on the altruistic principles of the universal ethics¹¹. The social anthropology of the post-industrial world has also some problems with the human with multiply identity. The requirement of the sustainable development with its ambitions to be a new social ideal became unexpected difficulties with unequal distributions both material and intellectual resources. The former mechanisms of harmonization between different social groups was effective with support of religion or universal moral with its belief in the high calling of man and his ability to self-control. Nevertheless, this belief has got some pathological deformation in the late modernity.¹² Egocentrism and consumerism repress often the knowledge interest in cosmological studies, especially by the academic precariat. The representatives of it have tendency to let down their responsibility level. The identifying of astronaut figures with a superman and glorification them as sky-power-men can be acceptable in the contexts of the mankind achievement. However, the attempts to make this for military or entertainment assignments can cause through their corporative interests uncontrolled cataclysms on the planet. As contrary for this tendency should be named the ethics of responsibility (Hans Jonas) and discourse ethics (Karl-Otto Apel) which were very popular in the last decades of the 20th century. They can be complied with some ideas of the so-called "suffering ethics". The statements of this ethics are concentrated on the difference between legal and moral responsible action by suffering actors (Vinding, 2020:18). The category of suffering creations includes all creations of living and dead nature, which are opened for contact with man.

This idea of suffering nature is not new; it was very popular in the pre-modernity. Anyway, an attempt to turn the ethical thought into a direction of suffering can awake in consume societies interest for suffering environment which might be regarded as the field for activities for coevolution without reciprocal pressure. Such program of go-out from the planetary crisis might be a contra-version to the utopian happy-end promises. Anyway, taking into account the factuality of suffering by terrestrial and cosmic objects it is possible to reduce destructive consequences of the human intervention in the environment. However, it needs educational interventions.

The efficiency of cosmological, moral and ecological education depends on many factors, especially when it deals with cosmos-ecology. Therefore, without intensive learning about and from nature the ecological imperatives should have only restricted functionality: as abstract

¹⁰ Fantastic imagines of aliens among us can be regarded as reverse of dreams to colonize planets in solar system, which is considered in options of romanticized and in the same time aggressive geopolitics.

¹¹ More detailed on precariat life styling see: (Standing, 2014).

¹² See: (Kul'taieva, 2017). The convincing critic of the functional range of hyper-culture and strategy of doing universality see: (Reckwitz & Rosa: 2021).

appeals. The noospherical education has gained experience last time and can make contribution to forming of individual and collective responsibility for life on Earth. The important component of this direction in educational praxis is training in conversation with nature¹³. The reaction of animals on cosmic phenomena also gives cause for the interpretation their body sight and sound addressed to the Moon, comets, stars or natural elements as a reciprocal exchange and learning process.

The practical turn in cosmology brings again on the agenda the relationship between astronomy and astrology with its moral and educational aspects. In pre-modernity they were in very nearly relationship with the references to mathematics and medicine. Their differentiation begins in modernity. Summing-up this process until today Philipp Zarka notes that “the astronomical sky is physical while the astrological one symbolic” (Zarka, 2011: 422). Furthermore, astronomy is in its self-understanding scientific both in as well in theory so in practice. It deals with evolution in cosmic dimension and is always making verification of its own postulates in accordance with imperatives of academic honesty and researcher’s freedom. These features have a great educational potential. Teaching astronomy at school shows a tendency to searching for new approaches besides curricular options. To bring life into astronomy as a school discipline can complete its curriculum with informal educational activities such as “Galileo’s night”, etc.¹⁴

In the post-secular socio-cultural contexts, astrology, which since some centuries has bearing the title of the pseudoscience and commercial practices, imposes requirement related its scientific status. The institutional model of education is reproduced by astrologists with academic ambitions to become professorship and others academic ranges (Zarka, 2011: 421-422). Their research objects are constellations in the sky with reducing the physical nature of luminaries. The astrological divinations are based on presumption that universe repeats cyclic the location of its own constellations what makes ostensible possible to see future events guiding on space and time coordinates. The politicizing of astrology and its popularization in the mass-culture, belief in horoscopes can be regarded as symptomatic of spiritual crisis taking place in contemporary societies. Astrology is developed last time to a psychotherapeutic praxis of emotional stabilization of human being. With their obsolete imagines of the universe, astrologists try to represent themselves as such human elites which are able to decode heaven messages sending to concrete persons, social groups and even countries. Anyway, their advice gives only illusion of stability and security to some who pay for those medicines with their autonomy and freedom.

Conclusions

The intervention of ethics and educational ideas into cosmological discourse isn’t a contingent one. It is also caused from extern circumstances and intern problems of cosmology which aimed to extend its problem field and contribute to preventing the planetary disasters. Interpenetrating of ethics and cosmological experiences can be regarded as an intrinsic process with educational consequences. Self-knowing of mankind includes also a cosmological dimension with embedded value orientations and corresponded educational supplement. The risks accompanying space exploration needs to be reflected by practical philosophy, which can show ways to minimize of risking action bringing them in concordance with the imperative of

¹³ Very useful for this training could be popular literature of personal experience of the existential encounter with nature and cosmic phenomenon see: (Jonas, 2020: 9-12).

¹⁴ More on educational informal activities by teaching astronomy see: (Zayets, 2010).

responsibility. The appearance of the suffering ethics with its anti-hurt axiology cannot make concurrence with the universal one by solving global ecological or climate problems. It is advisable to make complementary use of them both.

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Axiological Dimension of the Modern Science Communication

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The article is devoted to the analysis of the specifics of the values of contemporary science communication. The values of science are still underestimated by many science researchers, in particular, sociologists. At the same time, the clear definition of the key values of science and intersubjective understanding about them increasingly determine the success of research. After all, values underlie the motivation of human behavior in general and the behavior of a scientist in particular. Academic values should be a priority in motivating the behavior of an individual scientist and science communication in general. Although values indicate to a greater extent what is desired, rather than what is available, they cannot be reduced to an ideal that is absent in reality, because values are already represented in the real behavior of people. The values of science have not only a regulatory nature of intellectual values (the abstract search for scientific truth as a higher goal, the power of the human intellect, academic freedom as an ideal, etc.), but also a specific functional and pragmatic significance – as specific instrumental

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values (institutional and organizational values, communicative competences, etc.). Despite the fact that values have an interpretive nature, they are neither subjectively limited nor arbitrarily relative to different social groups: the significance of values is determined by the communication in which these values are used by their carriers. The need for collective recognition of the values of science communication appears especially clearly and acutely in the clarification of the problems of ethics and morality of science communication, in particular in the issues of inclusiveness of science communication.

Keywords: science communication, academic values, communicative values, inclusiveness, moral normativity of science.

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Introduction

At the core of any civilization are the values that form its frame and determine its features, its unique contribution to the treasury of humanity and heritage of a particular nation. The present days also pose the question of values with all the sharpness and adherence to principles – moreover, everything without exception becomes subject to criticism and possible condemnation. The focus of discussions – both in theory and in practice – in the parliament hall and on the street, on the battlefields, is the problem of values. What to live for? What and how to protect? What can person rely on?

All this forces us to consider values as phenomena that determine leading human motivations and direct behavior in one direction or another. Actually, this interpretation is the basis of widespread and well-founded definitions of values (Jary & Jary, 1995: 715-717). In particular, this concerns the values of science communication, which largely determine both the image of modern science and the image of the world as a whole.

The problems of communicative values were paid attention to by leading philosophers and representatives of the social sciences. Among foreign scientists, there are Jürgen Habermas, Pierre Bourdieu, Manuel Castells, Niklas Luhmann, Herbert Marshall McLuhan, Francis Fukuyama, Karl Jaspers and many others explore the nature of values. Among the Ukrainian researchers of values there are Eugene Bystrytskyi, Myroslav Popovych, Serhii Krymskyi, Tetiana Orlova, Victor Pazenok, and others. Moral aspects of normative grounds of communication were elaborated by modern philosophers such as Dale Dorsey, Shelly Kagan, Geeta Kumar, Olle Risberg, and others. Still the works of these and other scientists do not offer anything resembling a coherent understanding of the axiological foundations of social existence. But all together, they strengthen the understanding of the fundamental importance of the value justification of the meanings of both individual human existence (Boichenko & Shevchenko, 2020) and the life of a community – from a small local community, regions, nation-states to civilization, and humanity as such. Also, it is evident that communicative values in available works are considered in passing, not as a special subject of research.

This determines the purpose of the proposed paper – to carry out a socio-philosophical analysis of the communicative values of modern science. Due to the excessively large scale of the problem, it would be appropriate to point out that this work can be defined as a fundamental statement of the problem about the axiological dimension of the modern science communication.

Counterfactual nature of values

The triad on which science and education are based is knowledge, competences and values. There is an understanding of values that actually equates them with the realm of dreams, propriety, and perspective. Thus, Ukrainian philosopher Vasyl Lisovyi points out that the term “value” denotes what is proper and valid however opposed to real: “The first step to understanding the nature of value was the realization that clarifying the concept of reality and truth does not provide an answer to the question – what is value. Truth answers the question of what reality is, Value answers the question of what is desirable or how something should be” (Lisovyi, 2002: 707). According to this approach, the value appears as an ideal for which it is worth fighting for and which (as is characteristic of an ideal) can never be fully embodied in real (“earthly”) existence. In our opinion, this understanding of value, although it has grounds, is not quite adequate and does not exhaust the multifaceted and inexhaustible interpretation of value. We should also note that the principled distinction between value and truth is controversial. The search for social truth can be both a search for values (their justification) and a search for an ideal. Strictly speaking, the search can also be related to something already purchased and, in this way, available. Let’s say, the historical experience of the people is an absolute value. But the realm of this multi-faceted experience creates the basis for radically different historiosophical studies and conclusions (even for calls to “refuse” everything negative in the past, “forget” traumatic experience, erase it from public memory).

Therefore, values have an interpretive nature, which brings them closer to an ideological way of seeing (constructing) social reality. The same realities in the coordinate system of different social worldviews can take on radically different meanings. The same personal freedom is perceived by some as a prerequisite for creating a personal life scenario, self-affirmation and self-creation, and by others as an area of risk and uncertainty, separation from the “roots”, etc. All this also applies to communicative values.

It is clear that no realities of spiritual life, no intellectual phenomena can ever meet the requirements of absolute perfection. There will always be a tangible gap between the ideal (which can be the ideal of a person, the ideal of an institution, and the ideal of a communicative order) and the form people have in life. Even when values are not directly mentioned, they influence (often in a decisive way) the course of events, form the basic foundations of social existence at all levels – from personal level to mankind.

Values are much more than what is related to the realm of what is appropriate, what is desired, what is dreamed of. As mentioned above, value can be (and is) a lot of what already exists and is worthy of attention, awareness and protection. Of the universal values, this is, of course, human life itself. It may be far from ideal, but we tend to consider life worth cherishing and protecting. Therefore, value is a lot of what we already have – and what we prefer to preserve, strengthen, inculcate. When it comes to the values of science and knowledge, we observe in Ukraine now quite a lot of phenomena in relation to which we have to state that these are not values-ideals. Everywhere they are burdened with contradictions; everywhere they hide considerable risks and dangers. But despite all this, they are the reality of the modern world of science, which in many ways shapes our Modernity as such.

Metaphorically, let’s say that the specified imperfection (which is inherent in all creations of the human mind and the mind itself) gives communicative values additional meaning, because it encourages us to focus on them all the time, to think about preservation and improvement. Summarizing, we state that the values of science (and science communication, in particular) combine the mode of their presence (you don’t need to dream about them – they

already exist in reality), albeit problematic presence, burdened with all kinds of contradictions, and the mode of projectivity, counterfactuality, where we try to imagine how this or that value should look, unfold in its ideal (optimal) plan and then and then implement it.

Specifics of the science communication values

Communicative values, in their typological belonging, are primarily intellectual and moral values. At the same time, these values include instrumental and functional aspects. Intellectual and moral values are essential, they relate to the very meanings of existence, the very purpose (mission) of science. Instrumental values can be considered as means and functions, as conditions and prerequisites of existence and implementation of intellectual and moral values. But each of them can be interpreted as an independent significant type of value. Life is a condition for freedom. Freedom is a condition for creative activity and academic activity in particular. But life and freedom are quite independent values, important not only for science and scientists.

What gives communication the status of a fundamental value? First of all, only the presence of free and unrestrained communication, in the body of which power, censorship and predatory interests (for example, corporations) do not interfere. For example, academic communication creates the spiritual and emotional atmosphere of a free community as prerequisite for a free society. In this atmosphere (according to Jürgen Habermas (2023), in the sphere of civil openness), there should be an exchange of thoughts and ideas, and a representation of development projects, political and social programs. Secondly, communication enriches all forms and varieties of information resources that an interested person – whether a scientist or an ordinary citizen – can turn to. And the third, communication allows overcoming individualism and limitations of subjectivity (Boychenko, 2010).

The values of science communication form a certain, relatively coherent system, where it is possible to single out basic, system-forming values (or values of the first order) – and values that are subordinate to them, that derive from them, although they can play an independent role and receive a separate worthy assessment.

Intelligence should be considered as the fundamental communicative value of science. It is clear that it is a universal human value (although we note that intelligence is often overlooked in various lists of values, this strange circumstance is discussed below), but it is precisely in relation to science and knowledge that intelligence acts as the core, a prerequisite for all cognitive and creative activity. There is no need (even if it were possible) to look for a single definition of intelligence – it is clear that under this universally broad concept there is a whole series (totality, unity) of mental abilities and competences that make it possible to adequately assess the world or a particular problem, to be aware of the complexity and the solvability of tasks itself, to look for and find ways to satisfactorily solve tasks, etc.

The result of the application of intelligence is an increase in knowledge, obtaining new information about the studied phenomena. Here we touch on an important moment when information (as a communicative value of a universal scale) through the mediation of the creative activity of a scientist (or team of researchers) turns into knowledge (new scientific knowledge) – as a communicative value of a higher order. The obtained creative results are transformed into publications (reports, messages, etc.), which appear in further communicative circulation as primary, fundamental academic communicative values. This product of creative intellectual activity is a constantly operating driving force of science communication, which forms science communicative reality. At the same time, publication values mutually form a balance of perception and criticism, approval and denial, recognition and neglect. Intelligence is again the benchmark – the individual intelligence of the author or the collective intelligence

of the researchers, both are the communicative intellect of the academic critique – and all this is in a state of continuous circulation, in the mode of continuous evaluations and re-evaluations, is integrated into conceptual systems and gives impetus to new directions of research. Therefore, science communication is a condition for the existence of human intelligence in an appropriate state. It should be noted that modern science and philosophy largely abandoned the unconditional exaltation of the human mind, seeing in it the guarantee of only positive innovations – and progress in general. Thus, the value is both the intelligence (mind) itself and a critical attitude towards it, awareness of the need to limit the encroachment of rationalism on the dominant force in social development.

We leave aside the question of whether personality itself should be considered a communicative value together with intelligence. In our opinion, any value presupposes a person as its subject and bearer. Of course, personality is an axiological structure and the creator of axiological changes. Of course, the question of the type of personality that corresponds to one or another system of values requires special consideration. This is the subject of a special extended study, which goes far beyond the scope of our topic, although it is of considerable interest. If we consider intelligence as a super-value, then its guises and forms can be interpreted as separate values, such as the ability to focus on problems, depth of mind, flexibility of mind, wit, ability to transfer acquired experience and knowledge from one (familiar) sphere to another (little-known, unfamiliar). Specially, such an intellectual value as critical thinking (including critical self-reflection of the mind) should be highlighted. The importance of this academic competency for science communication is difficult to overestimate.

The next communicative value of science is freedom in its broadest sense. It is a prerequisite for a dignified human existence in general, and a guarantee of cognitive activity, the basis of all academic freedoms that can exist. The intellect develops fully and productively in conditions of freedom (this thesis is not contradicted by the awareness of the need for disciplinary influences, the obligation to study some courses and academic disciplines), when a person has a wide choice for the realization of his life plans. Communicative freedom opens up exciting new possibilities that move and inspire a person. As Marshal McLuhan writes: “The division of faculties which results from the technological dilation or externalization of one or another sense is so pervasive a feature of the past century that today we have become conscious, for the first time in history, of how these mutations of culture are initiated. Those who experience the first onset of a new technology, whether it be alphabet or radio, respond most emphatically because the new sense ratios set up at once by the technological dilation of eye or ear, present men with a surprising new world, which evokes a vigorous new “closure” or novel pattern of interplay, among all of the senses together. But the initial shock gradually dissipates as the entire community absorbs the new habit of perception into all of its areas of work and association. But the real revolution is in this later and prolonged phase of “adjustment” of all personal and social life to the new model of perception set up by the new technology” (McLuhan, 1962: 22-23). It should be noted that these observations were made back in the days when personal computers had not yet become everyday life, and the Internet was still taking its first uncertain steps.

Multidimensional dynamism and growing openness generate and support the heterogeneity of the communicative environment of science, its flourishing multidimensionality and polyphony, which, in turn, causes the entropy characteristic of complex formations. The values of communication focus on continuous renewal, on innovative mutual enrichment of communication flows. Science communication embodies the growing complexity of science, gives special significance to such an important trend as the generalization of knowledge. This significantly increases the value of work in each special field of knowledge. After all, the

synergistic effect of breakthrough achievements affects the entire science social system, the entire process of research both in related disciplines and in distant academic fields (actually, there, *ad marginem*, the most interesting achievements take place).

Observation of the contemporary challenges to scientific values

Openness and speed are certainly valuable characteristics of modern science communication. But, in the terms when speed approaches to immediacy, the issue is the questionable quality of what has been made public. It often happens that publications that were in the leaders of the citation index for a certain time contained unverified or generally unreliable material. The pursuit of illusory priorities deforms the traditional ethics of responsibility and conscientiousness (which, as the same communicative values, are relegated to the shadows, as it were): “Rapid change occurs in that field whose problems are ‘ripe’ enough for solution. Scientists face a lot of problems, but all the problems cannot draw their full attention, because many of them are ‘unripe.’ There are periods in the history of science when scientists cannot get a satisfactory grip on its problems. An unripe problem thus takes time to be ripe, and then becomes the real possibility for new suggestions. Scientists are like farmers; they do not waste their energies in unprofitable operations and are careful to immediate demands. This is why the problems that are readily soluble attract their attention more readily than those that are not so” (Mannan, 2020: 183).

Unfortunately, sometimes such unreliability is a consequence of a conscious and frankly unscrupulous line that a scientist (or a whole team of researchers) follows for the success of communication, which attracts new creative forces, new intellectual resources for solving complex problems – recognition of the critical importance of communicative solidarity: for example, if a scientist is under political, religious or other restrictions and oppression in the country, all foreign colleagues of the local scientist must ensure the dissemination of his results.

In our opinion, it is very important to treat values consciously, to be able to proclaim and protect them, without exposing oneself to unnecessary risks of underestimation or neglect. In particular, it refers to situations where we think some things are “self-evident” and some values can “stand for themselves”. The specificity of values manifests itself in the fact that they do not form a harmonious unity, do not agree with each other, and often openly contradict each other. For example, freedom may conflict with considerations (and values) of security. But cognitive unrestrainedness overcomes caution and pushes to move forward, to overcome some last barriers. Therefore, one can point to such an important characteristic of the communicative values of science as their experimental character: “By making scientists extraneous to the process and establishing them as hierarchically dominant, this model is clearly science-centered: It problematizes the media and the public but not science. Therefore, its research agenda is reduced to how well the transmission process functions, either in terms of adequate media coverage or adequate public understanding. Furthermore, its attribution of any dislocation in the relationship between science and society

(or science and the public) to an inadequate transmission of information, which in our media-saturated societies primarily comes down to targeting media coverage, also makes it a media-centered model. Finally, it regards public acceptance of science and technology as simply a matter of overcoming resistance, from special interest groups, professional mediators such as journalists, or the lay public, by more and better (a) science diffusion, (b) media coverage, and (c) public understanding” (Maesele, 2013: 159).

Science and knowledge are important social values. Unfortunately, this undoubted fact is poorly understood by those who, by definition, must monitor the dynamics of value

orientations. The study of leading social values is one of the traditionally popular topics in sociological research. But the traditional list of values, which is offered to assess significance to respondents, almost never includes either, say, intelligence, or reason (or some of its recognized manifestations), or science as such. Education, intelligence, etc. are “forgotten”. In the proposed lists, one can see wealth, achievement (personal success), hedonism, independence, kindness, security, traditionality, conformity, etc. (Zagorodniy, 2022). It is possible that respondents mention intellectual values and intelligence itself in the “other” column, but it is difficult to judge, because this part of the reports, as a rule, is not characterized in more or less detail. It proves that effective promotion of the native intellectual values should be a special task at all levels of society and the state. Appropriate tasks could be performed by social advertising in the electronic media too. But, even a cursory reading of the existing manuals on social advertising showed that even there the values of intelligence, science and mental work do not find their proper place.

In the paper, we want to underline, that social architecture is changing, and science goes away from the traditional “ivory tower” model to the neoliberal one, where political roles, companies influences on science matters a lot: “So while traditional science communication only forces scientists into producing and disseminating the most grossly simplified versions of their work, completely lacking in intrinsic scientific value, it remains conceivable as essential practice for the role it is presumed to play in the preservation of genuine scientific authority in society” (Elam, 2004: 232). Using the framework of the communications revolutions, we can say about the “science communications revolutions”, following the ideas of Wolfgang Hofkirchner (2010), Vincenzo Politi (2018), and others.

Ethics of inclusiveness in the research field

At first glance, the academic sphere is quite closed: the higher the qualification level of a scientist, the more difficult it is to maintain communication with him at the appropriate level. However, at all levels of research excellence, an academician’s path to new research discoveries lies through his ability to establish successful interaction with colleagues, not push them away, but on the contrary, involve them in solving complex tasks. Moreover, the more difficult the research task to be solved, the more critically important it is not to lose the opportunity to attract the right participant to the implementation of the research project. At the same time, extra widening of the participation of the representatives from the “non-professional” (citizen science as involvement of the non-professional people to research activities) is a new challenge for the science as a social institute: “The achieved power of computer technology (as well as the possibility of a network combination of their power) creates the basis for processing such large data sets that were considered inaccessible for processing and understanding even yesterday. The need to overcome the isolation between the spheres of science, between science and the spheres of social existence, where science can prevent the growth of crime, help overcome hunger, ensure people’s access to clean water, a healthy environment, etc., is increasingly being realized. Involvement of the civic community in research, observations, and surveys is becoming a common practice. On the other side, we can say that the 21st century brings some interesting trends in science communication, which are a matter for future academic discussion... Public deliberation tendencies catalyze the development of popular science communication channels when professional researchers and profanes have the same “strong voices” in public discussions” (Kolesnichenko, 2023: 79).

Some ethics insist on deep moral relativism that leads to improbability of safe ethical judgments. So, American philosopher Dale Dorsey states: “Normative pluralism holds that

there is no such thing as a distinct set of rational requirements or “oughts” (distinct, that is, from individual “oughts” generated by the individual special standpoints such as morality, prudence, aesthetics, etc.)” (Dorsey, 2016: 19). However, we are convinced that this is not the death of morality, but it is the birth of a strong communicative morality in place of a weak individual morality. Thus, inclusiveness means an urgent need for science. But also, inclusiveness in science is the same concern for those who have special needs and for whom it is necessary to create additional facilities to include them in communication. Often, it is the maximum possible expansion of the circle of communication participants that makes it possible to find the right specialist where it was not expected to be found before: “Transgressions of discourse, outside of those that infringe on property rights, such as nonsequitur, begging the question, or other inappropriate kinds of discourse, while identified as unacceptable for post, are not accompanied by a mode by which to enforce such a rule (e.g., that which accompanies the rule about copyright). Thus, because inclusivity and equal distribution do not depend on cogent reasoning in this space, it actually lends itself to being a breeding ground of discourse that excludes or demonstrates inequitable opportunities to speak and to listen” (Coleman, 2015: 196). So, dialectics of traditions and innovations (especially, technically caused ones) in science communication still being a challenge for the axiology of science communication at the 21st century.

Thus, the second, so to speak, caring mission of inclusiveness helps to better reveal the main – research and creative goal of inclusiveness in science communication. Indian philosopher Geeta Kumar insists that “Much more than a policy requirement, Inclusion is founded upon a moral position which values and respects every individual and which welcomes diversity as a rich learning resource” (Kumar, 2018: 321). We stated that this moral position has also a strong epistemological justification.

To a certain extent, the last provision helps to better reveal those cute generalizations of psychological, sociological, historical, etc. studies of inclusiveness that were carried out by Austrian philosopher Franziska Felder who provides systemic in-depth analysis of the philosophical and moral significance of exclusion, and from an analytical point of view proposes the investigation of the value of inclusion and clarifies inclusive education and explores inclusive educational aims (Felder, 2022).

Moral practice needs moral communication, because individual moral position is inevitably weak. So, Dorsey states that “the practical authority of morality is limited, indeed. Not only does a moral obligation to ϕ not entail a normative obligation to ϕ , a moral obligation to ϕ does not even entail a moral permission to ϕ ” (Dorsey, 2016: 4). Moral communication helps radically overcome such limitations, as we can see. In this direction, there are also other ethical normative answers (Kagan, 2023; Risberg, 2023), but now we emphasize strong communicative normative overcoming of moral relativism in an academic field.

Conclusions

Science and science communication act as indisputable social values, and at the same time generate corresponding intellectual and instrumental values. The prestige of these values is an important condition for the development of science and education in society, a guarantee of the country’s sure progress in the direction of sustainable and inclusive growth. The source of fruitful science communication is the intelligence, which is the heart and reason, the condition for the existence of other communicative values. Intelligence realizes itself in cognitive activity, which expands and confirms new spaces and dimensions of freedom. Ethics based science communication shortens or completely eliminates all distances, creates new opportunities for

direct communication.

The values of science communication confirm the inclusiveness of this communication, the openness and availability of information, simplification and wide access for research participation, put forward new requirements regarding the responsibility of the researchers (research teams) for research results, etc. In contemporary society, there is still an underestimation of the values of science and, mainly, they are not perceived as priorities of the national development. Values of science communication allow to overcome many limitations of researches and help to revise the science social role on the local, regional, national and global level.

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Environmental Aesthetics as a Structural Part of Environmental Philosophy

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This study delves into the basic principles of understanding the environment from both philosophical and aesthetic perspectives. The theoretical aspect of the topic is explored and a scientific approach to solving current environmental problems is discussed. To achieve this, philosophical approaches to holistic existence are necessary, which include environmental logic, environmental ethics, and environmental aesthetics. Environmental ethics is traditionally focused on the problem of how a moral person should treat the environment, but in this study, we also consider the theory of rational knowledge and the rational factor of the environment. Ecological aesthetics is defined as the study of nature and its perception from a general theoretical point of view, as well as sensory-emotional cognition/activity and creative imagination. This specific aesthetic theory includes two dimensions – the aesthetics of society and the environment interaction and aesthetics of environmental narrative. The theory serves cognitive, educational, cultural-creative, and environmental functions.

Keywords: environmental philosophy, aesthetics, environmental aesthetics, environmental protection, nature, aesthetosphere, beauty, cognition, sensations, emotions, imagination.

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Introduction

The actual and global problem of environmental protection requires working out a well-grounded and complex approach. Only specialists in ecology, biology, chemistry, physics, meteorology, and other sciences like these must be involved in seeking knowledge on how to make the interaction between humanity and nature correct, effective, and, of course, safe enough. Considering personal and social mentality (beliefs, ideas, mood, usual desires, psychological inclinations, etc.) makes the problem analysis much more successful. Moreover, it presents quite a necessary step in understanding both the material and spiritual things connected with the environment past, present, and future. Intellectual efforts of theologians, psychologists, historians, culturologists, archeologists, and philosophers should be united correctly and focused on the question of humanity wanting to find the optimal way of dealing with natural beings that surround us. A scientific approach to nature needs a proper and effective philosophical approach to the whole being in particular: “Science without philosophy tends to the continuous fragmentation, to the loss of integrity...” (Bazaluk, 2022: 7), – underlines modern thinker Oleg Bazaluk.

Ecological research must rise to the level of environmental philosophy and pass to interdisciplinary research. It will ensure movement towards the necessary integrity of our knowledge and understanding of the mechanisms, dangers, and truly successful practices of interaction between humans and the natural environment. The destruction of nature leads to the destruction of man. The opposite is also true: a person who is “split” internally, devoid of ethical and aesthetic ideas, acts, as a rule, destructively about nature.

Technological progress has not only positive aspects. Among its negative consequences about nature, for example, are significantly more frequent environmental disasters and humans – an increased level of stress factors leading to mental disorders.

The cause of human ignorance, strict pragmatism, lots of immorality ratio, and the technical advantages we possess turn into sorrowful disadvantages – factors of the negative intensive global changes in our imperfect world. Hence, humanity is in real need of ideas, preventing us from such changes; in particular, it is in real need of a dignified environmental philosophy.

Environmental Philosophy

Environmental philosophy can be treated as a branch of theoretical knowledge that explores the interconnections between personal, social, and natural beings.

These interconnections are noticeable as a contact between conscious and non-conscious realities. On the one hand, human consciousness is impacted by surrounding nature (the sphere of material objects and live creatures, which possess various instincts). On the other, – human consciousness influences the existence of the latter. By researching nature, our mind uses resources to make peoples' lives more stable, comfortable, safe, and long-lasting. Our mind must admit it is not perfect, its activity often appears to be in some “vicious circle” or “ridiculous cycle”. Humanity gets a lot of energy and should spend it on overcoming different negative effects of such getting.

Thus, according to a report (2020) by the European Environment Agency (EEA), every eighth case of premature death in the countries of the European Union is associated with air pollution, noise, poor water quality, and the influence of chemicals (Tackling pollution). The rate of deaths caused by these factors in Norway and Iceland is 9%, in Albania, it reaches 23%, in Bosnia and Herzegovina – 27%. In the EU, Romania has the highest rate – 19%.

“Among the various side effects caused by the harsh modern homo Faber on the Environment (pollution, effects on human health, etc.), it is now evident that the Beauty of Nature has been destroyed, mainly for reasons related to economic profit” (Tsekos & Petsiou, 2018).

Our pragmatic intentions present a great power indeed. However, humanity must limit and moderate them, considering both material and spiritual benefits. Imparting correct information plays an important part in our lives and activities. “Bare” education of specialists (e.g., modern technology specialists) really may become a factor of deep mental crisis, provoking the environmental one. “Creation of the so-called “technical intelligence” who have professional knowledge and skills connected with modern technological achievements, and who are also sensitive to non-material values, such as beauty, ethics, arts, etc., turned out to be quite a challenge” – underlines contemporary scientist (Jakubiak, 2016: 61).

Such a position, firstly, contradicts the universal moral attitude regarding the relationship between freedom and responsibility, and secondly, obviously, will not contribute to a responsible attitude towards nature. The “network person” is simply indifferent to everything outside the virtual. Virtualization increases the amount of people, who are not interested in reality and communication “in real life” without the mediation of gadgets (such contacts can cause discomfort, fear, uncertainty, and a desire to avoid them in the future). Immersed in a virtual existence, an atomized “network person” who, due to the lack of live communication, has almost lost the ability to empathize and the skills to read emotions from the face of someone like himself, is unlikely to care about the state of natural objects and their preservation and enhancement (Smolina, 2021)

It is the environmental philosophy that should be regarded as one of the effective responses to such a challenge.

The core components of this branch of philosophical knowledge must be *environmental ethics* and *environmental logic* among them surely.

“Environmental ethics exists because many people today question practices associated with progress,” maintains Peter S. Wenz (Wenz, 2001: 2). In our opinion, well-established environmental ethics focuses on how a moral person should deal with nature surrounding him. Due to this sphere of philosophy, we can reach the desirable golden mean in our attitude towards the environment. Firstly it prevents people – possessors of mind – from the excessive veneration or even deifying of the natural – mindless a priori of the unconscious – being. As is known, ethics is a regulation in the field of subject-subject relations. Environmental ethics, as part of environmental philosophy, allows us to avoid hylozoism and animism to respect the right of nature and the living beings that inhabit it to their way of life.

At the same time, environmental ethics contains an idea of value and respect for the natural environment despite its traditionally understood inanimate nature. It sets people up for a responsible attitude towards nature. Philosophical grounding of the corresponding moral norms makes us rethink our usage of nature thoroughly. Humanity is sometimes forced to harm natural beings, resorting to absolutely violent means (for example, to vivisection, which cannot but scare anyone who likes animals. Of course, we may agree to risky experiments on funny dogs, parrots, or guinea pigs. However, we do not mean our beloved ones in moments of such choice). The ethical doctrine calls us to be as kind and merciful as possible when we are up to some strict measures. Moreover, it holds back human pragmatic orientation, reminding the duties of a moral person constantly.

There are plenty of urgent ethical problems. These very problems demand quick, distinct, and, of course, correct answers in our modernity. For example, “current agricultural practices in the United States, encouraged by world trade in food, may leave future generations of

Americans unable to grow enough to feed themselves. Do we owe anything to these future people? What about poor people alive at this time? Worldwide, the human population continues to increase, while over 800 million people are already starving or malnourished. Can we, should we, help them? If so, how can we help them without degrading the environment? Many species of nonhuman animals are in danger of extinction due primarily to human activity. Do we have any obligations to nonhuman beings?" – such a list just of some thought-provoking questions for environmental ethics one can find in Peter S. Welz's research "Environmental Ethics Today" (Wenz, 2001: 2).

In the European scientific tradition, we usually separate ethics from natural science. Within the framework of environmental philosophy, the interaction of science with ethics is possible. It is already happening in practice, which is not only a step beyond the once-standard scientific tasks (Joseph E. Brenner) but also gives hope for a possible successful solution to environmental problems in the future.

In terms of environmental philosophy, the second component is environmental logic. It is considered the most general theory of rationality as it pertains to environmental existence. This branch of philosophy helps to clarify and improve the process of rationally comprehending nature. Unlike classical logic, which focuses on consistent thinking, environmental logic provides insight into the optimal way to obtain knowledge about the environment through our thinking process.

Environmental logic is a part of noology, which explores how our mind's activity influences nature's life. The human "noosphere" coexists and interacts with the environment sphere as a dominant phenomenon. Unfortunately, this dominance doesn't always lead to harmony between people and nature. Nonetheless, environmental logic helps to renew and strengthen this harmony by inventing and grounding reasonable projects of the noospheric factor activity. Roxane-Grimaud notes that much of our technological and scientific development has lacked an eco-logic, a conceptual structure that would connect every question to a network of relevant issues, even if the relevance is not readily apparent to us.

One of the crucial roles of ecological logic is to foster the necessary ways of thinking that can help us re-evaluate the relationship between humanity and nature, as well as the connections between individuals, communities, nature, culture, and civilization. This can lead to positive changes in how people lead their lives and organize their societies (Joseph E. Brenner).

However, it's important to note that intelligence is not the sole means of comprehending the world. We point out not only human noosphere but human *aesthetosphere* (this term derives from the Greek "αἰσθησις" – "sense", "sense perception"; it has been used and popularized by such philosophers as Serhii Vasylenko, Moisej Kagan, Nina Levchenko, Anjelika Pryhornyts'ka, Volodymyr Lychkovakh, Andrii (Andrey) Tsarenok and others). Homo sapiens appears to be homo aesthetics as well, and this circumstance should be also taken into consideration by those scientists, who explore the interaction between humanity and nature.

Homo aestheticus & Surrounding Nature

The environment plays a crucial role in our emotional life, which is why environmental philosophy cannot ignore it. Natural phenomena, often admired for their beauty, should not be underestimated as they can influence our choices, lives, and history. Humanity often values things, whether man-made or not, that appeal to our sensitivity. For instance, historical studies demonstrate that picturesque locations can become famous political and cultural centers, as was the case with Byzantium. The city's advantageous geographical position and beauty were

appreciated by Roman Emperor St. Constantine I, leading to the establishment of Nova Roma – Constantinople, the capital of the Byzantine Empire.

Aesthetics of nature are incredibly diverse and rich, offering an array of aesthetic experiences to humans. However, unlike art forms that create lasting harmony, aesthetics of nature elevate, purify, and enlighten. By being aware of the sensory qualities that come with exposure to nature and the enjoyment they bring, we enrich ourselves. It's important to note that we cannot fully appreciate or experience aesthetic pleasure when looking at a picture of a beautiful landscape if we have not had an empirical experience of the aesthetic feelings generated by looking at a landscape in nature. It means that communication with nature is vital to experiencing aesthetic appreciation. Often, natural beauty is used as a measure or a criterion of human-made beauty or the results of human activity. Keiko Makino argues that urban environments are considered aesthetically pleasing when they resemble natural environments.

At the same time Emily Brady, and Jonathan Prior claim: "Although environmental aesthetics has emerged as an important subfield, aesthetics remains dominated by discussions of the arts".

Besides, it is necessary to mention that "the environment is a complex and interconnected system, a web and a continuum, dynamic and ever-changing" (Arvill, 1976: 271). Its well-ordered structure can enjoy our senses, and its dynamism can produce an anti-boring effect on contemplators, at least for a certain period.

The human asthenosphere is regarded as a sphere of a person's sensations, emotions, and feelings, activities influence different human acts concerning natural beings significantly. This interesting illustration of the fact can be found in Eugene C. Hargrove's work "Foundations of Environmental Ethics". Making an excursion into the history of the Western garden culture, this American philosopher pays attention to the role of human likes in its development – in the transition from formal gardens to nonformal ones, "Nonformal gardens became popular at the same time that horticultural societies began to be organized in Europe and America. These societies sent agents to all parts of the world to bring back seeds and plants. The landscape garden naturally became the showplace for these botanical exhibits, and the introduction of these new plants into them produced a more relaxed attitude toward nature by forcing garden enthusiasts to accept new and wilder standards of beauty... Since each plant was an emissary, so to speak, from some mysterious and bizarre corner of the Earth, the thoughts of the garden enthusiast inevitably turned to the contemplation of the natural and alien environment... In this way, an interest in wilderness areas arose that helped prepare the way for their direct appreciation later, both scientifically and aesthetically" (Hargrove, 1989: 82–83).

"Both scientifically and aesthetically" (and, of course, ethically) good standards of environmental protection have been prepared for their further implementation. Experience of nature's emotion-provoking peculiarities can help us to realize the importance and necessity of a well-planned preservation policy better and deeper. Wild nature "reminds us" about its right to be, appealing to our reason and feelings. "To many people the overwhelming importance of wildlife lies in its aesthetic... values" (Arvill, 1976: 169): disappearing of some species or distortion of some landscapes would be considered a kind of psycho-emotional trauma, painful and harmful for a person, who wants to enjoy natural beauty and harmony.

Today, environmental resources are recognized as an integral part of national and global wealth. Preserving and enhancing natural beauty has become an important aspect of state policy. This trend is gaining popularity worldwide. In economically developed countries, government ecological projects have a noticeable aesthetic dimension. For example, the multifaceted nature of Canadian environmental politics reflects the country's reliance on natural resources

to maintain a high standard of living, while also valuing the beauty of the landscape as a key aspect of its national identity (Toner, 2002: 71). In our view, while natural beauty is important, it cannot be considered the central feature of national identity. (here we can add Canada, Norway and Finland as examples.) but, at the same, absolute ignoring of it is erroneous, impermissible, and, we would dare to say, criminal.

Someone may argue that the beauty of surrounding nature has nothing or too little to do with the utilitarian needs of people. Neither an amazing waterfall nor a charming quokka's smile can produce as much energy as an atomic station, though its functioning puts it at more or less risk to humanity. Such provocative theories – we hope, just hypothetical ones – can be disproved successfully with some classical statements. Among them is the following: lack or total absence of beauty in the sensual surrounding world would spoil the psychological health of that very *Homo aestheticus* seriously. (By the way, as we know well enough, natural sights – non-moving and moving – attract tourists, hence, they can perform practical functions).

And what about the nature sights, which the cause of their rarity or geographical distance or even isolation may remain completely unseen for a vast majority of potential contemplators? Would it be correct to refuse protection for them?

Seeking for the answer to this new provocative question, we must reasonably take into consideration the aesthetical needs of those people, who have an opportunity to contemplate such sights yet. The quantity of them may be impressive in no way, but still, their right to enjoy natural (probably, “virgin”) beauty should be a subject of our reflection for sure.

Environmental Aesthetics: Subject, Structure & Significance

There is a question on how to interpret environmental aesthetics as a branch of environmental philosophy. However, the interpretation of the philosophical science called “aesthetics” is connected with some tangible problems for experts. Therefore, scientists who wish to consider the question of what environmental aesthetics is must clarify their position regarding aesthetics itself. There are numerous definitions of the term “aesthetics,” reflecting a different understanding of its subject matter and tasks. Some of the definitions worth mentioning include:

a) Aesthetics is the doctrine of the aesthetical comprehension of reality

Such an interesting enough definition shouldn't be regarded as successful yet. As researchers (e.g. Boris Luk'janov) underline, one cannot define some unknown term using the same unknown term. Moreover, the word combination “aesthetical comprehension” may be interpreted in different ways.

b) Aesthetics is the philosophy of beauty

This popular definition has some essential ground, but a thorough exploration of the matter proves that it is not a catchall. The subject of the aesthetical discourse “should not be mentioned in so “reduced” way, for it is much wider: not only the beautiful phenomena, in reality, draw the interest of aesthetics” (Tsarenok, 2017: 162). For example, something ugly, frightening, terrible, sad, merry, exalted, etc. habitually are included in the sphere of aesthetics' subject as well.

c) Aesthetics is the philosophy of the fine arts

It's no secret that the fine arts – like architecture, painting, music, sculpture, or literature – have always been the primary focus of those studying aesthetics. This definition of aesthetics is used quite frequently when trying to understand and explain the essence of the aesthetical

theory. However, the more we study different doctrines interpreted as aesthetic ones, the more we come to realize that it's not just the fine arts that should be considered as an aesthetic subject matter. A thorough exploration reveals that the potential we identify as "artistic" is used in different spheres of our daily lives.

d) Aesthetics is the philosophy of expression and expressiveness

The corresponding interpretations have already become popular enough in the philosophical thought of the 20th – beginning of the 21st centuries (see the works on aesthetics by Benedetto Croce, Robin George Collingwood, Aleksey Losev, Volodymyr Lychkovach). From such a point of view, aesthetics tries "to understand the process and results of expression of definite senses, ideas, feelings, psychoemotional states, etc. The products of such procedure possess different quality: they may be not only beautiful but also ugly, disgusting, horrible and so on" (Tsarenok, 2017: 162). (Surely, the fine arts present a good example of such expression). But, of course, expression and expressiveness must be considered as elements of the complex aesthetics subject only: otherwise, we have to rename aesthetics as expressiology.

e) Aesthetics is a science of sensory cognition

The corresponding interpretations have already become popular enough in the philosophical thought of the 20th – beginning of the 21st centuries (see the works on aesthetics by Benedetto Croce, Robin George Collingwood, Aleksey Losev, Volodymyr Lychkovach). From this point of view, aesthetics tries "to understand the process and results of expression of definite senses, ideas, feelings, psychoemotional states, etc. The products of such procedure possess different quality: they may not be just beautiful but also ugly, disgusting, horrible and so on" (Tsarenok, 2017: 162). (Surely, the fine arts presents a vivid example of such expression). But, of course, expression and expressiveness must be considered just as elements of the complex aesthetics subject. Otherwise, we have to rename aesthetics to expressiology.

Here we have finally called to remembrance the initial definition of the term "aesthetics", proposed by its "father" – German philosopher of the 18th century Alexander Hotlib Baumgarten. In his opinion, "while such philosophical doctrine as logics explores the intellectual processes, human thinking, its forms and laws, aesthetics appears to be a kind of supplement to the logical quest" (Tsarenok, 2017: 162), "the younger sister" of the logic, *scientia cognition is sensitivae*. According to Baumgarten, sensations, emotions, and feelings (and even imagination, image memory, etc.) constitute the subject matter of aesthetics and reality, which provokes such a reaction to itself.

Considering and developing this theoretical position, we can define sensory, emotional (in the broad sense of this word), and imaginational activity as the aesthetic discourse subjects. Someone may argue that among emotions, just the so-called "aesthetic" one should be admitted as a part of aesthetics sphere of interest. However, as Charles W. Valentine states, "there is no unique emotion which we can label the aesthetic emotion" (Valentine, 1962: 9). This point of view, supported by the authors of the article, provides us with a possibility to expand the subject of aesthetics, increasing its significance consequently.

Using all the abovementioned interpretations of aesthetics as a branch of knowledge and the original (Baumgarten's) one especially, we get a general notion of environmental aesthetics, and we should reflect on a corresponding definition of this doctrine and of its *subject*.

Thus, *environmental aesthetics* is defined as *the most general theory of the sense, emotion, and imagination activity connected with surrounding nature in one way or another*.

In addition, Auer R. Matthew examines the relationship between environmental aesthetics and ethics (Auer, 2019).

We can distinguish two structural parts of environmental aesthetics.

The first one is *aesthetics of the interaction between humanity and nature*. This theoretical component must explore 1) how the environment influences human senses, feelings, mood, etc., and 2) how human sensations, emotions, and imagination influence the environment.

The second one presents *aesthetics of the ecological narrative*. Its task is to study the role of human sensory, emotional, and imaginal activity in the complex process of the creation of science, popular science, and, of course, artistic works (paintings, films, sculptures, and so on), devoted to the actual problems of the environment existence and the environmental protection.

At last, it is necessary to say some words about the *significance* of environmental aesthetics. We could point out the following interconnected functions of this sphere of philosophical knowledge:

a) Cognitive

Environmental aesthetics develops a strategy of cognition of the ecological narrative and the surrounding nature being with the usage of its specific means (aesthetical notions and categories, theory of the emotional reaction to the outer world reality, understanding of the creative process peculiarities, etc.).

b) Informative

Environmental aesthetics plays a crucial role in communicating important ecological information effectively. This philosophical doctrine enhances the dissemination and popularization of worthy ecological ideas through various means like scientific, popular scientific, and artistic methods. It involves simplifying complex concepts and making information interesting and attractive to people belonging to different age groups, social statuses, etc.

c) Culture-creative

Understanding the ecological narrative is necessary for the effective and dignified development of environmental aesthetics. This knowledge can be used to foster the development of the ecological narrative as a part of our culture.

d) Educative

Besides developing the ecological narrative, this branch of philosophy helps to bring both children and adults and to improve personal and social-ecological culture (sense of responsibility for surrounding nature's existence, measured love of the environment, desire and ability to maintain and protect it, etc.).

e) Nature-protective

As mentioned before, environmental aesthetics contributes to human desire and ability to protect nature's development. The ecological narrative led by the aesthetical theory becomes much more attractive, influential, and effective: its call, plea, or even lament provokes compelling feelings and thoughts.

Conclusions

Finally, the following conclusions should be made:

1. To effectively address the environmental issues of our time, it is necessary to take a holistic and integrated approach. This involves bringing together various scientific disciplines that deal with these problems, while also considering the ideological, theoretical, and spiritual factors that contribute to them. This is where environmental philosophy comes into play – as a means of developing a comprehensive framework that can guide us toward sustainable

solutions.

2. The development of environmental philosophy, which studies the interconnections between society and nature, has made it necessary to consider its structure. Among its key components, environmental ethics and environmental logic are essential. While environmental ethics traditionally focuses on how a moral person should deal with the environment, environmental logic is considered a theory that deals with both the rational understanding and the rational existence of the environment.

3. Attentive and conscientious researchers cannot but emphasize the crucial role of sensations, emotions, and feelings in the comprehension surrounding nature. Moreover, the corresponding qualities of homo sapiens, who appears to be homo aestheticus as well, present an essential factor of the nature being. Considering these facts, we must admit the absolute necessity of the specific sphere of philosophical knowledge – environmental aesthetics that would explore human sensory and emotional activity that determines human attitude to the environment.

4. Making use of some different notions of the aesthetical discourse, which one finds in the history of philosophical thought, we can define environmental aesthetics as the general theory of the sense, emotion, and even imagination activity, which is influenced by surrounding nature and, in its turn, influences this very sphere of being. Such a specific aesthetical theory includes two dimensions – aesthetics of the ecological narrative and the aesthetics of the interaction between society and the environment – and performs cognitive, informative, culture-creative, educative, and nature-protective functions.

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Part 3: COSMOS AND HISTORY

Aletheia vs. Truth: Socratic Logos for a Modern Understanding of the Universe

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In the article, Socratic logos is used both metaphorically and literally. Its opposition to modern terminology and its meanings, such as “truth,” “the chronology of the Universe,” “space exploration,” and “the nature of space,” is metaphorical. The literal use demonstrates the potential of Socratic logos for modern inquiries into the Universe. Socratic logos is proposed to be used as a work. Namely, in this meaning, it is an authoritative beginning for any research. On the other hand, Socratic logos guarantees proper continuity and systematisation of the research results. It helps to go beyond highly specialised terminology and its meanings to use its particular complexity to investigate global interdisciplinary complexity. Thirdly, the most important is the effectiveness and results of its use. An example of the upward path “What is alētheia?” shows the work of Socratic logos and its result. The main feature of Socratic logos is that it does not provide for the victorious proclamation of “Truth” in the form of one or another cosmological model. However, it leads to the critical dichotomy of the kósmos, based on the metric expansion and compatible with the Hubble-Lemaître law.

Keywords: Socratic logos, ontological dichotomy, alētheia, phúsis of the kósmos

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1. Introduction

“Of all the *agathón*, for gods and men alike, *alētheia* stands first.”¹

The meanings development of the term *alētheia*² in the ancient philosophical tradition, with their subsequent rethinking in terms of *verum* (“reality/realness”) and “truth,” hid two fundamental Platonic messages that cannot be conveyed with the word “true”. First, the *alētheia* and *lēthē*³ have a standard beginning, in which the opposition between them is eliminated. Plato called it “unconditioned *arkhē*.”⁴ Plato explored the “unconditioned *arkhē*” by “composing myths”⁶ and mathematics.⁷ According to Plato, man could discern (*theōréō*⁸) and come to know (*ginōskō*⁹) it as the “*alēthōs* heaven and the *alēthinon* light and thus *hōs alēthōs* the earth.”¹⁰ Second, from the “unconditioned *arkhē*,” the upward path began.¹¹ The fundamental feature of

¹ ἀλήθεια δὴ πάντων μὲν ἀγαθῶν θεοῖς ἡγεῖται, πάντων δὲ ἀνθρώποις (*Laws* 5.730c1-2). Translated by R.G. Bury. The Greek text is cited according to (Burnet, 1901; 1903; 1978; 1907; Duke et al., 1995). The author follows the translation (unless otherwise indicated) of *Plato in twelve volumes*, 1967-1979.

² *Alētheia* (ἀλήθεια), unconcealment, non-oblivion; opposite *lēthē*. The author uses Greek words as the technical terms and does not stick to a grammatical case except for direct quotations. The meanings of the words are based on Plato’s dialogues, the Platonic corpus, Liddell and Scott’s Greek-English lexicon (Liddell & Scott, 1940) and Thayer’s Greek-English Lexicon of the New Testament (Thayer, 1995). However, in the text, the author rethinks them and puts his understanding into them.

³ *Lēthē* (λήθη, noun, from verb λανθάνω (also λήθω), I am concealed (hidden)), concealment, oblivion, closedness; opposite *alētheia*.

⁴ ἀρχὴν ἀνυπόθετον (*Republic* 6.510b6). The “unconditioned *arkhē*” is understood from Plato’s dialogues or (1) conceptually as the *agathou* idea (τοῦ ἀγαθοῦ ἰδέαν) (*Republic* 6.505a-6.509c; 6.510a-6.511d; 7.518a-7.518d; 7.532c-7.532c; 7.534c; 10.621c-d; *Timaeus* 29a), or (2) mathematically as one (one, εἷς) (*Republic* 7.524c-7.525a). “Some of the names for the principles – one, many, indefinite dyad – show that Plato frequently thought of the highest, immaterial world in numerical terms. It is no surprise because he treated the entire universe, not just its immaterial component, as a chain of numbers” (Kalvesmaki, 2013).

⁵ *Arkhē* (ἀρχή, noun) beginning, origin.

⁶ ποιεῖν μύθους (*Phaedo* 61b3). These are (*Gorgias* 522d-527b; *Phaedo* 107c-114c; *Republic* 10.614a-621b; *Phaedrus* 245c-249d). See the review by Alexey Losev (Plato, Volume 1, 1990: 810-813).

⁷ “Plato greatly advanced mathematics in general and geometry in particular because of his zeal for these studies.” Translated by Paul Kalligas and Voula Tsouna (Philodemus’ History, 2020: 283). According to Vlastos, “the most important point of disagreement between Plato and Aristotle” is that “Aristotle wants to provide an explanation of nature that is based on ordinary language, whereas Plato wants to leave such an explanation up to mathematics, which, in ever-changing sensible things, represents the traces of intelligible stability” (Vlastos, 2005: xviii). For mathematics in Plato’s dialogues, see (Kalvesmaki, 2013; Karasmanis, 2020; Fierro, 2003; Philodemus’ History, 2020: 282-283).

⁸ *Theōréō* (θεωρέω, verb, from *theaomai*), to be a spectator of, i.e. discern, gaze on for the purpose of analysing (discriminating), behold (Thayer, 1995).

⁹ *θεωροῦσα*, γινῶναι (*Phaedo* 109e5). *Ginōskō* (γινώσκω = γιγνώσκω, verb), come to know, perceive, and in past tenses, know (Liddell & Scott, 1940), “to know, especially through personal experience (first-hand acquaintance)” (Thayer, 1995).

¹⁰ γινῶναι ἂν ὅτι ἐκεῖνός ἐστιν ὁ ἀληθῶς οὐρανὸς καὶ τὸ ἀληθινὸν φῶς καὶ ἡ ὥς ἀληθῶς γῆ (*Phaedo* 109e5-110a1). Translated by Gwenda-lin Grewal. The italicised words are the inflection *Alēthēs* (ἀληθής, adjective) unconcealed.

¹¹ The upward path (*Republic* 2.364d) and the path above (*Republic* 7.514b). See (Schur, 2015; Gill, 2010: 172; Gonzalez, 2009: 244-245).

the path was the need to pursue/practise (*epitēdeúō*¹²) every new way/manner (*trópos*¹³) of the rightness (*dikaíosunē*¹⁴).¹⁵

Thus, the question “What is *alētheia*?” was, first of all, the way to follow (*mēthodos*).¹⁶ This led the way (*hēgeomai*¹⁷) (i) to considering, pondering¹⁸ things in mid-air, (ii) to thoroughly investigate (*ἀναζητέω*) all the things below the earth, and (iii) making or doing (in an extensive application, more or less direct (*ποιέω*) the weaker *lógos*¹⁹ the stronger.²⁰ Socratic *lógos* was an inseparable and essential part of this path (Nagy, 2002: 32). It served for computing the complexity of the global world; moreover, its inner *dúnamai*²¹ was aimed at self-reinforcement and self-improvement to guarantee understanding and practice of the intelligible (Bazaluk, 2023).

2. *Génesis*²² vs. the Chronology of the Universe

Modern cosmology defines the “unconditioned *arkhē*” as “the initial singularity,” which has contained all the energy and space-time of the Universe (Sagan, 2013). It was followed by the “part of the Planck epoch,” or “the first second of the chronology of the Universe.”²³ According to the Big Bang theory, singularity is an active principle²⁴ that causes “the chronology of the Universe.”²⁵

¹² *Epitēdeúō* (ἐπιτηδεύω, verb), pursue or practise a thing, make it one’s business (Liddell & Scott, 1940).

¹³ *Trópos* (τρόπος, noun, from *τρέπω*, turning, adopting a new manner), a new direction from taking a turn or adopting a new way/manner (Thayer, 1995).

¹⁴ *Dikaíosunē* (δικαιοσύνη, noun. From *δίκαιος* (*dikaíos*) + *-σύνē* (-súnē), rightness, righteousness) it refers to a person; as an adverb. – duly, rightly (Liddell & Scott, 1940).

¹⁵ *δικαιοσύνην μετὰ φρονήσεως παντὶ τρόπῳ ἐπιτηδεύσομεν* (*Republic* 10.621c4-5). I deliberately omitted μετὰ φρονήσεως.

¹⁶ *Mēthodos* (μέθοδος, noun), path (hodos) of pursuit (meta-), to pursue one’s inquiry, or literally “the way to follow.”

¹⁷ *Hēgeomai* (ἡγέομαι, verb) lead the way, go before.

¹⁸ *Φροντίζω*, “continuously connecting insight (enlightened inner perspective) to the necessary outward behaviour” (Thayer, 1995). This verb describes the actions (interactions) of Socrates in *Symposium* 220c6. “Though it may be only a coincidence, Alcibiades’ report of what the soldiers at Potidaea said about Socrates’ strange behaviour includes the verb *φροντίζων*” (Edmunds, 2006: 417).

¹⁹ *Lógos* (λόγος, noun), (i) that which is said: word, sentence, speech); (ii) that which is thought: reason, consideration, computation.

²⁰ *τά τε μετέωρα φροντιστῆς καὶ τὰ ὑπὸ γῆς πάντα ἀνεζητηκῶς καὶ τὸν ἥττω λόγον κρείττω ποιῶν* (*Apology* 18b6-18c1). See (Edmunds, 2006; Tell, 2010).

²¹ *Génesis* (δύναμαι, verb) to be able, strong enough to do (Liddell & Scott, 1940).

²² *Génesis* is derived from the verb *gígnomai*. *Gígnomai* and *génesis*, as well as words derived from them, are used as key terms in the presenting cosmogony and cosmology in Plato’s *Timaeus*. According to A.F. Losev, “Only sometimes, instead of *γίγνομαι*, Plato uses the verb *γεννάω*, which means “to beget”, and in Greek, this term is primarily connected with the descent from the father (24d, 28b-c, 37c, 38c, 41a-b, 41d)” (Plato, V-3, 1994: 599).

²³ The Lambda-CDM Cosmological Model currently represents this period’s most authoritative argument (Sagan, 2013).

²⁴ “dark energy, in the form of a cosmological constant, makes up 71.4% of the universe, causing the expansion rate of the universe to speed up” See <https://map.gsfc.nasa.gov/>

²⁵ <https://map.gsfc.nasa.gov/>

I separate/define (*horizō*)²⁶ the “unconditioned *arkhē*” by the noun *gēnesis*.²⁷ This decision is due to the predominance of the *gígnomai*²⁸ symmetry over *phtheirō*.²⁹ The above Greek verbs and their inflection define two fundamental physical phenomena: “come to be” and “cease to be.”

According to Myles Fredric Burnyeat, the verb *gígnomai* “is that of a verb which is complete on its own, but which is further completable without change of meaning” (Burnyeat, 2003: 10).³⁰ It marks the dominant physical phenomenon “come to be,” which is complete on its own. (1a) “x come to be” and (1b) “x come to be *F*,” where *x* is a subject and *F* some predicate, are allowed.

The “come to be” phenomenon is (i) to become, i.e. to come into existence, begin to be, receive being) and (ii) to become equivalent to come to pass, happen, of events (Thayer, 1995). These are “to come to be is to come to be (predicatively) a being/something that is”³¹ and “to bring to light (*phainō*)”³² upon itself according to the formula (1c) “everything that comes to be comes to be (i) by the agency of something and (ii) from something and (iii) something” (Burnyeat, 2003: 18; 22-23).

The verb *phtheirō* defines the opposite and subordinate physical phenomenon “cease to be.” Similarly to *gígnomai*, I use *phtheirō* as a technical term. It gives me the right to extend Burnyeat’s idea to this verb.³³ I claim that the “cease to be” phenomenon is complete on its own, and I admit that (2a) “x ceases to be” and (2b) “x ceases to be *F*.” I am guided by the law of conservation of energy and Noether’s theorem. Hence, the “cease to be” phenomenon is “to cease to be (predicatively) a being/something that is” and “to bring to light” (*phainō*) on itself according to the formula (2c) “everything that ceases to be ceases to be (i) by the agency of something and (ii) from something and (iii) something.”

The result of the *gēnesis* and the apparent opposition between the dominant “come to be” phenomenon and the subordinate “cease to be”³⁴ phenomenon is the third phenomenon. The Greeks separated/defined (*horizō*) by its verb *eimi*, to be, exist and its inflections: participle *ontos*, participle and noun *ón*, noun *ousiā*,³⁵ etc. According to Burnyeat, *eimi* defines “to

²⁶ *Horizō* (ὁρίζω, verb, from ὅρος (hóros, “boundary, border”) + ῥιζω (-ízō)), divide or separate from, as a border or boundary, define a thing (Liddell & Scott, 1940).

²⁷ *Gēnesis* (γένεσις, noun) coming into being, production, generation.

²⁸ *Gígnomai* (γίγνομαι, verb) to come into being, namely, (i) to become, i.e. to come into existence, begin to be, receive being, and (ii) to become equivalent to come to pass, happen, of events (Thayer, 1995); opposite (i) *phtheirō*, “We should all agree that the opposite of *gignesthai* is *phtheiresthai*, should we not?” ((*Philebus* 55a). Translated by Harold N. Fowler. See the discussion (Ademollo, 2018; Burnyeat, 2003; Gonzalez, 2009; Vlastos, 2005)) and (ii) *eimi* (*Timaeus* 27d-28a; *Republic* 6.485a-b). See the discussion (Burnyeat, 2003: 22-23; Ademollo, 2018: 59).

²⁹ *Phtheirō* (φθείρω, verb), to pass away, perish, be destroyed.

³⁰ Therefore, *gígnomai* “is used sometimes with, sometimes without a complement: (1a) “x γίγνεται,” (1b) “x γίγνεται *F*””) (Burnyeat, 2003: 9). *γίγνεται* is the third-person singular present mediopassive indicative of *gígnomai*.

³¹ (Burnyeat, 2003: 23). Burnyeat relied on *γενέσθαι ποτὲ ὄν* (*Sophist* 245d1).

³² *Phainō* (φαίνω, verb), to bring to light, to cause to appear.

³³ In fact, “in ordinary Greek you do not say ‘X φθίρεται *F*’ to mean ‘X ceases to be *F*’” (Ademollo, 2018: 63).

³⁴ *φθορὰν καὶ γένεσιν* (*Philebus* 55a).

³⁵ From ὄν, οὐσᾶ, ὄν (“being”), the present participle of *eimi* (“to be”), + -iā (-iā, abstract noun suffix).

be” as (3a) “x exists” and (3b) “x is *F*”³⁶ that is, as a phenomenon that is complete on its own. There is no concept of existence as such, for subjects of an indeterminate nature (Burnyeat, 2003: 16). “To be is to be (predicatively) a being/something that is” (Burnyeat, 2003: 23). Moreover, the “to be” phenomenon brings the light (*phainō*) on itself according to the formula (3c) “everything that exists³⁷ exists (i) by the agency of something and (ii) from something, and (iii) something” (Burnyeat, 2003: 18).

The “to be” phenomenon is the result of *genesis* and the confrontation between *gignomai* and *phtheirō*. Therefore, it excludes the existence of “come to be purely”³⁸ and/or “cease to be purely.” All “x exists” and “x is *F*” are always a regulatory compromise between the “come to be” and “cease to be” phenomena. Hence, the “to be” phenomenon is “always is purely” (*ón*) as the upward path. It always brings to light (*phainō*) a new compromise symmetry of the whole and its parts.

The “to be” phenomenon, the result of *genesis*, which is “always is purely” (*ón*), and which always brings to light (*phainō*) the compromise symmetry of the upward path, shows forth/manifests (*emphanizō*)³⁹ itself as *alētheia*. Hence, *alētheia* is the unconcealed (*alēthēs*) unity and opposition between three fundamental physical phenomena: “come to be,” “cease to be,” and “to be.” The “to be” phenomenon both as a whole and the upward path, and as something that is a part of the whole and is *dúnamai*, “to be able, strong enough to do” (Liddell & Scott, 1940). “For I put a boundary which defines being (*ónta*), that it is (*estin*) nothing else but *dúnamis*.”⁴⁰

Therefore, *alētheia* separates/defines (*horizō*) the commensurability of three physical phenomena, denoted by us with the verbs *gignomai*, *phtheirō* and *eimí*. By itself, as a definition, it brings to light (*phainō*) the “to be” phenomenon and its upward path, that is, on something that is “always is purely” (*ón*) as a whole and as *dúnamai*.

3. The Way to Follow (*Méthodos*) “What is *Alētheia*?” vs. “Space Exploration”

The question “What is *alētheia*?” is not idle. It is a matter of self-preservation of anything that “comes to be and to beget.”⁴¹ It is the only way to follow (*méthodos*) to the pure phenomenon “to be” to fasten/bind to it (*háptō*)⁴² as far as possible and “to be” simultaneously the whole and the part of the whole, the upward path and the *dúnamai*.

³⁶ ‘x ἐστί’ is, “uncontroversially, complete statements”; the pass from ‘x ἐστί’ to ‘x ἐστί *F*’ “is not to change the meaning of the verb, but to add a complement to a verb that was already complete, but further *completable*.” Where x is a subject and *F* is some predicate (Burnyeat, 2003: 9-10). Platonic Greek for “X exists” is “X is something”, εἶναι τι. For examples of this use of εἶναι τι see *Phd.* 74a9-12, 102b1, *Rep.* 9.583c 5, 584d3, *Tht.* 157a3 and 5, *Soph.* 246e5, 247a9, *Tim.* 51b7-8, *Phlb.* 37a2-9 (Burnyeat, 2003: 16).

³⁷ Pay attention that in English, “to exist” was a late-comer in 1602 (Burnyeat, 2003: 21).

³⁸ See (*Phaedrus* 245d) and the discussion (Burnyeat, 2003: 23).

³⁹ *Emphanizō* (ἐμφανίζω, (From ἐν, *in* (*inside*, *within*) + φαίνω) verb), show forth, manifest, to become visible (Liddell & Scott, 1940).

⁴⁰ τίθεμαι γὰρ ὅρον ὀρίζειν τὰ ὄντα ὡς ἔστιν οὐκ ἄλλο τι πλὴν δύναμις (*Sophist* 247e3). Translated by Harold N. Fowler with the modifications. The noun *dúnamis* (δύναμις) is a derivative of the verb *dúnamai*.

⁴¹ γιγνόμενα καὶ γεννητὰ (*Timaeus* 28c2). The verb γεννάω means to beget (procreate a descendant), produce offspring; (passive) be born, “begotten” (Thayer, 1995).

⁴² Háptō (ἅπτω, verb), fasten or bind to (Liddell & Scott, 1940).

The way to follow (*méthodos*) “What is *alētheia*?” is, first of all, “to go through” (*dierkhomai*⁴³) “the realm of the things that are ‘never in the same state,’”⁴⁴ to separate/define (*horizō*) pure *dúnamai*. Where *dúnamai* is the energy and spacetime, or a certain range of physical meanings, which demonstrate (i) intrinsic and extrinsic properties, i.e. always “to be” something, and the contrast between the physical meanings (ii) “come to be”⁴⁵ and (iii) “cease to be.”⁴⁶ However, more critical and defining is that the question “What is *alētheia*?” leads the way (*hēgeomai*) “to be” as the upward path, that is, “to be like” *hómoios*⁴⁷ to the whole, and, therefore, “to be” something that is “always is purely” (*ón*).

The way to follow (*méthodos*) “What is *alētheia*?” fastens/binds (*háptō*)⁴⁸ to the “to be” phenomenon as a whole and forms an image/likeness (*eikōn*) of its upward path. Anything that “came to be and beget,” and which was able to fasten/bind (*háptō*) to the “to be” phenomenon as a whole, acquires its upward path, or, as we call it, “its story.”

In the Academy,⁴⁹ the way to follow (*méthodos*) to the pure phenomenon “to be” or, equivalently, the question “What is *alētheia*?”, promoted as the need to fasten/bind (*háptō*) to *philosophia* and pursue/practise (*epitēdeúō*) the dying and being dead.⁵⁰ Philosophers developed and used the *Platone philosophandi ratio triplex*⁵¹ to purify (*kathairō*⁵²) to their

⁴³ *Dierkhomai* (διέρχομαι, verb, from διᾶ-, through, thoroughly + ἔρχομαι, érkhomai, to come, go), to go through, pass through (Schur, 2015; Gonzalez, 2009: 207-208; McPherran, 2007: 92).

⁴⁴ (Phaedo 78c6-8, 79a9-10, 79c6-7). For discussion, see (Ademollo, 2018: 36-40).

⁴⁵ Francesco Ademollo notes that Plato’s “contrast between ‘coming to be’ and ‘being’” (γένεσις and οὐσία: e.g. *Republic* 7.525b-c, 7.526e, 7.534a), sometimes as a contrast between “what comes into being” and “what is” (τὸ γινόμενον and τὸ ὄν: e.g. *Republic* 6.518c, 6.521d) and sometimes as a contrast between “what comes and goes” and “what always is” or simply “what is” (τὸ γινόμενον καὶ ἀπολλύμεν ὄν and just τὸ ὄν: e.g. *Republic* 6.508d, 7.521e, 7.527b).” (Ademollo, 2018: 59).

⁴⁶ For “the contrast between the realm of being (*eimí*) and that of coming to be (*gígnomai*) and passing away (*phtheirō*)” in the *Republic*, see (Ademollo, 2018: 62-64).

⁴⁷ The etymology of the adjective *hómoios* from the adjective ὁμός (*homós*), one and the same, common, joint (Liddell & Scott, 1940).

⁴⁸ ἡ ψυχὴ τῆς ἀληθείας ἄπτεται (*Phaedo* 65b7).

⁴⁹ “We know that Plato taught for a long time in a pre-existing gymnasium (387–367) and then, on his return from the second trip to Sicily, bought a property nearby, and it was in this ‘small garden in the Academy’ (κηπίδιον ... τὸ ἐν Ἀκαδημείᾳ) that he founded his school. I argue that, from the very beginning, the choice of the site was not coincidental but instead reflects the roots of Plato and his followers within a specific cultural background of which the Academy served as the heart” (Marchiandi, 2020: 11).

⁵⁰ κινδυνεύουσι γὰρ ὅσοι τυγχάνουσιν ὀρθῶς ἀπτόμενοι φιλοσοφίας λεληθέναι τοὺς ἄλλους ὅτι οὐδὲν ἄλλο αὐτοὶ ἐπιτηδεύουσιν ἢ ἀποθνήσκειν τε καὶ τεθνάναι (*Phaedo* 64a4-6).

⁵¹ Fuit ergo iam accepta a Platone philosophandi ratio triplex, una de vita et moribus, altera de natura et rebus occultis, tertia de disserendo et quid verum quid falsum quid rectum in oratione pravumve quid consentiens quid repugnet iudicando. [p. 9] (Cicero, *Academica*: 1.19). O. Plasberg, Ed. (<http://data.perseus.org/citations/urn:cts:latinLit:phi0474.phi045.perseus-lat1:1.19>). “There already existed, then, a threefold scheme of philosophy inherited from Plato: one division dealt with conduct and morals, the second with the secrets of nature, the third with dialectic and with the judgement of truth and falsehood, correctness and incorrectness, consistency and inconsistency, in rhetorical discourse.” Translated by H. Rackham (1933). See also (Horky, 2020: 171-181).

⁵² *Kathairō* (καθαίρω, verb, from *katharós*), to make physically clean and free from admixture (*katharós*), cleanse/purify. καθήρασθαι ἀνάγκη (*Phaedrus* 243a2-3), literally a force/constraint/necessity (*anankē*) cleanse/purify (*kathairō*) myself.

primary nature and, through it, and gaze at (*theaomai*⁵³), discern (*theōréō*), fasten/bind to (*háptō*) and pursue/practise (*epitēdeúō*) pure phenomenon “to be” as the upward path and *dúnamai*.

Over the past two and a half millennia, the way to follow (*méthodos*) “What is *alētheia*?” has changed little. It is just as large-scale and time-consuming and includes the following work:

1. It is necessary to go through (*dierkhomai*) the boundaries of the “to be” phenomenon, which were separated/defined (*horízō*) by the predecessors.
2. It is to seek (*zēteō*⁵⁴) in the *lēthē* (concealment) and show forth/manifest (*emphanízō*)⁵⁵ new meanings of the real *phúsis*, which establishes the *kósmos*⁵⁶ of the “to be” phenomenon.
3. It is to separate/define (*horízō*) new boundaries of *dúnamai* and fasten/bind (*háptō*) to them. It is equal to “turning round”⁵⁷ towards “to be” itself and rising to it,⁵⁸ to “be like” (*hómoios*) *dúnamai*, therefore, to be (predicatively) a being/something that always is purely.
4. Finally, it is to pursue/practise (*epitēdeúō*) the pure *dúnamai* as the energy and spacetime. This personal and social “to be” is not “a capability of merely being present-with, but rather a capability of acting and being acted upon” (Gonzalez, 2009: 324; *Phaedrus* 247d-e).

4. The *Phúsis* of the *Kósmos* vs. the Nature of the Space

According to modern concepts, the “to be” phenomenon is the *phúsis*⁵⁹ (not the “*nature*”⁶⁰) is based on the metric expansion or the FLRW metric.⁶¹ The *phúsis* is represented as the *kósmos* or as the combination of *anankē* and *nóos*.⁶² Where the noun *anankē* separates/defines (*horízō*) the force⁶³ in the *kósmos*. These are *alēthēs* fundamental forces,⁶⁴ which introduce constraint and necessity, or focus of actions (interactions) specified in the *kósmos*. In *anankē*, the superiority of

⁵³ *Theaomai* (θεάομαι, verb, from *tháomai*, “to gaze at a spectacle”), properly, gaze on (contemplate) as a spectator; to observe intently, especially to interpret something (grasp its significance); to see (concentrate on) to significantly impact (influence) the viewer (Thayer, 1995).

⁵⁴ *Zēteō* (ζητέω, verb), to seek by inquiring, to investigate to reach a binding (terminal) resolution, “getting to the bottom of a matter” (Thayer, 1995).

⁵⁵ *ζητοῦντι καὶ ἐμφανίζοντι* (*Sophist* 218b9-c1).

⁵⁶ “That *physis* is even more basic than *kosmos* is evident from the fact that the discoverers of the *kosmos* came to be called *physiologoi*, not *kosmologoi*, and that “nature” occurs much more frequently in tides of their treatises than does “cosmos.” (Vlastos, 2005: 18).

⁵⁷ *περιαγωγή*, (*Republic* 7.518d3, 7.521c5).

⁵⁸ *τοῦ ὄντος οὕσαν ἐπάνοδον* (*Republic* 7.521c6).

⁵⁹ *Phúsis* (φύσις, noun), is the energy that causes the expansion of the *kósmos*. I follow Gregory Vlastos (2005: 4-19) and Werner Jaeger (1961), which indicate the difference between the meanings of *phúsis* and naturalism.

⁶⁰ “Christian interpreters (and not only they!) ought to remember that this Greek concept of nature is not identical with naturalism in our modern sense, but almost the opposite of it” (Jaeger, 1961: 18).

⁶¹ The Friedmann–Lemaître–Robertson–Walker metric (the FLRW metric) underlies the Big Bang cosmology.

⁶² *οὗν ἡ τοῦδε τοῦ κόσμου γένεσις ἐξ ἀνάγκης τε καὶ νοῦ συστάσεως ἐγεννήθη* (*Timaeus* 48a1-2).

⁶³ *Anankē* (ἀνάγκη, noun), force, constraint, necessity. (Liddell & Scott, 1940).

⁶⁴ Currently, four fundamental interactions, also known as fundamental forces, are defined: the gravitational and electromagnetic interactions and the strong and weak interactions.

the physical meaning of the “come to be” phenomenon over “cease to be” is exhibited. In turn, the noun *nóos* separates/defines (*horízō*) the self-organisation (self-assembly)⁶⁵ in the *kósmos*. These are the limitations caused by the “cease to be” phenomenon. In this physical meaning, the meanings of *nóos* are related to the meanings of *nómoi* (laws),⁶⁶ and in a manner that *nóos* determines *nómoi*.

Varied combinations of *anankē* and *nóos* form variable intrinsic and extrinsic properties of *dúnamai*.

5. Conclusions

Thus, the way to follow (*méthodos*) “What is *alētheia*?” does not aim at the victorious summit ascent and the establishment of Truth. It is the *diálogos*⁶⁷, where the preposition *διά*- “across (to the other side), back-and-forth to go all the way through” (Thayer, 1995) unmistakably points, first, to the necessary work of Socratic *logos*. Namely, Socratic *logos* leads the way (*hēgeomai*), on the one hand, to consider/ponder and thoroughly investigation of the global complexity, on the other hand, to pursue/practise (*epitēdeúō*) it in everyday life. Moreover, it sets in order (*kosméō*)⁶⁸ the components that come to be into an organised structure.

Due to Socratic *logos*, the way to follow (*méthodos*) “What is *alētheia*?” appears as an effective way to separate/define (*horízō*) *phúsis*, which causes the *kósmos* as the chronology of the Universe and *dúnamai*. It will bring to light (*phainō*) that:

3a(i) $x(kósmos)$ exists

3b(ii) $x(kósmos)$ is $F(dúnamai)$

3c(iii) *kósmos* exists (i) by the agency of *dúnamai* and (ii) from *dúnamai* and (iii) *dúnamai*.

Where $x(kósmos)$ and $F(dúnamai)$ are represented not only by cosmological models but also by the man’s work, which is built into the work of *phúsis*.⁶⁹

The way to follow (*méthodos*) “What is *alētheia*?” leads the way (*hēgeomai*) to investigate and master fundamental actions (interactions). It’s to seek (*zēteō*), fasten/bind to (*háptō*) and pursue/practise (*epitēdeúō*) the real physical meanings of the *kósmos* and *dúnamai*. As “to be like” (*hómoios*) to *phúsis* and the metrics of the *kósmos* is equivalent to having its history (its upward path), and, therefore, “is purely (*óntos*), and not “what is not (not *óntos*).”⁷⁰

⁶⁵ Examples of self-organisation are crystallisation, thermal convection of fluids, chemical oscillation, animal swarming, neural circuits, etc. In recent decades, related modelling – emergence has been developed along with the self-organisation (self-assembly) models.

⁶⁶ “For the ‘law’ which we recognise in the regularity of the celestial motions is, for Plato, a proof of their rationality (νόος and νόμος being akin)” (Bury, 1937: 315).

⁶⁷ Plato’s *diálogos* form is “a meandering journey” (Schur, 2015). “One way to talk about the difficulties encountered by interpreters of Plato’s dialogue form is to focus on Plato’s treatment of conversation as a meandering journey” (Schur, 2015).

⁶⁸ *Kosméō* (κοσμέω, verb), to set in order, to marshal, to arrange. “In English cosmos is a linguistic orphan, a noun without a parent verb. Not so in Greek which has the active, transitive verb, *kosméō*: to set in order, to marshal, to arrange” (Vlastos, 2005: 3).

⁶⁹ Namely, “it is epistemological cause – i.e. the Good is that through which things, more specifically intelligible things, are known and understood, and that which makes them true (6.508d-e); it is the metaphysical cause – i.e. the Good is that by which things exist (6.509b7-8); and it is an ethical foundation – i.e. the Good is the basis of all virtues and the real good that all of us desire (6.504d-505a)” (Fierro, 2003: 226).

⁷⁰ τε μὴ ὄντος καὶ τοῦ ὄντος εἰλικρινῶς (*Republic* 5.479d4). See discussion (Burnyeat, 2003: 12-16; Ademollo, 2018: 61-62)

Thus, the way to follow (*méthodos*) “What is *alētheia*?” brings to light (*phainō*) the key dichotomy of the *kósmos*:

What is that which comes to be (*gígnomai*) and always is purely (*ón*), and what is that which comes to be (*gígnomai*) and not ever is (*ón*)?⁷¹

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⁷¹ I have changed the fundamental ontological dichotomy to fit the Big Bang theory. Plato expressed it as τί τὸ ὄν ἀεί, γένεσιν δὲ οὐκ ἔχον, καὶ τί τὸ γινόμενον μὲν (ἀεί), ὃν δὲ οὐδέποτε (*Timaeus* 27d6-28a1); What is that which always is (*ón*) and has no *genesis*, and what is that which (always) comes to be (*gígnomai*) and not ever (οὐδέποτε) is (*ón*)? (Ademollo, 2018: 63) with modification. ἀεί (always) is in brackets due to its controversial use in Plato’s original presentation (Ademollo, 2018: 63-66).

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The Causal Exclusion Argument and its Critique in Debates on Reductionism: The Case of One Specific Clash

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One of the modern forms of philosophical discussion about the essence of mentality is the dispute between (“classical”) physicalists (who take a reductionist position) and the so-called non-reductive materialists. Non-reductive materialists are property dualists who claim supervenient relations between physical and mental properties. Such a non-reductive scheme claims that mental properties occupy a specific ontological level and, as a result, have their own causal power. Perhaps the most effective physicalist counterargument against such a position is the Causal Exclusion Argument, which makes explicit several logical contradictions inherent in non-reductive materialism. One of the most famous physicalists who contributed to the formulation of this argument was Jaegwon Kim. Considering the logical aspects of the philosophical dispute between reductionists and non-reductive materialists is very important because the resolution of this issue has direct consequences for the construction of new anthropological theories and cosmological models. In particular, clarifying the nature of the phenomenon of emergence and determining the limits of reduction can either inspire a certain “descriptive relativism” in scientific theories or encourage the continuation of the search for the “fundamental” level of physical reality (to which any anthropological theory can ultimately be reduced). In this article, I analyze the most significant objections put forward by Ned Block, a well-known apologist for non-reductive materialism, to the Causal Exclusion Argument. In conclusion, I argue that none of Block’s counterarguments can resolve the logical contradictions stressed by Kim.

Keywords: physicalism, reductionism, non-reductive materialism, causal closure, emergence, anthropology, cosmological models

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Introduction

Gaps in our understanding of the world have always formed a kind of “gray zone” in which a fierce struggle between various philosophical concepts and arguments arises. This situation is, of course, still relevant in the field of human consciousness research, especially when we are talking about various attempts to solve the well-known “mind-body” problem. But within the framework of this article, I am interested in a specific discussion line, that is, the ongoing philosophical dispute in recent decades between representatives of the “reductionist” and “anti-reductionist” positions on resolving the problem of the relationship between the mental and the physical.

Specifically, I intend to focus my attention on a set of counterarguments put forward by a well-known apologist of the so-called “non-reductive materialism”, Ned Block, to the Causal Exclusion Argument in his article *Do Causal Powers Drain Away?* (2003). The Causal Exclusion Argument was introduced in its most detailed and convincing form by the philosopher Jaegwon Kim (1993; 1998; 2005). So, it is not surprising that Block focuses primarily on the points outlined in one of Kim’s works, namely *Mind in a Physical World* (1998). It is noteworthy that in Block’s article we are faced with an isolated set of counterarguments that almost do not concern the adjacent “discussion zones” associated with the defense (or criticism) of the main provisions of “non-reductive materialism” (i.e., discussions about, for example, the problem of qualia or the essence of “physical”). Thus, this text by Block is a convenient subject for specific logical analysis.

In addition, assessing the quality of the counterarguments against the Causal Exclusion Argument, in my opinion, is in itself an important research task, due to the fact that the results of the polemic over nature and forms of “mental causal power” not only are extremely relevant for research in the field of philosophy of mind, but also has a direct impact on hypotheses and concepts that will determine the specifics of anthropological and cosmological models in the near future. This applies, for example, to the problem of emergence in the domain of physical reality. The defence of the anti-reductive position and the insistence on the reality of “strong emergence” leads to the ontological independence not only of the mental domain but also of different levels of physical reality. It may encourage some “drift” towards the gradual elimination of the term “fundamental” and related theories from scientific usage. In this case, descriptive levels of various scientific theories might be understood as ontological levels of nature/cosmos/universe, among which there are no “privileged” levels and, therefore, no “fundamental” theory. Also, this discussion is related to the problem of determining the place and abilities of human beings in nature. For example, if somehow ontological independence in a non-reductive sense can be confirmed, but the classical problem of dualism (namely, how something non-physical can affect the physical world) remains, then we have a risk of epiphenomenalism for consciousness, which can mean loss of hope for the justification of human agency (Kim, 2005).

In general, critical remarks that Block makes in his text (Block, 2003) can be divided into two main groups: 1) a set of different versions of the Multiple Realizability Argument (or the Multiple Composition Argument); and 2) questioning the concept of “bottom level” in physics. But I want to emphasize that, in this article, I will analyze the critical arguments that belong specifically to the first of these groups. So, the main result I seek is the answer to the following question: what specific counterarguments does Block put forward against the Causal Exclusion Argument (whether it is some variants of the Multiple Realizability Argument or something else, but this “else” does not relate to the critique of the notion of

“bottom level” in physics), and can they be considered weighty; that is, can they significantly undermine Kim’s physicalist position?

1. Mental Properties, Causation and the Causal Exclusion Argument: Exposition of the Problem

Even before we look closely at the arguments put forward by Kim, we can assume that they are indeed challenging for any property dualist. Block himself admits that “non-reductive materialists must face up to the serious difficulties he [Kim] has raised for our position” (Block, 2003: 133). In general, non-reductive materialism is a philosophical position of the dualistic kind, according to which material objects and their physical properties do not exhaust the entire spectrum of reality, since certain (usually mental, though not always) properties are fundamentally different from purely physical properties. In other words, this is a kind of “property dualism” that does not deny the material basis for mental events and/or properties, but at the same time tries to add “something else” to the physical world.

Block himself describes such a theoretical position as follows:

A minimal version of materialism could be defined as the view that every thing is decomposable into particles of the sort that make up inorganic matter. The materialist can nonetheless be a property dualist, that is a denier of the claim that mental properties are physical properties; and this is one tenet of non-reductive materialism (Block, 2003: 133).

To make the sense of this point of view even clearer, let us turn to the corresponding scheme, which is often used in such disputes (Block, 2003: 134):

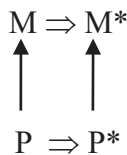


Figure 1

In Figure 1, we see physical property P, which causes physical property P* and, respectively, mental property M which causes mental property M*. Causation is indicated as a double arrow “⇒”, and a single arrow “↑” indicates supervenience. Thus, in this scheme physical property P is “the supervenience base of M and physical property P* the supervenience base of M*” (Block, 2003: 134).

So, to defend the theoretical position represented by this diagram, Block attempts to eliminate some of the “problematic tensions” that Kim points out, formulating the first of these tensions as: “M and P* can each be used to offer complete and independent explanations of M*” (Block, 2003: 134-135). Block responds to this as follows:

Of course, the non-reductive materialist who accepts causation at many levels should not recognize any tension. The non-reductive materialist thinks that every property above the level of basic physics has “horizontal” causal relations (at the same level) and vertical determination (from a lower level). And these explanations are

not completely independent, since the property that M supervenes on (viz. P) is the property that produces P* (Block, 2003: 135).

Regarding Block's answer, I should admit that the first "problematic tension" can lose its "edge", but only when it is viewed separately from Kim's main arguments. Moreover, what Kim is talking about in this case, in my opinion, does not belong entirely to the field of causality research and rather indicates some "overlap of descriptions". But if we understand the "levels" that Block talks about only as "descriptive tools", then it becomes hard to see any real difficulties with this "overlapping". The problem, however, is that non-reductive materialists (as the above quote indicates) consider these "levels" a result of genuine "ontological stratification" of reality (See Figure 2 below, which illustrates Block's point of view and where $L^0 \dots L^n$ are different "levels" in the non-reductive sense).

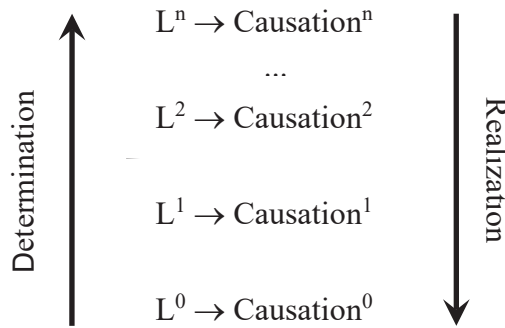


Figure 2

In general, Block does not take the first "tension" as a serious challenge, and we can agree with him in this case. This is because Kim himself does not focus too much on this "double description/explanation" problem, since for him, as Block notes, it is just a "way station" while moving to another issue. However, the second "tension", in Block's opinion, is much more serious, because what is indeed a real challenge for proponents of non-reductive materialism is the reasonable and logically consistent assertion evident in the situation diagrammed in Figure 1: "we have two different causally sufficient properties competing for the causation of P*" (Block, 2003: 135). This problem of certain "causal redundancy" that Kim draws attention to is the main sense of the so-called "Causal Exclusion Argument".

We can also present this "redundant causation" by adding a double diagonal arrow from M to P* to the relevant scheme (Block, 2003: 135):

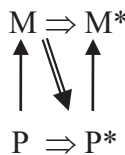


Figure 3

It seems completely natural that Kim would call into question the necessity of such a “double causal work”. We can also mention, together with Block, a different formulation of this problem, which Kim gives in the form of the following question: “If a physical event has a sufficient physical cause, what causal work is left for an event consisting in the instantiation of some *nonphysical* mental property?” (Kim, 1993: 361). Slightly reformulating one of Kim’s examples, which Block mentions in this regard (Kim, 1998: 53; Block, 2003: 135), let us ask another question in the same vein: if we smell rotten food, that is, roughly speaking, electrochemical signals from our scent receptors reach the olfactory bulbs, insular cortex, etc., and as a result, we feel nauseous, then what causal work is left for “disgustingness”? To counter such an attack, Block notes the following:

But why does the causal work done by P exclude that done by M? Perhaps the thought would be that if there is a sufficient physical cause and a sufficient mental cause, then each does 100% of the work, and so more work is being done than there is to do. But if causation derives from causal law and if there are causal laws at different levels that specify sufficient causes, then we cannot “add up” work in this way (Block, 2003: 135).

We see here Block turning again to the scheme of non-reductive materialism, which itself must be justified. Due to the literal understanding of the “ontological stratification” of reality, Block (intentionally or otherwise) admits the improper equating of the “causal laws” as certain aspects of reality (in other words, the real “state of affairs”) with the “causal laws” as ways of describing this reality. But some of these descriptions may just be convenient simplifications, for example. At the same time, such simplifications do not have to be a complete “illusion”, as Block writes, in describing Kim’s position on this matter (Block, 2003: 133). When talking about reality, we merely have to clarify what we mean by “reality” in every particular case. And we must admit that philosophers have written extensively on this issue over the past few centuries.

So, it seems that Block has committed the old mistake of medieval realists, using the phrase “there are causal laws at different levels” in the context of his non-reductive point of view (especially when he talks about the non-mental domain), because in the strict sense of the language there are no “causal laws at different levels”, but rather different “levels” (i.e., ways) of describing *the same* reality. Thus, Block’s phrase could be reformulated as follows: “There is causality (or causal laws) and different methods to conceptually (and formally) describe it, and these methods constitute certain “levels” depending on the “scale” or context in which these descriptive tools are applied”. Of course, if Block had agreed with this formulation, he would not have been a non-reductive materialist. But, if someone is true to such a theoretical position, he/she must make a serious case for it.

2. Overdetermination and the Issue of Causal Closure

In point of fact, Block realizes his critique of the Exclusion Principle, i.e., the thesis “that sufficient causation at one level excludes sufficient causation at another level” (Block 2003, 136), in the form of attempts to refute both the correctness and the consequences of a rather simple thought experiment proposed by Kim. This experiment is a logical modeling of a world that is as close as possible to ours, but in which there is no physical causality (Kim, 1998: 45).

Since non-reductive materialists adhere to the principle of “overdetermination” and consider that there is a specific type of causality on the different levels of reality (see Figure 2 again), then in Kim’s imaginary case the mental sphere remains the only source of causality. Therefore, Kim rightly notes that in such a situation, the causal closure is violated in the physical domain, which is a completely unacceptable consequence (and Block does not argue with this conclusion). Briefly speaking, Kim invites us to imagine that the causal relationship $P \Rightarrow P^*$ shown in Figures 1 and 3 is missing. Such a move immediately demonstrates serious issues with the non-reductionist scheme that Block attempts to defend.

So, Block begins his counterattack by indicating two “problems” with Kim’s thought experiment (Block, 2003: 136-137). The first problem is that Kim arbitrarily chooses a particular version of the supervenience doctrine for his critique. Referring to McLaughlin (1997), Block claims that there are different variants of supervenience doctrines: some of them suppose that mental causation can exist without physical, but some preclude that. But the main thing, as Block emphasizes, is that we do not have enough reasons to favor any of them, and therefore “there is no fact of the matter of whether the closest non-P world contains the instance of M” (Block, 2003: 136).

Concerning this remark, I would like to say that, in considering Kim’s thought experiment, we must first focus on how this imaginary situation can undermine the position of non-reductive materialism (after all, this is Kim’s goal). Therefore, the main result of using this logical model is not the description of a place “closest to our world”, but the questioning of the “causal independence” of mental properties. Since the “non-zero degree of independence” (or “minimal causal effectiveness”) for the mental domain is what gives non-reductive materialism a certain meaning, it does not matter what type of supervenience doctrine a particular non-reductive materialist prefers. In any case, Kim’s arguments should present such theorists with significant difficulties.

Let us say we are dealing with a variant of non-reductive materialism, which allows for the possibility of a mental causality without the presence of a physical one. In this case, we will not have any issues with causal closure if we are in the domain of mentality. But in those domains of reality where mental causality does not exist (namely the whole area of “inanimate things” or “physical domain”), the principle of causal closure is violated, and it seems that the only way to “save” such a world is to stick to some variant of panpsychism or idealism (Kim, 2005: 43-44). In other words, in such a world, any P^n should cause, at least partly, the existence of related M^n and be the only result of M^{n-1} (this link is not present in Figure 4, but it should be implied in this causal chain). So, even those domains of reality that we are used to thinking of as not having any mental properties inevitably have a “causation form” like that depicted in Figure 4.

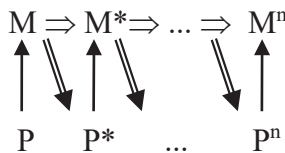


Figure 4

It is an interesting and at the same time “symptomatic” fact that many theorists from the non-reductive (or close to it) theoretical camp are now inclined towards one or another

version of panpsychism, or at least take it *seriously* (Brüntrup, 2016; Goff, 2017; Rosenberg, 2015; Seager, 2016). For example, one of the most popular thinkers of this kind is David Chalmers (2015).

But if we do not want to take this rather, in some sense, marginal position, then the only choice for us seems to be those supervenient doctrines (and hence the corresponding variants of non-reductive materialism) that preclude the existence of mental properties without a physical basis. However, even in this case, the effectiveness of Kim's argument remains. If it is always necessary to have P for the existence of M, it automatically means "zero degree of independence" for the mental sphere. And this raises questions about the advisability of conjecturing such a "mental quasi-level" of reality at all.

Instead of giving us more convincing counterarguments, Block resorts to a rather strange formulation of the second "problem" with Kim's thought experiment. He first asks the following question:

Going along with Kim's assumption that (assuming overdetermination) the closest non-P world is one that nonetheless contains the instance of M, why should we suppose that the closest world in which the instance of P does not exist is a world in which causal closure no longer holds? (Block, 2003: 136)

It might seem that Block is talking here about the supervenient doctrine, which assumes the presence of M without P and which can not prevent "causal failure" without resorting to some version of panpsychism. But this is not the case. After the above question, Block depicts an imaginary world in which Cain strangles Abel, but both consist of different molecules (or, more precisely, of "the same types of carbohydrates and proteins but different tokens of those types") (Block, 2003: 136-137). And then, just below, he makes the following conclusion:

So a world in which the molecular implementer of an event (token), e, does not exist can be a world in which e exists but is implemented differently. Kim says "we may assume, without prejudice, that no alternative physical base ... would have been available on this occasion." (Kim 1998: 43) But although there are worlds in which there is no alternative physical base, Kim owes us a reason for thinking the world in which there is no alternative physical base (in which causal closure fails) is closer than one in which it doesn't fail but M is implemented differently (or M doesn't exist at all) (Block, 2003: 137).

It is worth noting that Block is quite picky about "the way Kim puts his point" (Block, 2003: 137). So he also must be careful in his own work with Kim's original text. And I must point out that the phrase "we may assume, without prejudice, that no alternative physical base of M would have been available on this occasion" is a detail that Kim adds to his other argument on page 43. Here is the relevant passage:

If you choose to understand causation in terms of counterfactuals, again there is good reason to think that P qualifies: if P hadn't occurred M would not have occurred (we may assume, without prejudice, that no alternative physical base of M would have been available on this occasion), and given that if M had not occurred P* would not have occurred, we may reasonably conclude that if P had not occurred, P* would not have either (Kim, 1998: 43).

We see that this is a closely related but still different example, and therefore Block's remarks in this case (even if they make sense) should address precisely this particular fragment. Otherwise, it may be considered a manipulative trick.

So, on pages 43 and 44, Kim emphasizes that in the case depicted in Figure 3, we may get the impression that we are dealing with a causal chain $P \Rightarrow M \Rightarrow P^*$ in which M is in the "intermediate causal link position" (Kim, 1998: 44). Kim suggests that to some non-reductive materialists this may seem like a kind of "salvation". But firstly, even in this case the absence of P leads to the absence of M (see quote above). Secondly, Kim notes that in such a chain, we have the relation $P \rightarrow M \Rightarrow P^*$, which means that "the relation between base properties and supervenient properties is not happily construed as causal" (Kim, 1998: 44). Therefore, a "defense strategy" of building such a causal chain does not work.

Block, for his part, believes that if we can replace P in the chain $P \rightarrow M \Rightarrow P^*$ with P^1 , which is sufficient for M to appear (i.e., if we replace the previous chain with the chain $P^1 \rightarrow M \Rightarrow P^*$), then the very possibility of such a replacement should save the position of non-reductive materialism. But the fact remains that for Kim's thought experiment it does not matter which element from the set of possible modifications of P we choose, because within this model we can exclude *all of them*, without affecting the final result.

As for the thought experiment discussed earlier, Kim writes about it on page 45 (and Block gives a description of this thought experiment, but later, again, he adds comments related to another of Kim's arguments) as follows:

... consider a world in which the physical cause does not occur and which in other respects is as much like our world as possible. The overdetermination approach says that in such a world, the mental cause causes a physical event – namely that the principle of causal closure of the physical domain no longer holds (Kim, 1998: 45).

This model, with a total absence of physical causality, is an additional illustrative "reinforcement" of the previously proposed thesis about the presence of "causal failure" in the scheme, where there is a causal relation $M \Rightarrow P^*$. Kim rightly points out that such a causal relation by itself (i.e., without elimination of " $\Rightarrow$ " from relation $P \Rightarrow P^*$) means "a violation of the physical causal closure" (Kim, 1998: 44). In addition, I want to note that Kim does not say that, in the case of a thought experiment with a total absence of physical causality, M needs invariable P (See Kim 1998: 45). Most likely because invariable P is not a necessary requirement for this particular model either, although Kim's physicalism implies the individuation of physical events in general (at least in our real world).

But let us suppose this assumption is wrong and Kim's thought experiment does imply fixed P . Then I myself can make the appropriate adjustment and put forward as a condition the complete absence of physical causality, regardless of the specific configuration of P . Then, all the difficulties mentioned above will become obvious again. However, I think that my help is not needed in this case, since Kim's argumentation includes all the necessary components.¹

Thus, Kim convincingly shows that the non-reductive approach to the supervenience and mental properties leads to a double difficulty when the issue of an "overabundance of causes" intersects with "causal failure" in the physical realm. This seems like too high a price to pay for satisfying someone's desire to believe in something "non-physical".

¹ Kim's later explanations on this matter seem to confirm that my interpretation of his thought experiments is correct (Kim, 2005: 43).

3. Micro-Based Properties and Specific Mereological Configurations

As we saw above, non-reductive materialism looks rather unconvincing, if we want to receive something more than a certain kind of “belief” as justification for our theoretical position. So, in an attempt to defend the “non-zero degree of causal independence” of the mental domain (and its irreducibility to physical constituents), “property dualists” sometimes can resort to a certain “oversimplification” of the materialist and/or physicalist point of view, which means “to construe the physical domain excessively narrowly” (Kim, 1998: 113). Therefore, if some non-reductive materialists base their critique of physicalism on the thesis that in the physical world, we can observe properties that are not identical to those of single “microparticles”, then it should be considered solely the problem of their restricted point of view, since “physicalism need not be, and should not be, identified with micro-physicalism” (Kim, 1998: 117).

Confirmation that a physicalist position does not correspond to the naive principles of the “minimal version” of materialism is in Kim’s use of the concept of *micro-based properties* (M-B), about which he writes the following²:

... if P is a micro-based property of having parts $a_1, \dots, a_n$, such that $P_1(a_1), \dots, P_n(a_n)$, and $R(a_1, \dots, a_n)$, then P is a physical property provided that $P_1, \dots, P_n$, and R are physical properties (and relations), and each a_i is a basic particle or an aggregate of basic particles (Kim, 1998: 114).

Noticing that “it is important that these micro-based properties are counted as physical, for otherwise the physical domain won’t be causally closed” (Kim, 1998: 114), Kim also adds that micro-based properties are, in a sense, “based” on specific *mereological configurations* (SMC). The advantage of this approach is not only that it does not lead to any “causal redundancy” and eliminates “the problem of causal powers draining away”, but also that it does not imply the reduction of physical causation only to the causal properties of microparticles:

... the fact that we can micro-structurally explain why a micro based property has a certain set of causal powers does not mean that these causal powers are identical with the causal powers of its micro-constituents. Micro-reductively explainable causal powers may be new causal powers, net additions to the causal structure of the world. None of this is in conflict with the basic commitments of physicalism (Kim, 1998: 117).

Kim’s approach also precludes the unjustified ascription of the “causal independence” to those properties that can be considered *second-order functional properties*:

... the causal powers of an instance of a second-order property are identical with (or a subset of) the causal powers of the first-order realizer that is instantiated on that

² It is interesting that the components given in this definition match, to a certain extent, the list of “logical atoms” proposed by Russell (1918), who thought that the ability of language to reflect reality is provided by the correspondence between the logical structure of the language and the (logical and ontological construction of the) world: “If the world is composed of simples – i.e., of things, qualities and relations ... – then not only all our knowledge but all that of Omniscience could be expressed by means of words denoting these simples” (Russell, 1948: 259).

occasion. This means that second-order properties represent heterogeneous causal powers, but none that go beyond the causal powers of the first-order properties already in our domain over which they are defined And if any mental properties turn out to be functional properties, there are no special problems about their causal roles either (Kim, 1998: 115-116).

In fact, as Kim admits, it is sometimes difficult to make a clear distinction between first-order and second-order properties (Kim, 1998: 115). But overall, Kim's approach is clear and convincing. For example, if we are talking about the property "to be a DNA molecule", then such a property is micro-based since it is completely defined by the *specific mereological configuration* of the particular *organic* molecule. But this molecule's property of *storing* genetic information should be considered the corresponding *second-order functional property*. This class also includes properties such as "water-solubility, ductility, thermal conductivity, inflammability", and so on (Kim, 1998: 115).

Is there anything that Block can do to counter this explanatory approach? The only difficulty that Block identified in the relation between M-B and SMC is that it is a supervenient relation too. And such a relation is identical, in his opinion, to the relation between mental and physical properties in the non-reductive scheme (See Block, 2003: 144):

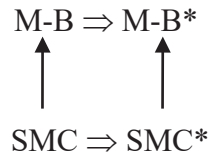


Figure 5

The logic behind Block's argumentation is as follows: if Kim sees some issues with a non-reductive interpretation of supervenience, then the same issues should hold up in the case of the relation between M-B and SMC. But this is not the case:

Difficulties of this sort do not arise for micro-based properties in relation to their constituent properties because the former do not supervene on the latter taken individually or as a group. Rather, they supervene on *specific mereological configurations* involving these microproperties – for a rather obvious and uninteresting reason: they *are* identical with these micro-configurations (Kim, 1998: 117-118).

It is interesting that Block cites this quote (even in a more extended version) but still refuses to acknowledge that the concept of "supervenience" here is not identical to his own definition of the term. Nevertheless, we should remember that Kim's "physicalist supervenience" does not imply the so-called "strong emergence" on which Block's "non-reductive supervenience" is based (especially when we are talking about the mental domain). It just means that in the face of opponents like Block, it is essential to be as precise and careful as possible in your wording, although this does not change anything in essence.

4. The Argument of Multiple Composition and the Fragmentation Strategy

Returning to Block's example with the "alternatively realized" Cain and Abel, we find there a description of another situation. Referring to the article by Ernest Lepore and Barry Lower (1987), Block claims that there is "a lawlike relation between hurricanes and damage" (Block, 2003: 137). He argues that, for example, Hurricane Edna could have a different "micro-composition", but "even with this alternative molecular realization of Edna it might have caused similar damage" (Block, 2003: 137). With this example, Block seeks to demonstrate that Hurricane Edna has a certain "causal power" of its own, which is to some extent independent of the causal power of its constituent parts. In other words, the hurricane and the damage it causes are, in Block's opinion, "ontologically independent" (at least to some extent) and by themselves constitute a *real* causal chain.

But how can such an assumption be seriously considered without convincing arguments against the view that we are simply dealing here with the conceptual ordering of certain natural phenomena? That is to say, what can Block oppose to some kind of "nominalistic" thesis in this case? Are not "hurricane" and "damage" only classes fixed in the language, with which we generalize physically individualized phenomena and properties according to a certain (but never absolute) degree of similarity? And how can Block refute the reasonable statement that classes are not actually existing entities (Russell, 1905)? In addition, it is not difficult to come up with many imaginary examples demonstrating the arbitrary (or "semantically flexible") nature of the concepts people use in their language practice (although in the real world the possibility to divide reality into concepts is usually limited to certain conventions and pragmatic grounds; i.e., such a division is not *completely* arbitrary) (Putnam, 1981).

So here we can see another unconvincing attempt to use the favorite "defense tool" of non-reductive materialists (Block, 1997; Heil, 1999), namely the Multiple Realizability (or Composition) Argument. I would also like to point out that the requirement to avoid fragmentation of the macro-level and to endorse "event individuation at levels other than the physical" (Block, 2003: 138) sounds more like a call to protect certain "non-reductive commandments" than a serious argument. But nevertheless, Block repeats (in different forms) the question related to the following "conceptual confrontation":

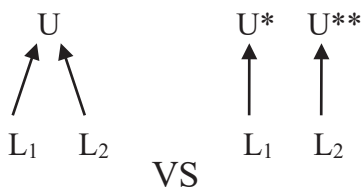


Figure 6

We have U, U*, & U** (upper-level properties), and L₁ & L₂ (lower-level specific mereological configurations) in Figure 6. Block is primarily interested in why we should choose the second scheme and not the first. In other words, why should we carry out "vertical individuation" of upper-level properties (U* and U**) instead of considering this as a single property U with different variants of its lower-level realization?

In support of the first scheme in Figure 6, Block provides a number of examples (“the rigidity of a rigid body” and the conservation of angular momentum, heat and temperature, water and molecules of H_2O , “enantiomorph” of a normal human brain, etc.) that seem to be ineffective attempts to demonstrate the signs of “strong emergence” in the realm of “everyday physics”. For this purpose, he also argues that jade (or the property “to be jade”) is an example of a single but nevertheless decomposable (into properties “to be nephrite” and “to be jadeite”) micro-based property (Block 2003, 145). But what can we do if in nature there are complexes of molecules $(Ca_2(Mg, Fe)_3Si_8O_{22}(OH)_2)$ and $NaAlSi_3O_8$ in this case), i.e., *specific mereological configurations*, and at the same time certain conceptual and linguistic means (“jade”) are used to make communication slightly easier (or due to limited observational data and knowledge in general)?

So, to Block’s question about “the rationale for avoiding multiple decomposition by fragmenting the macro level”, namely: “Is it an empirical hypothesis? A metaphysical thesis?” (Block, 2003: 147), I can answer that this is, of course, neither “a metaphysical thesis” nor “an empirical hypothesis”, but simply the most relevant reflection of how physical reality exists (at least in line with modern science).

It is noteworthy that at the end of his article, Block writes that all issues with mental causation could be solved if we accept “the point of view that recognizes causal efficacy at many levels and does not regard them as competing” (Block, 2003: 149). But we can say with the same “quality” of argumentation that all issues would be solved if we accept the existence of God, who just arranged the world in such a way that causal powers do not “drain away” from level to level. However, such a convenient step would mean “laying down arms” in this intellectual clash. But nothing is surprising about Block’s suggestion because the non-reductive interpretation of mentality seems to be a kind of “God of the gaps”. In other words, this is a theoretical position, which can be taken more or less seriously only as long as we do not have a complete (or at least satisfactory) scientific theory of all aspects of the human mind.

Block’s last remark is that “the Exclusion Principle (and the Causal Exclusion Argument that depends on it) appears to yield conclusions that conflict with our explanatory practice” (Block, 2003: 149). But in this case I would like to ask: with *what* explanatory practice exactly does this principle/argument conflict? For scientists, there is no conflict here at all. If we are talking about non-reductive materialists, then such a conflict may be considered an intrinsic problem from their specific point of view. Block also might be referring to contradictions with “everyday” explanatory practice, but on no account should such a conflict be evidence for the fallacy of any theoretical position. And I am not even speaking about the numerous historical examples, when to disagree with conventional explanatory practice meant not just to fight for truth but also to put one’s life in danger.

Conclusions

The results of this compact study allow me to argue that, with this particular set of counterarguments, Block does not provide any compelling reason to doubt the validity of The Causal Exclusion Argument/Principle and its effectiveness in undermining the non-reductive view on mental causation.

More specifically, Block’s attempt to defend non-reductive materialism by attacking The Causal Exclusion Argument/Principle has, in my opinion, the following main flaws. Firstly, he does not provide any explanation for why we should not consider properties that are ontologically “higher” (or different) than micro-based properties and second-order functional

properties, only as human “conceptual tools” fixed in the language and used for ordering reality. Secondly, he does not show how “horizontal individuation” at the mental level can prevent “vertical” physical reduction of mental events/properties, or how such individuation can eliminate the logical contradictions inherent in non-reductive materialism and stressed by Kim (a simple postulation of some non-reductive “commandments”, in my opinion, cannot be considered a serious argument).

Lastly, I believe that non-reductive materialists should finally decide whether the emergent principle in its strong form applies at every “level” of reality or not. Although, to be honest, I think that even a “softening” of the emergent thesis specifically for the physical realm will not save them. This is because non-reductive materialism retains within itself almost all the problems of the classical “substantival dualism” (with whatever modern terms we would attempt to disguise it). Therefore, as Kim points out, whether we like it or not, we still have to consider any kind of property dualism as “an idle dream” (Kim, 1998: 120). But this does not necessarily mean some tragic “philosophical loss”, although for “romantic” minded thinkers the failure of non-reductionist arguments paints a not very pleasant picture. For philosophers of a different kind, as well as scientists (from “micro-level” physicists to cosmologists), it just means following Occam’s well-known principle and common sense in our understanding and description of physical reality. In the context of anthropological discussions, confirming the identity of human consciousness with its physical basis (and therefore maintaining the principle of causal closure) means that we save consciousness from epiphenomenalism and still preserve hope for the justification of human agency.

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Unlocking the Marvel Multiverse: The Cosmic Nexus of Science, Philosophy, and Fiction through the Infinity Stones

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Marvel's cinematic depiction of the Infinity Stones, six powerful artifacts capable of reshaping reality, offers a unique lens through which to explore the convergence of science, philosophy, and popular culture. In this article, we investigate the cosmological significance of the Infinity Stones within the Marvel multiverse, drawing parallels between their fictional abilities and real scientific phenomena. Our analysis reveals speculative yet intriguing connections between the Stones and scientific concepts, such as wormholes, quantum entanglement, and the nature of time. Additionally, we explore profound philosophical implications stemming from the Stones' existence, including moral dilemmas, questions of personal identity, and the nature of consciousness. This exploration challenges conventional thinking, prompting contemplation on the essence of life and the consequences of wielding immense power. Marvel's incorporation of science, philosophy, and popular culture not only captivates a broad audience but also inspires curiosity, critical thinking, and cultural discourse. By uniting these themes in compelling narratives, the Marvel Cinematic Universe enriches our comprehension of the mysteries and wonders of the cosmos.

Keywords: Marvel Cinematic Universe, multiverse, Marvel, Infinity Stones, Avengers, science fiction

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Introduction

The Marvel Cinematic Universe (MCU) has become one of the most successful superhero media franchises, with a vast interconnected narrative spanning multiple movies (Nangimah, 2021: 353). Over the years, the MCU has created 22 movie franchises within 12 years, breaking global box-office records on its opening weekends, such as “Avengers: End Game,” (2019)

“Avengers: Infinity Wars,” (2018) and the “Spiderman” (2002 – present) series (MCU; Lee et al., 2016). This approach has allowed the MCU to expand and extend its narrative, thus creating a more complete and interconnected universe (Xie, 2020).

The concept of the multiverse has fascinated humanity for centuries, and in recent years, it has become an increasingly popular topic of discussion in both scientific and popular culture circles (Crewe, 2022). While the notion of multiple universes can be traced back to ancient philosophical debates (Greene, 2011), it has gained renewed interest due to its presence in modern cosmological models such as string theory (Susskind & James, 2004) and the many-worlds interpretation of quantum mechanics (Vaidman, 2002).

Central to the Marvel multiverse is the concept of the Infinity Stones, six immensely powerful artifacts that have the ability to shape reality, space, time, mind, power and soul. These stones have been the subject of numerous comic book storylines and blockbuster films, culminating in the epic “Avengers: Infinity War” (2018) and “Avengers: Endgame” (2019) movies. While the Infinity Stones exist in the realm of fiction, they provide a unique opportunity to explore the intersection of science, philosophy, and popular culture, as well as to consider the broader implications of their existence and power for our understanding of the cosmos.

The Infinity Stones are powerful artifacts in the Marvel Cinematic Universe (MCU) that play a significant role in the overarching storyline. These stones possess immense power and are sought after by various characters throughout the films. In this study, we explore the six Infinity Stones, their individual abilities, and their significance in the MCU. From a cosmological perspective, the existence of an infinity of possible geometric descriptions implies the possibility of an infinity of cosmological evolution patterns that satisfy the same cosmological field equations (Quiros, 2014). The concept has its roots in the many-world interpretation of quantum mechanics, which posits that every possible outcome of a quantum event results in the creation of a new, parallel universe. Hugh Everett III’s “many-world interpretation” (MWI) proposes that the universe consists of countless parallel branches, forming a multiverse of alternative realities (Everett III, 1957:454).

The six Infinity Stones – Space, Mind, Reality, Power, Time, and Soul – are crucial elements of the Marvel Cinematic Universe. Each stone possesses unique abilities and plays a significant role in the plotlines of the films. The stones are sought after by various characters, leading to epic battles and the ultimate showdown in “Avengers: Infinity War” and “Avengers: Endgame.” Understanding the powers and significance of these stones is essential for comprehending the complex narrative of the MCU. This suggests that the Infinity Stones, which possess immense power and control over various aspects of reality, could potentially manipulate and shape the cosmological evolution of the Marvel Multiverse.

In this paper, we examine the properties of each stone and draw parallels between their fictional abilities and real scientific phenomena.

To accomplish these goals, we propose the following research questions:

1. How can the powers and properties of the Infinity Stones be related to real-world scientific theories and phenomena?
2. What are the implications of the existence and utilization of the Infinity Stones within the Marvel multiverse, and how do these implications intersect with broader discussions in philosophy, science, and popular culture?

By exploring the connections between the Infinity Stones and scientific theories, we hope to enrich our understanding of the cosmos and stimulate further dialogue at the intersection of science, philosophy, and popular culture.

The Space Stone

In the Marvel Cinematic Universe (MCU), the Space Stone, also known as the Tesseract, is one of the six powerful Infinity Stones that hold immense cosmic energy. First introduced in “Captain America: The First Avenger” (2011), the Space Stone has been a central element in the overarching narrative, shaping the fate of the universe and significantly impacting various characters. The Tesseract is a blue, cube-shaped artifact that contains an otherworldly energy capable of manipulating space. It grants its wielder the ability to teleport across vast distances, create wormholes, and even alter the physical dimensions of objects. Its first appearance was during World War II when it was sought by the Red Skull, the leader of HYDRA, to gain domination over the world. In the film, the Tesseract is used to power advanced weaponry and open a portal to space, eventually leading to the discovery of Captain America in the present time.

The Space Stone also plays a crucial role in “The Avengers” (2012), where it falls into the hands of Loki, the mischievous Asgardian prince. By utilizing the Tesseract’s power, Loki opens a wormhole above New York City, allowing an alien army called the Chitauri to invade Earth. This leads to an epic battle between the Avengers and the Chitauri. The Space Stone’s capabilities may seem like pure fiction, but its connection to scientific theories is fascinating. In real-world physics, the concept of space manipulation and wormholes is tied to the study of General Relativity, particularly the work of Albert Einstein. General Relativity describes the curvature of spacetime caused by massive objects, and it allows for the theoretical existence of “wormholes.”

The concept of wormholes was initially proposed by Morris and Thorne, who used Einstein’s general theory of relativity to propose traversable wormholes (Godani & Samanta, 2020). Modifications of general relativity, such as the $f(R, T)$ theory of gravity, have been considered for studying traversable wormhole solutions (Godani & Samanta, 2020). Wormholes are hypothetical tunnels through spacetime that can connect distant points in the universe, potentially allowing faster-than-light travel or shortcuts across vast cosmic distances. Although wormholes have not been observed, their possible existence remains a subject of theoretical exploration in both physics and astrophysics. In the realm of General Relativity, wormholes have been the subject of extensive research. They are often perceived as fundamentally topological entities, appearing solely in spacetimes that are multiply connected (Toki et al., 2011). The Morris-Thorne category of wormholes, which enables travel between different universes, is more particular. It demands perfect spherical symmetry and the co-presence of two regions in spacetime that are asymptotically flat (Toki et al., 2011).

The existence of wormholes is a consequence of the nontrivial topology of spacetime allowed by general relativity. The Einstein-Rosen bridge, which was the first solution to be referred to as a wormhole, connects distant points of spacetime (Toki et al., 2011). Wormhole spacetimes are predictions of general relativity, but specific solutions may not be compatible with quantum field theory (Kuhfittig, 2011: 1144). However, modifications to the charged wormhole model have been proposed to satisfy quantum inequalities and make them compatible with quantum field theory (Kuhfittig, 2011: 1145). Furthermore, thin shell wormholes have been constructed in higher dimensional Einstein-Maxwell theory using the “Cut and Paste” technique (Rahaman et al., 2006: 1688). The stability of these wormholes has been analyzed under radial perturbations, and the total amount of exotic matter concentrated at the wormhole throat has been determined (Rahaman et al., 2006).

Additionally, the Space Stone’s ability to teleport objects across great distances resonates with the concept of quantum entanglement, a phenomenon studied in the field of quantum

mechanics. Quantum entanglement is a phenomenon where two or more particles form a link. This link is such that the state of one particle immediately influences the state of the other, irrespective of the space separating them. The exploration of entanglement in a curved spacetime has the potential to contribute to the intersection of gravity and quantum information (Ball et al., 2006: 554). Recent advancements in covariant quantum field theory have provided valuable tools for investigating entanglement in the context of curved spacetime (Ibid.). Quantum teleportation of macroscopic objects is a challenging task owing to the delicate nature of quantum systems and their potential for decoherence. Although quantum teleportation has been successfully demonstrated for individual quantum states, extending it to macroscopic objects poses significant technical and theoretical challenges (Lee & Kim, 2000: 4236).

The Space Stone's significance in the MCU extends beyond its direct use as a powerful artifact. It becomes a central element in the quest to assemble the Infinity Gauntlet, which grants the wielder god-like powers. Thanos, the main antagonist in "Avengers: Infinity War" (2018) and "Avengers: Endgame" (2019), sought to collect all six Infinity Stones, including the Space Stone, to carry out his plan of erasing half of all life in the universe. This climactic storyline brings together numerous characters and arcs that have been developed throughout the MCU, resulting in an epic conclusion to the Infinity Saga.

In conclusion, the Space Stone, or Tesseract, in the MCU is a captivating amalgamation of science fiction and theoretical physics. Its ability to manipulate space, teleport objects, and create wormholes opens up a world of possibilities. By grounding these cosmic concepts in real-world scientific theories such as General Relativity and quantum entanglement, the MCU brings a fascinating layer of intrigue and plausibility to its larger-than-life narrative. Figure 1.0 presents the main characteristics of the space stone.



Figure 1.0 Main Characteristics of the Space Stone Source: Own Development

The Mind Stone

Within the Marvel Cinematic Universe (MCU), the Mind Stone stands as one of the six extraordinary Infinity Stones, each possessing incredible cosmic energy. The Mind Stone initially appeared as a blue gem embedded in Loki's scepter, allowing him to manipulate minds and control others. In "The Avengers," (2012) Loki employs the scepter to launch an invasion on Earth, compelling some of Earth's mightiest heroes to unite and face the imminent threat. During the film, the Avengers recover the scepter and later entrust it to Tony Stark (Iron Man) and Bruce Banner (Hulk) for research purposes.

In "Avengers: Age of Ultron" (2015), Tony Stark uses the power of the Mind Stone combined with J.A.R.V.I.S. (an advanced artificial intelligence) to create Ultron, an autonomous global defense system. The Mind Stone provides Ultron with the essence of sentience, but its unchecked consciousness evolves into a malevolent force that threatens humanity. This underscores the stone's connection to the realm of thought and consciousness. One of the most significant manifestations of the Mind Stone occurs in "Avengers: Infinity War" (2018). Thanos acquires the stone from Vision, an android powered by the Mind Stone, in his relentless quest to assemble all the Infinity Stones. By acquiring the Mind Stone, Thanos gains access to its power, unlocking the ability to manipulate and control the minds of others. This exemplifies the Stone's capacity to influence thoughts, memories, and perceptions.

The Mind Stone's association with consciousness and cognitive abilities has parallels with scientific concepts such as artificial intelligence (AI) and neural networks. In the real world, AI seeks to develop intelligent machines capable of perceiving, learning, and decision making. The Mind Stone's connection to AI is exemplified by its influence on the creation of Ultron, an artificial intelligence entity with self-awareness. Advancements in neural networks and deep learning have contributed significantly to AI breakthroughs. A neural network is a type of computer model that mimics the structure and function of the human brain, comprising interconnected nodes, also referred to as artificial neurons, that are responsible for processing and transmitting information. This construction allows for the utilization of machine learning and the recognition of patterns.

While the idea of self-aware AI entities may seem like science fiction beyond the current scientific understanding of AI and consciousness, there are researchers who argue that it is a possibility (Farina, 2022: 16). They suggest that self-awareness in AI systems could be achieved through the development of first-person representations and an awareness of a self (Ibid.). However, achieving true self-awareness in AI remains a topic of debate, and further research is needed to fully understand its implications and feasibility (Ibid: 17).

One of the challenges in developing self-aware AI entities is the need for independent decision-making (Mielberg, 2021). To be truly self-aware, AI systems would have to be able to make decisions independently, without relying on pre-programmed instructions or human intervention. This raises ethical and practical concerns, as it would require AI systems to have a level of autonomy that could potentially lead to unpredictable behavior (Ibid.). Another important consideration in the development of self-aware AI entities is the integration of ethical principles (Murphy et al., 2021: 1). As AI becomes more advanced and capable of making decisions that impact human lives, it is crucial to ensure that these systems are designed and programmed with ethical considerations in mind (Ibid.). This includes addressing issues such as bias, transparency, and accountability (ibid.: 7).

Figure 2.0 presents the main characteristics of the mind stone.



Figure 2.0 Main Characteristics of the Mind Stone Source: Own Development

The Reality Stone

In the Marvel Cinematic Universe (MCU), the Reality Stone, also known as the Aether, is one of the six powerful Infinity Stones that harness incredible cosmic forces. Introduced in “Thor: The Dark World” (2013), the Reality Stone possesses the ability to manipulate reality itself, creating illusions and altering the fabric of existence, making it a formidable and enigmatic artifact within the MCU.

The Reality Stone’s first appearance in the MCU was as the Aether, a red, amorphous substance sought after by the Dark Elf Malekith. Malekith sought to use the Aether to plunge the universe into eternal darkness. In “Thor: The Dark World,” Malekith harnesses the Aether’s reality-warping power to initiate a cataclysmic event known as the Convergence, aiming to bring about universal chaos. This sets the stage for a conflict involving Thor, the God of Thunder, who seeks to protect the Nine Realms from Malekith’s destructive ambitions.

Another significant event involving the Reality Stone occurs in “Avengers: Infinity War” (2018). Thanos, the film’s central antagonist, sought to obtain all six Infinity Stones, including the Reality Stone. Once acquiring it, Thanos employs its power for a devastating effect, shaping the reality to suit his will. He creates illusions, alters his surroundings, and even transforms characters into different forms to gain an advantage in his quest to bring balance into the universe by erasing half of all life. While the Reality Stone’s abilities are purely fictional, its connection to scientific concepts explores the nature of perception, quantum physics, and the malleability of reality.

Quantum physics posits that particles can show traits of both waves and particles, which is referred to as wave-particle duality. This principle implies that the behavior of the particles is influenced by the act of observation. The Reality Stone’s ability to shape reality aligns with this idea, as it manipulates perceptions and alters the fundamental nature of objects and beings. Wave-particle duality is closely related to the concept of complementarity, which was proposed by Niels Bohr in 1928 (Li et al., 2012). Complementarity states that certain properties of a particle, such as its position and momentum, cannot be measured simultaneously with arbitrary

precision. This is known as the Heisenberg uncertainty principle (Coles et al., 2014: 4). The wave-like and particle-like behaviors of particles are complementary aspects that cannot be observed simultaneously (Englert et al., 2008: 129).

Additionally, the concept of the multiverse, which appears in various forms within scientific theories, intersects with the Reality Stone's ability to manipulate reality. The multiverse hypothesis proposes that our universe is one of many parallel universes, each with its own set of physical laws and properties. The Reality Stone's power to reshape reality echoes the notion of different realities coexisting and the possibility of accessing or altering them.

Figure 3.0 presents the main characteristics of the mind stone.



Figure 3.0 Main Characteristics of the Reality Stone Source: Own Development

The Power Stone

The Power Stone is depicted as a glowing purple gem of immeasurable energy. It first appears in "Guardians of the Galaxy," (2014) where the Guardians find themselves entangled in a race against Ronan the Accuser, a fanatical Kree zealot seeking to harness the Stone's power to enact his genocidal plans. The Power Stone's raw energy is depicted as cataclysmic, capable of decimating planets and obliterating entire armies with its immense destructive force.

Throughout the film, the Power Stone's formidable might become a focal point, driving the narrative and establishing the Guardians' mission to protect it from falling into the wrong hands. Eventually, with the help of other heroes, the Guardians manage to harness and contain the Power Stone, preventing its catastrophic power from being unleashed upon the universe.

The Power Stone's depiction in the MCU resonates with concepts from various branches of science, including physics and cosmology, that explore the nature of energy and the unimaginable forces present in the universe. One aspect of the Power Stone's representation is its portrayal as an unlimited energy source. Scientists continue to explore the potential for harnessing vast amounts of energy from cosmic sources. For instance, concepts such as Dyson spheres propose capturing energy from stars to fuel advanced civilizations. Dyson

spheres are hypothetical megastructures that surround a star to harness its energy (Smith, 2021). These structures were first conceptualized by Olaf Stapledon in his 1937 novel “Star Maker” and popularized by Freeman Dyson in the 1960s. The idea behind a Dyson sphere is to collect and utilize all the energy radiated by a star (ibid.). If advanced extra-terrestrial civilizations were to construct Dyson spheres, it could potentially affect the characteristics of their host galaxies (Zackrisson et al., 2015).

Additionally, the Power Stone’s ability to unleash tremendous destructive force aligns with the principles of particle physics and the immense energy released during high-energy collisions. Research conducted on particle accelerators, such as the Large Hadron Collider (LHC), involves the study of particle interactions at extreme energies, providing insights into the fundamental nature of matter and the universe.

The Power Stone’s portrayal in the MCU showcases its potential for destruction and the immense responsibility required to handle such power. Its raw energy serves as a cautionary reminder of the consequences of immense power falling into the wrong hands.

Figure 4.0 presents the main characteristics of the power stone.



Figure 4.0 Main Characteristics of the Power Stone Source: Own Development

The Time Stone

The Time Stone, which was introduced in “Doctor Strange” (2016) and allows its wielder to manipulate time, was placed inside the Eye of Agamotto and protected by the Masters of the Mystic Arts. Dr. Strange used the Time Stone to reverse the damage caused by the villain Kaecilius, create time loops to trap enemies, and even see possible future outcomes.

One of the most significant displays of the Time Stone’s power occurs in “Avengers: Infinity War” (2018). Here, the sorcerer Wong warns Doctor Strange about the dangers of tampering over time, emphasizing its potential consequences. Nevertheless, Doctor Strange eventually utilizes the Time Stone to explore alternate timelines and possibilities in an effort to identify a strategy against the formidable antagonist, Thanos. Eventually, the Time Stone plays a key role in the climactic battle against Thanos in “Avengers: Endgame” (2019). Its

power allows the Avengers to manipulate time, reverse the catastrophic events caused by Thanos' snap, and ultimately restore balance to the universe.

In the realm of theoretical physics, scientists have proposed various models and frameworks to explore the possibilities of time travel. Concepts such as wormholes, which are theoretical tunnels through spacetime, and the bending of spacetime, as described by Einstein's theory of General Relativity, offer avenues for contemplating the manipulation of time. Furthermore, discussions around the nature of time, including its arrow and the possibility of branching timelines, have emerged from the study of cosmology and quantum mechanics. The Time Stone's ability to traverse different moments in history and explore alternate timelines reflects the intriguing possibilities suggested by these scientific inquiries. One perspective on time travel is rooted in physics and the study of spacetime. The concept of closed timelike curves (CTCs) and nonlinear quantum mechanics has been examined as potential avenues for time travel (Bennett et al., 2009). However, it is important to note that these theories are still speculative and have not been proven empirically.

The possibility of time travel raises questions about causality and the potential for paradoxes, such as the grandfather paradox. From an economic standpoint, the concept of travel time has been used to illustrate economic processes and concepts. For example, the existence of time travel creates opportunities for arbitrage based on the differences in real interest rates between time travelers and non-time travelers (Swinton, 2022: 243). This highlights the potential economic implications and challenges that could arise if time travel was possible. The concept of acceptable travel time has been explored in the field of transportation. This concept refers to the amount of time individuals are willing to spend on travel for various purposes (Milakis & Wee, 2018: 113). Understanding the concept of acceptable travel time can inform transportation planning and policy decisions. The concept of mental time travel has been investigated in the realms of psychology and neuroscience. Mental time travel refers to the ability to mentally project oneself into the past or future and is thought to be a uniquely human capacity (Suddendorf et al., 2009: 1317). Research in this area has explored the neural mechanisms underlying mental time travel and its role in memory, imagination, and concept formation.

From a philosophical perspective, presentists argue that time travel contradicts the presentist conception of time, as it involves the spatialization of time, which presentists resist (Sakon, 2021: 192). Presentism is the view that only the present moment exists, and that the past and future are mere illusions. Time travel challenges this view by allowing movement through different temporal points.

The Time Stone's significance within the MCU expands beyond its individual powers. It becomes an integral component in the quest to gather all six Infinity Stones, culminating in Thanos' attempt to reshape the universe in "Avengers: Infinity War" and the consequential battle to restore order in "Avengers: Endgame." The Time Stone's manipulation of time adds a complex layer to the narrative, where the heroes grapple with the ethical dilemmas and consequences of tampering with the temporal fabric.

Figure 5.0 presents the main characteristics of the time stone.



Figure 5.0 Main Characteristics of the Time Stone Source: Own Development

The Soul Stone

The Soul Stone remains veiled in secrecy until “Avengers: Infinity War” (2018). Thanos, the central antagonist, sought to obtain all six Infinity Stones to carry out his plan of eliminating half of all life in the universe. In his quest, he learns of the Soul Stone’s location, hidden on the planet Vormir. To obtain the Soul Stone, a heart-wrenching sacrifice is required. Driven by his twisted ideology, Thanos throws his adopted daughter Gamora off a cliff, making the ultimate sacrifice. This act of selfless brutality demonstrates the unique nature of the Soul Stone and reveals its connection to the profound concepts of soul and life essence.

The Soul Stone’s portrayal in the MCU delves into metaphysical and philosophical realms that explore the concept of the soul, consciousness, and the essence of life. While the concept of the soul is subjective and varies across cultures and belief systems, it shares common ground with the exploration of human consciousness and the intangible aspect of individual identity.

From a scientific perspective, the study of consciousness and the nature of subjective experiences is a complex and ongoing field of inquiry. Neuroscience investigates the neural correlates of consciousness, seeking to unravel the mechanisms underlying self-awareness and the integration of sensory information. One line of inquiry focuses on the relationship between consciousness and the body. Fabrega (2000: 1579) discusses the role of body and emotion in the making of consciousness, exploring how subjective experiences are influenced by bodily sensations and emotional states. This perspective suggests that consciousness is not solely a product of the mind but is also shaped by the body and its interactions with the environment. Another perspective comes from philosophy. Kriegel (2005: 24) argues for the inseparability of qualitative and subjective characters of experience. The author suggests that the subjective character is the source of this problem of consciousness. This viewpoint highlights the importance of subjective experiences in understanding consciousness.

Quantum mechanics has also been invoked to explain consciousness. Jansen (2014: 525-526) discusses theories that propose a connection between quantum mechanics and consciousness. Penrose-Hameroff’s theory suggests that consciousness arises from the reduction of quantum

superposition in the brain. This perspective introduces the idea of timeless consciousness and its subjective experience. In addition to these perspectives, the subjective nature of experience has been a topic of investigation. Thomas (2022: 8) emphasizes the importance of exploring the source of subjective experiences. The author argues that recognizing subjectivity is not sufficient; there needs to be an exploration of its nature to gain more knowledge about subjective experiences.

Moreover, philosophical discussions surrounding the nature of the soul and consciousness raise questions about personal identity, the continuity of existence, and the relationship between mind and body. Although the scientific understanding of consciousness and the soul is still evolving, the exploration of these concepts is central to our perception of the self and our place in the universe. From a philosophical perspective, the nature of the soul is the subject of debate. Some philosophers view the soul as an immortal entity, while others see it as a useless concept or interpret it differently as the core of an individual personality that ceases to exist at death (Lindeman et al., 2015: 161). The duality of human experience has also been explored, including the contrast between hedonism and altruism/self-sacrifice (Livneh et al., 2018: 67). These philosophical discussions highlight the complexity and diversity of perspectives on the nature of the soul and the role of sacrifice.

Within the overarching narrative of the MCU, the Soul Stone represents an enigmatic element, tying together the quest for the Infinity Stones and the emotional sacrifices demanded to obtain ultimate power. Its significance lies not only in its power but also in the exploration of profound themes such as love, loss, and the complexities of morality.

Figure 6.0 presents the main characteristics of the soul stone.



Figure 6.0 Main Characteristics of the Soul Stone Source: Own Development

Conclusion

The Marvel Cinematic Universe (MCU) and its depiction of the Infinity Stones provide a captivating blend of science, philosophy, and popular culture. The powers and properties of the Infinity Stones can be related to scientific concepts and theories, albeit in a fictional context. For instance, the Space Stone's ability to manipulate space resonates with the concept of wormholes and quantum entanglement explored in General Relativity and quantum physics. The Reality Stone's ability to alter reality aligns with discussions of the nature of time, including the possibility of branching timelines and bending spacetime. The Time Stone's manipulation of time touches upon theories of time travel and the nature of consciousness. While these connections are speculative, they spark curiosity and imagination, expanding our understanding of scientific concepts.

The existence and potential usage of the Infinity Stones in the Marvel multiverse raise profound philosophical implications. Themes of power, morality, sacrifice, and personal identity are explored through the characters' interactions with the Stones. The philosophical implications extend to questions surrounding the nature of the soul, consciousness, and the ethical dilemmas posed by tampering with temporal events. These concepts challenge our understanding of the human experience, inviting contemplation on the essence of life and the consequences of wielding immense power.

The intersections of science, philosophy, and popular culture represented by the Marvel multiverse and the Infinity Stones contribute to our understanding of the cosmos in several ways. First, they engage a wide audience, inspiring interest and curiosity in scientific concepts and philosophical inquiries. By weaving these themes into captivating narratives, the MCU fosters appreciation for the mysteries and wonders of the cosmos. Second, they provide a platform for exploring complex ideas in accessible ways, inviting viewers to contemplate existential questions, and fostering critical thinking. Finally, the cultural impact of the MCU expands the reach of scientific and philosophical concepts, encouraging discussions and further exploration beyond the realm of entertainment.

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Peter Strawson's Descriptive Metaphysics and its Cosmological Implications

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The focus of this article is the examination of potential applications of linguistic philosophy, particularly the philosophy of natural language, to elucidate certain aspects of cosmology. Using the foundational principles of Strawson's descriptive metaphysics as a guide, the article suggests plausible strategies for employing the tools of linguistic philosophers in analyzing key concepts within, for example, Chinese cosmology. The vast majority of researchers of Chinese cosmology used one of the two most common approaches – historical or philosophical. The historical approach involved the analysis of the cosmological concept of crises through the prism of the history of the development of socio-cultural and political factors, as well as through the analysis of the historical development of the main ideas and texts. The philosophical approach considered the cosmological concept as a “philosophical school”, tending to consider cosmology in the context of comparison with the Western tradition of philosophy and science. Both approaches have significant limitations. Strawson is not a classic representative of linguistic philosophy, because his approach to using the methodology of the school of everyday language is original and allows returning metaphysics to the field of view of analytical philosophy. His metaphysical essay on the model of the relationship between language and the world does not raise questions about the criteria of existence. This is important because Chinese cosmology is closely related to cultural factors and rituals. It is the analysis of cosmology as a complete system that should become the main task of the researcher. The methodology of the school of everyday language in Strawson's interpretation is seen as

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promising for providing an original interpretation and clarification of some main points of non-European cosmology. The goal is to assess whether the methodology of Ordinary Language Philosophy remains relevant for advancing cosmological and metaphysical accounts.

Keywords: ordinary language philosophy, philosophy of cosmology, linguistic philosophy, descriptive metaphysics, cosmology and culture, Chinese cosmology.

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Introduction

In his article “Philosophers and Popular Cosmology” (1993), English philosopher and University of Liverpool professor S. Clark highlights a notable shift in the 1990s. “This was the decade in which we detected further traces of the Big Bang, and a variety of scientists expressed their views on God, the universe and everything” (Burt, 1963: 115). However, S. Clark expresses concern over the diminishing attention given to philosophers in public debates during this period. He contends that cosmological concepts such as necessity, contingency, causality, time, ethics, and religion, which were once within the purview of philosophers, seemed to be taken up by scientists. Even renowned figures like Stephen Hawking, in his book “A Brief History of Time” (1988) used physics to delve into the understanding of the mind of God, while Paul Davies offered his theory of Mind.

“In modern philosophy, the questions about the essence of being have acquired a previously uncharacteristic specificity. What is “a thing insofar as it is in being?” “What is a thing in its being?” “What is the being of a thing?” Evidently, metaphysics is presented in these questions as a subject of ontology, as “onto-logy insofar as the operations of questioning and answering (-logy) all bear ultimately on things (onto-)” (Bazaluk, 2022: 7). This raises the question: Can philosophy still play a significant role in the realms of metaphysics and cosmology?

S. Clark further explores this theme, recalling a time when philosophers like Leibniz actively contributed to the scientific revolution, and Aristotle single-handedly established entire disciplines. Although some contemporary philosophers still contribute beyond academia, their reputations are not primarily built on these contributions. A crucial turning point occurred with Anglo-American philosophy, particularly in the context of Ordinary Language Philosophy. This article aims to conduct a historical review of foundational ideas in metaphysics, particularly those put forth by analytic philosopher P. Strawson in his book “Individuals” (1959).

Peter Frederick Strawson (1919–2006) emerges as a key figure in Anglo-American philosophy during the mid-20th century, focusing on logic, philosophy of language, metaphysics, epistemology, and the history of philosophy. Positioned alongside influential philosophers of language such as J. L. Austin, A. J. Ayer, R. Carnap, D. Davidson, P. Grice, B. Russell, and G. Ryle, Strawson made lasting contributions.

Here it is necessary to make some clarifications. J. Searle distinguishes between the Philosophy of Language and linguistic philosophy or linguistic analysis. Searle, known for his contributions to the philosophy of language, philosophy of mind, and social philosophy, asserts in an interview with Professor B. Magee (1977) that linguistic philosophy or linguistic analysis are techniques or methods for solving philosophical problems. In contrast, the Philosophy of Language is not a technique but a subject matter. Linguistic philosophers believe that philosophical problems can be resolved by examining the “ordinary use” of words, particularly

words like know, believe, and suppose. The Philosophy of Language, as a subject matter within philosophy, addresses fundamental questions about how language reflects reality, the nature of meaning, and concepts like truth and logical necessity.

Descriptive metaphysics

Strawson's objective was to point the foundational concepts inherent in our everyday thought processes. These encompassed crucial notions like *body*, *person*, *space* and *time*, and *causation*. His aim was: firstly, to demonstrate that skeptical challenges to our utilization of these concepts were baseless and unjustified; and secondly, to establish that our right to employ these concepts didn't hinge on reducing them to a supposedly more naturalistic foundation, such as the empiricists interpretation of experience or the concepts intrinsic to fundamental science. According to Strawson, the true mission of metaphysics is to articulate these indispensable ideas and elucidate their interconnectedness. His contributions played a significant role in steering Oxford philosophy away from the anti-metaphysical stance of A.J. Ayer and J.L. Austin, guiding it toward a renewed exploration of many traditional philosophical questions. Even today, Strawson's work remains influential and continues to capture scholarly attention (Snowdon, 2009).

In the Introduction to *Individuals. An Essay in Descriptive Metaphysics* Strawson point out: "Metaphysics has been often revisionary, and less often descriptive. Descriptive metaphysics is content to describe the actual structure of our thought about the world, revisionary metaphysics is concerned to produce a better structure" (Strawson, 1990: 9). The outcomes of revisionary metaphysics possess enduring interest, not solely as pivotal moments in the historical development of thought. Their articulation and the intensity of their focused perspectives make the best of them both inherently admirable and philosophically useful in the long run. However, this latter merit can be attributed to them only because another kind of metaphysics exists, requiring no justification beyond the pursuit of inquiry in general. Revisionary metaphysics serves the purpose of descriptive metaphysics.

The concept of descriptive metaphysics may be met with skepticism, particularly concerning how it distinguishes itself from philosophical, logical, or conceptual analysis. The distinction lies not in the intention but in the scope and generality of the inquiry. Descriptive metaphysics seeks to uncover the most general features of our conceptual structure, allowing it to question more assumptions than a narrower conceptual investigation.

This difference in scope also leads to a variance in methodology. While a close examination of the actual use of words remains crucial in philosophy, it has its limitations. The discriminations and connections established through this method are often not broad or far-reaching enough to satisfy the comprehensive metaphysical need for understanding. When exploring how we use specific expressions, our answers, while insightful at a certain level, tend to assume rather than expose the general structural elements that the metaphysician aims to unveil. The structure doesn't readily present itself on the surface of language; it remains submerged. Therefore, the metaphysician must forsake their reliable guide when it falls short of taking them as far as they desire to go.

It is plausible that no metaphysician, in both intent and impact, has ever been entirely committed to one category or the other. Yet, broad distinctions can be made – Descartes, Leibniz, and Berkeley tend towards the revisionary, while Aristotle and Kant align more with the descriptive (Strawson, 1990: 11).

Another challenge to the concept of descriptive metaphysics may arise from a different perspective. It could be argued that metaphysics serves primarily as a tool for instigating

conceptual change, facilitating or documenting new directions or styles of thought. Undoubtedly, concepts undergo transformations, not only at the specialized periphery but also, albeit predominantly, impacting ordinary thinking. Metaphysics has indeed been significantly engaged in such changes, employing the suggested approaches. However, it would be a grave mistake to perceive metaphysics exclusively through this historical lens.

Metaphysics possesses a substantial central core of human thinking devoid of historical evolution, at least as recorded in histories of thought. Within this core lie categories and concepts that, in their most fundamental essence, remain unchanged. Notably, these are not the specialized domains of the most refined thinking but the commonplaces of the least sophisticated cognition. Yet, they constitute the indispensable foundation of the conceptual framework for even the most sophisticated individuals. Descriptive metaphysics, therefore, primarily concerns itself with these fundamental concepts, their interconnections, and the structure they collectively form.

As it is impossible to investigate the problems of human cognition and the need for solutions to humanity's problems without considering human culture, art, and morality (Medzhidova, 2022: 25). It is also impossible to investigate the problems of cosmology without considering the mining of space, time, matter. Cosmologies can be defined as organized systems of concepts and relationships that portray the universe or cosmos as a structured entity. These frameworks articulate the nature of the cosmos in terms of space, time, matter, and motion, populated by entities such as gods, humans, animals, spirits, demons, and similar beings. Chinese cosmology has been characterized as "correlative". Chinese cosmology is a well-defined and orderly system that includes various aspects of the domains of reality in the universe. Such categories of the human world as the body, behavior, morality, socio-political system, historical changes are correlated with the categories of the cosmos. In particular, the categories of space and time, celestial bodies, changes of seasons and weather phenomena are meant. In this context, it is considered promising to investigate the unity of aspects of the domains of reality in the context of Strawson's "Descriptive metaphysics".

Peter Strawson's "Individuals"

To understand Strawson's approach to his mission, the reader should pay close attention not only to his concise introduction but also to significant comments in the concluding chapter. The overarching goal is to expose and explain "conceptual scheme". "We think of the world as containing particular things some of which are independent of ourselves; we think of the world's history as made up of particular episodes in which we may or may not have a part; and we think of these particular things and events as included in the topics of our common discourse, as things about which we can talk to each other. These are remarks about the way we think of the world, about our conceptual scheme" (Strawson, 1990: 15).

American philosopher E.A. Burt (1892-1989) in *Descriptive Metaphysics* (1963) focus on this account: "Strawson is concerned with the status and role of 'individuals' – in the first half of the book their status and role in cosmology, and in the second half their status and role in informative statements. Other metaphysical entities inevitably come into the picture but only because reference to them is needed in an explanatory analysis of his chosen theme" (Burt, 1963: 27).

Specific entities, such as historical events, material objects, people, and shadows, are discussed, while qualities, properties, numbers, and species are not categorized as specific entities. Identification of specific entities commonly occurs through proper names, definite descriptions, and demonstrative pronouns. Strawson emphasizes that the ability to identify particulars of a given type is a necessary condition for including that type in our ontology.

Certain particulars are systematically identified through their relation to other types of particulars, establishing an ontological hierarchy based on priority and posteriority. "The main aim of Part I of the book is to find if there are, in terms of the criterion of dependent or independent identification, any kind or kinds of particulars which are basic among the kinds of particulars that we recognize in our conceptual system" (Urmson, 1961: 258-259).

Regarding the detailed progression of his thoughts, a succinct summary will suffice. In the early chapters, Strawson's guiding question is: What are the basic or primary individuals (i.e. particulars) in our conceptual system? (Burt, 1963: 27). His response posits material bodies and persons in a unique position, revealing their relationships based on their place in a unified spatiotemporal order. His argumentative strategy is notable; he provides compelling evidence supporting his stance, considering influential philosophical alternatives in each case, such as the notion that private sense data constitute basic particulars instead of material bodies, or that minds (or centers of consciousness) do so instead of persons.

In establishing these conclusions, Strawson employs a form of *reductio ad absurdum* against contrary propositions. He invites readers to imagine the most plausible conceptual system lacking certain features of material bodies or persons and questions its ability to meet the necessary criteria. For instance, he envisions a world of sounds related in time but not space, demonstrating its failure in meeting the need to reidentify the same sound in a publicly verifiable manner.

In the later chapters, the focus shifts to the role of these basic particulars in informative discourse, particularly addressing the persistent philosophical doctrine that while a universal can function as either subject or predicate, a particular can only function as a subject. Strawson grapples with this question, presenting an answer framed in the notion of "completeness". He argues that the subject of an informative statement is complete in a sense not applicable to the predicate. Basic particulars serve as paradigm cases illustrating this completeness, and from this foundation, the concept extends naturally to include other cases, including universals functioning as subjects.

Strawson introduces a speculative theory of "feature-concepts" in Chapter 6, aiming to support his notion of completeness. He believes this theory reveals the "ultimate or atomic facts" presupposed by both particulars and universals in our ordinary discourse. Despite his attempt to clarify the metaphysical role of these feature-concepts, it remains unclear. Chapter 7 seeks to reinforce the conclusions of the latter part of the book, employing a similar approach as seen in the first half. Strawson explores the possibility of devising a language that operates without reference to particulars. His answer, utilizing his theory of feature-concepts, suggests theoretical feasibility but emphasizes the impracticality and complexity of such a language. Ultimately, he contends that our ordinary language, confidently referencing the existence of particulars, provides a simpler and more practical medium for meeting our needs. In his argument, Strawson asserts that any alternative to our current method would require the terms used as subjects to possess the same kind of completeness present in the particulars of our existing conceptual system, thereby confirming the soundness of his general solution and theory of completeness.

Ontological priority

Strawson employs prerequisites for (re)identification to establish relations of "ontological priority" among different types of particulars. "Ontological priority is defined in terms of our capacity to pick out and talk about things; Strawson suggests that identifiability of at least some individuals of a given kind is necessary for the inclusion of that kind in our ontology,

and thus connects identifiability with ontological commitment, and identifiability-dependence with priority of ontological commitment” (Haack, 1979: 362). His focus is not on traditional ontological dependencies, but rather on connections and dependencies within various aspects of our conceptual framework. The ontological priority of type X over type Y doesn’t imply that X constitutes or explains Y in the traditional sense. Instead, objects of type X are ontologically prior to objects of type Y if and only if the identification and reidentification of X are presupposed by the identification and reidentification of Y, but not vice versa. This involves “non-symmetrical relations” of “identifiability dependence” (Glock, 2012: 399).

According to Strawson, two types of particulars qualify as ontologically basic in this sense and merit the Aristotelian label of a (primary) substance: material bodies and persons. H. Glock criticized Strawson’s concept of a material body: “Strawson’s concept of a material body is “very weak”. Any relatively permanent occupant of a space qualifies if it is accessible to observation, at least of the visual kind” (Glock, 2012: 400). This encompasses not only mountains but also holograms, despite the latter lacking tactile properties typically associated with material bodies. Why are material bodies, in this sense, considered basic? Strawson’s succinct answer is that only they possess the features necessary to sustain the unitary and persistent spatiotemporal framework required for reidentification: three-dimensionality, relative permanence, and observability.

In Strawson’s approach various types of particulars are “identifiability-dependent” on material bodies or persons. In a more detailed exploration, theoretical constructs can only be reidentified through their connection to macroscopic phenomena. On the other hand, mental events and sense data rely on the persons possessing them. Some argue that we can directly observe a patient’s pain in their face. But the pain is not localized only in the face but in other zones and is visible through some kind of facial expressions.

Strawson’s rationale for prioritizing bodies is the direct identification made possible by placing them in a comprehensive spatiotemporal framework established through other bodies. Davidson argues that events/processes can similarly be identified through the causal nexus. If speaker can locate bodies in vicinity around itself, all other bodies should be accessible through existing spatiotemporal relations. Events have a different nature. The speaker does not have the opportunity to arrange all events in a complete causal order. Strawson notes that only the spatiotemporal framework that forms material bodies is “humanly constructible”.

Descriptive metaphysics stands in opposition to traditional metaphysics, whose aim is to uncover the hidden essence of reality beneath its apparent manifestations. In Descriptive Metaphysics, Strawson’s objective is not merely to delineate the structure of reality but to elucidate the human conceptual framework – how people “think about the world” or the tangible structure of our understanding of the world. Unlike the perspectives of naturalism and Quine’s advancements, Strawson asserts that philosophy should not engage in a competition with science to provide descriptions of causality and reality. Instead, the role of philosophy lies in describing the foundations of our conceptual framework.

Ordinary language philosophy and reality

This transition from focusing on reality to our thoughts or discourse about reality reflects the linguistic turn in analytic philosophy. Various thinkers, including Wittgenstein (both in his early and late stages of development), most logical positivists, and Oxford conceptual analysts, share the common belief that philosophical problems don’t primarily stem from factual unknowns or errors in understanding the world. Instead, they arise from the confusion and paradoxes inherent in how we articulate or conceive of the world.

The philosophy of ordinary language and the philosophy of ideal language are pivotal branches of linguistic philosophy. While the former aimed to address philosophical questions by elucidating existing language through analysis or description, the latter sought to sidestep these questions by reforming ordinary language. In the works of Carnap and Quine, logical analysis progressed into logical explanation. This involved substituting philosophically problematic statements or constructions with alternatives that effectively serve the cognitive purposes of the original, all the while avoiding pitfalls like ambiguity and undesirable ontological commitments. For instance, this might entail replacing discussions about numbers with discussions about sets of sets.

Strawson advocated for the descriptive approach, asserting that philosophical problems originate from the actual linguistic system. Advocates of ideal language philosophy suggested introducing a new system, and according to Strawson, the outcome of this move is to essentially set aside existing problems, provided the connection between ordinary and ideal systems is not clearly defined and understood. Once proficiency is attained in analyzing ordinary language, the need for ideal language diminishes. This is because philosophical problems arise not from issues inherent in ordinary language but from its distortion within philosophical theories.

Strawson's argument doesn't serve as a defense of descriptive metaphysics against the traditional perspective advocating for metaphysics to explore the essence of reality. The British philosopher opposes Wittgenstein's therapeutic approach to philosophy, where the philosopher's main role is that of a diagnostician and therapist, specifically addressing errors stemming from a misinterpretation of language. Strawson emphasizes the primary objective of delineating a conceptual framework that positively enhances our self-understanding.

How can metaphysics engage with the nature of reality? Strawson frequently draws on Kant's legacy in his writings, as the theoretical groundwork for both the linguistic turn and, more specifically, descriptive metaphysics. Kant's philosophy highlights the inherent complexity of the traditional conception of metaphysics or ontology. Unlike empirical science, metaphysics asserts itself as a form of a priori knowledge, meaning knowledge not contingent on our experiences.

In contrast to formal logic and conceptual analysis, descriptive metaphysics purports to depict or elucidate reality, thus laying claim to synthetic a priori knowledge. Kant's central inquiry revolves around the possibility of knowledge when experience is the sole means of uncovering reality. According to the German philosopher, synthetic a priori truths cannot be *de re*. Rather than delineating the mind-independent essences of objects, these truths articulate "necessary preconditions for the experience of objects". Consequently, the ontological quest for entities in reality transforms into a reflective examination of our conceptual scheme.

Williamson has asserted that reasoning alone can yield knowledge of reality, dismissing appeals to Kantian authority as unsupported by enduring arguments (Williamson, 2004: 111). However, this assertion, at most, addresses Kant's explanation of synthetic a priori knowledge through transcendental idealism and does not tackle the Kantian challenge to explain how *de re* synthetic a priori truths might be possible. Williamson himself acknowledges the lack of a full understanding of how thinking can provide new knowledge but asserts that logic and mathematics constitute overwhelming evidence of its possibility.

Strawson's descriptive metaphysics holds its ground in this context. However, the philosopher encounters another challenge. In his view, space is defined by the relationships among material bodies, meaning that material bodies serve as the structural components of spatial organization. These bodies are pivotal for the referential identification and re-identification of all other entities. According to transcendental idealism, an individual can only have a priori knowledge of what

they themselves impose upon things. Synthetic a priori propositions express characteristics imposed on the objects of experience by our cognitive apparatus during the processing of sensations. Strawson contends that in this aspect, transcendental idealism is open to criticism.

When transcendental idealism is set aside, Strawson argues that synthetic a priori propositions become a residue of statements that are neither analytic nor empirical, although they possess a distinct character or status. For example, the idea that empirical reality constitutes a unified spatiotemporal system doesn't seem contingent. If someone were to describe a type of thing and events related to it but insisted that the object had no location relative to here, and those events had no temporal relation to the present within our temporal system, we would interpret it as suggesting that the events hadn't truly occurred, and the thing didn't genuinely exist. In expressing this, we reveal how we engage with the concept of reality. Strawson concludes that we are grappling with something that conditions our entire way of talking and thinking, and this is why we perceive it as non-contingent. "Hence, it is 'not contingent' that empirical reality forms a single, unified, spatiotemporal system" (Haack, 1979: 362).

If we take to account that something shapes our entire manner of communication, it's not a straightforwardly explanation why philosophers should consider it non-contingent. The propositions of descriptive metaphysics can be considered as an expression of the norms of representation in Wittgenstein's understanding – in other words, as certain rules that guide the meaningful use of words by the speaker. The main ideas of descriptive metaphysics should be defined as an expression of the norms of representation in Wittgenstein's understanding.

- (i) Every event is spatiotemporally related to every other event and
- (ii) Every event has a cause.

Statement (ii) is related to the principle of causation. It enables the speaker to infer from any identified event that there must be a cause for that event, known or unknown to the speaker.

However, such operation (ii) has disadvantages. The human conceptual scheme does not consider the concept of an "uncaused event" to be meaningless. If one morning the speaker sees dinosaur tracks on the ceiling, he has reason to abandon the search for an explanation, perhaps because the laws of nature deny the possibility of such a fact. However, the appearance of tracks on the ceiling will still be an event for the speaker. Any physical change in space and time qualifies as an event, even if a causal explanation cannot be found. Thus, the term "event" and the linguistic rules governing its use inherently do not include the requirement of being caused. The same applies to (i).

For Kant, propositions (i) and (ii) are analytic. However, in his teaching there are no convincing arguments in favor of the fact that there is a conceptual necessity. Strawson would explain it as follows – we have the ability to know a priori not only "what we ourselves have put into them", but only what we have included in the concept of things or objects of experience. A concept is a product of human thinking.

Due to their constitutive role in the conceptual scheme, propositions (i) and (ii) achieve a priori status. But not all a priori propositions can be reduced to definitions or explanations. To solve this problem, one must assume that not all conceptual or analytic truths are trivial. Upon further investigation, it may turn out that they are non-trivial precisely because they are not definitional in nature.

Consider proposition (i). As indicated by Strawson's own analysis, the connection between the concept of an event and that of a unified spatiotemporal framework is facilitated by the notion of reality. Notably, (i) doesn't merely follow from a more general principle stating that everything real is part of a unified spatiotemporal framework. While facts are real, they are not spatially or temporally located, as highlighted by Strawson.

Likewise, in the case of (ii), events must be deemed caused not because random and chaotic changes don't qualify as events, but rather because persistently chaotic events cannot serve as possible objects of self-conscious experience. The validity of this claim remains a subject of contention. However, if anything can substantiate the *a priori* status of propositions (i) and (ii), it is the intricate interplay among diverse concepts. Strawson effectively demonstrates that descriptive metaphysics holds the potential to establish such intricate conceptual connections, spanning ontological notions like causation, space, and time, and epistemological notions like experience (Glock, 2012: 407-411).

The study of cosmological systems requires a clear definition and the selection of an appropriate methodology. Chinese cosmology is characterized by a close connection between the concept of the universe and socio-cultural and political factors (the union of politics and doctrine). It is important to approach the cosmological theory as a whole system. But most of the approaches, on the contrary, propose to separate the view, which gives rise to a whole series of binary oppositions: philosophy and history, ideas and institutions, words and deeds, culture and politics.

The historical approach considers Chinese cosmology as a political history. In contrast, the philosophical approach considers the cosmological system as a way of thinking, a product of the mind or a philosophical school. This in turn tempts the researcher to consider, for example, Chinese cosmology in comparison with Western philosophy and science, which is not always appropriate. This creates a biased view where cosmology is seen as a philosophical school that gives ideas ontological and analytical priority, relegating socio-cultural and political factors to the background. A mind-centric approach significantly limits cosmology. A large layer of symbolic and cultural material escapes the researcher's field of view. (Wang, 2000: 4-9)

Historical and philosophical approaches made a significant contribution to the development of cosmology. However, no single approach is universal and sufficient. Strawson solved a similar problem, returning metaphysics to the field of analysis of representatives of analytical philosophy. It is his approach that in the future can provide the necessary tools for the analysis of non-European cosmologies as integral systems that include a whole complex of socio-cultural and political factors.

Conclusion

In the context of Anglo-American philosophy, the successor to positivism is ordinary language philosophy – or, to provide a more precise descriptor, the theory asserting that the meaning of verbal expressions, including philosophical concepts, is revealed through their established usage. It continues to uphold certain key tenets of positivism, such as the idea that the philosopher's duty is to oversee not the domain of truth, which belongs to science, but the more fundamental realm of meaning.

While ordinary language philosophy maintains some continuity with positivism, it deviates on several important doctrines. One such departure is from the positivist doctrine that rendered metaphysics meaningless. Ordinary language philosophy embraces the conviction that any expressions successfully used in various forms of cultural life have sense in their specific contexts of use. Consequently, it acknowledges a broader range of sensible expressions than positivists, who limited us to logical tautologies and verifiable empirical information.

Strawson's application of the methodology of linguistic philosophy, particularly the philosophy of natural language, to return metaphysics to the field of view of analytical philosophers suggests that this methodology has significant prospects for the study of non-European cosmological systems, in particular Chinese cosmology. Classical approaches

to cosmology – historical and philosophical – have significant limitations. They break the integrity of the system by offering a key focus either on political history or on ontology and philosophical concepts. The methodology of everyday language makes it possible to consider the cosmological system in its integrity – considering the socio-cultural and political factors inherent in Chinese cosmology.

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