Inductive Probabilities in Astrobiology and SETI: Have Sceptics Retreated?

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For the atoms being infinite in number, as has just been proved, are borne ever further in their course. For the atoms out of which a world might arise, or by which a world might be formed, have not all been expended on one world or a finite number of worlds, whether like or unlike this one. Hence there will be nothing to hinder an infinity of worlds.

—Epicurus, *Letter to Herodotus* (cca. 300 BC)

1 Introduction: Probabilities and Extraterrestrial Life

Since we have very little empirical insight into the origin of life (abiogenesis) and intelligence (noogenesis), much of what we say about these two crucial processes is of necessity highly speculative. Obviously, this pertains to abiogenesis and noogenesis on Earth (which are observer-selected local facts) as well as anywhere else in the universe. Both necessary and sufficient conditions for either process are highly uncertain in absolute terms; therefore, the usual approach has traditionally been to speculate on how these could be characterized in relative terms, i.e., relative to the conditions prevailing on Earth in their respective epochs (late Hadean for abiogenesis and early Quartenary for noogenesis[1]). This relational perspective leads

[1]For example, Chernavskii (2000); Luisi (2006); Dodd et al. (2017). Here and elsewhere in this paper, I assume the standard view of history of life and intelligence, neglecting highly non-standard scenarios such as life being brought on Earth via directed panspermia or the possibility that some late dinosaurs could have been intelligent, etc.

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G. Y. Georgiev et al. (eds.), *Evolution, Development and Complexity*,
Springer Proceedings in Complexity, https://doi.org/10.1007/978-3-030-00075-2_5

to various *probabilistic* arguments about these crucial evolutionary steps: attempts to derive probabilities for these events based on conjunction of various prerequisites and, in the second step, using such probabilistic estimates to justify uniqueness of terrestrial life and intelligence (plus various consequences drawn thereof, from lobbying for cessation of our SETI efforts to elevating Earth's biosphere and humans to specially exalted moral status). Of course, this reasoning is better known as an argument for non-naturalistic origin of life and intelligence, but that is less important for us here.

Since we know for only a single instance of both abiogenesis and noogenesis thus far, and we are obviously strongly biased by the observation-selection effects (Bostrom 2002), such probabilities are bound to be only very loosely related to anything in the real world. This quite basic epistemological insight has been, however, consistently downplayed or ignored. While we may not be able to correct for some of these biases (at least until we get the opportunity to study other habitable worlds), it is extraordinarily important to *acknowledge* their existence and their impact on any conclusions we derive about extraterrestrial life and intelligence.

This topic deserves separate attention from the purely astrobiological problem of existence (or else) of extraterrestrial biospheres or extraterrestrial intelligence. In the last 60 years or so, there have been many uses and abuses of probability and probabilistic arguments in discussing life and intelligence in their general cosmic context. Here we wish to focus on frequent alleging very low probabilities for the existence of other intelligent species in the Galaxy, or even the entire visible universe. Sceptics on the issues of extraterrestrial life and intelligence have time and again suggested that the discovery of extraterrestrial life and intelligence in general, and the success of our SETI projects in particular, have very small probabilities, implying that there is a scientifically sound way one can derive such negligible chances. Of course, the next step has always been that such minuscule probabilities make our searching efforts misplaced, unfounded, and wasteful. In most such sceptical discourses, less attention has been devoted to the actual computation of probabilities and much bigger on the practical consequences of what has been more or less assumed from the beginning: that there is a meaningful way – in most cases an inductive way – in which the probabilities could be constrained to be minuscule. Problems with such an inductive procedure, like various observation-selection effects, biases, the lack of continuity, etc., have been routinely swept under the rug.[2]

In this preliminary study, I wish to set a framework for a reassessment of the role of inductive probabilities in our search for life and intelligence elsewhere – and, indirectly, much of our more general contemporary reflection about our place in the universe. The plan of the exposition is as follows. In Sect. 2, I list some of the instances of what I term sceptical discourse in this respect – sceptical in the sense that from particular small probabilities, estimated or calculated, a

[2]For a more detailed analysis of the philosophical claims, see Ćirković (2012), esp. Chapter 7.

negative claim is derived.[3] In Sect. 3, the influence of modern cosmological discourse (especially embedding cosmological background into a wider whole, the multiverse) on our probabilistic reasoning is considered. Zooming into the world of the contemporary 'astrobiological revolution' (1995–today) in Sect. 4, I intend to sketch how recent astrobiological findings undermine the sceptical discourse and, even more importantly from the present point of view, how sceptical discourse has been proven to be inert, non-responsive, and essentially decoupled from these revolutionary changes in our perspective on life in its widest cosmic context. As reiterated in the concluding section, the point of the present note is not to resolve these deep and involved astrobiological and philosophical issues, but rather to bring the attention to cognitive deficiencies and double standards in the sceptical discourse. Debunking these constitutes an interesting research programme in its own right.

2 Examples of the Sceptical Discourse

Early clashes between self-styled sceptics regarding extraterrestrial life and intelligence on one side and the classical 'pluralists' (about habitable worlds) or 'optimists' have been documented in histories of Crowe (1986) and Dick (1996). The modern round started as soon as the SETI era was launched in 1960 with the Ozma Project and the contemporary criticism of George Gaylord Simpson (1964) based on evolutionary biology and a kind of proto-rare-Earth argument. While the original argument of Simpson's has several weak spots which could be recognized only recently with the advent of modern astrobiology, as I have discussed elsewhere (Ćirković 2014), the debate certainly continues, and it now includes many other elements.

There has been a substantial amount of sceptical discourse, from the time of Simpson to this day, but his criticism in many ways presented a blueprint for all subsequent elaborations. As much as he *reacted* against the nascent SETI projects and voiced his ire over alleged wastefulness of space research, most of his sceptical inheritors continued to emphasize that it is allegedly irrational to engage in research with so low probability of success. Hence arose the scientific – at least formally – criticisms of Tipler (1980), Bond (1982), Barrow and Tipler (1986), Diamond (1992), and Mayr (1993). Over and above it are several philosophical treatments, which usually attempted to add weight to these low-probability estimates by treating them as specifically inductive probabilistic inferences. In this category one can find McMullin (1980, 1989), Rescher (1985), Mash (1993), and Kukla (2001, 2010).[4]

[3]Such a negative claim could be existential ('there are no viable SETI targets') or pragmatical ('SETI search programs are not feasible'). While I have studied this dichotomy in some detail elsewhere (e.g. Ćirković 2013), it is not essential from the point of view of the present discussion.

[4]For a different kind of scepticism, see, e.g. Ulvestad (2002) and Basalla (2006).

Most of these belong to the coldest period of the 'SETI winter' of 1980s and 1990s, when the original enthusiasm of the 'founding fathers' faded and scepticism and disappointment contributed to cancellation of the NASA SETI programme, among other things (Garber 1999). Some of these criticisms (for instance, those of McMullin) are arguably motivated by extrascientific concerns; others mention either 'expensive' SETI projects or even explicitly connect them with the fiscal deficit and national debt (Mash, Mayr).

On the other side of the story, we find various probabilistic estimates for abiogenesis vehement in claiming that it is an astronomically improbable event and more or less openly supporting creationism/ID. In an extremely valuable study, Carrier (2004) has compiled data from dozens of sources exhibiting the same tendency of miscalculating probabilities in order to make abiogenesis practically impossible. No less than 7 categories of errors are identified, and it is shown that such estimates are not only numerically unreliable, but more importantly substantially unfounded, since they either mistake a part for the whole or misrepresent the complexity of early living systems or commit any number of other substantial errors. Although similar comparative study has not been performed for noogenesis (or for the probability of the 'Cambrian explosion analogues') so far, there is no doubt that similar errors are common there as well. And while subjects of Carrier's study are mostly creationists and ID-supporters, this does not make much difference in the context of the sceptical position: Jacques Monod's "lucky accident" school of thought, or completely secular sceptics like Simpson can be targeted in the same manner (Fry 2000), although it might be downplayed for tactical reasons.

Why is that interesting again now? In contrast to the "SETI winter", in recent years, there has occurred a modest revival of interest for SETI, together with a new generation of observational searches (e.g. Wright et al. 2014) and new ideas on the theoretical front (e.g. Bradbury et al. 2011). The theoretical side of SETI has been sorely neglected in earlier times, as a consequence of several factors, some of which are of extrascientific nature. The misuse of the probabilistic arguments has certainly been one of these factors: if one believes – on the basis of often spurious arguments – that the probability of target's existence is negligible, the development of sophisticated theoretical models for evolution and detectability of targets sounds like decisively bad idea for investing time and resources.

An important theoretical development has been the advent of large-scale numerical simulations of the astrobiological 'landscape' based on well-established cosmological simulations (e.g. Vukotić et al. 2016; Forgan et al. 2017). The emergence of such studies clearly testifies that astrobiology and SETI have become more mature and sophisticated in comparison to previous decades. One key point stands out about them; however, they are studies of *habitability*, and if we wish to translate their results into specific search proposals or even target selection rules, we need to adopt a set of *probabilities* for particular stages in evolution. Probabilities are understood here in purely epistemic sense, as reflections of our ignorance about the details of the dynamical evolution.

In parallel, we have seen the emergence of the new breed of scepticism, embodied in the 'rare-Earth' hypotheses, starting with publication of the eponymous book at the turn of the century (Ward and Brownlee 2000). They start with the model in which the emergence of complex biosphere – and specifically noogenesis – is contingent upon the conjunction of many logically and physically independent requirements: a conveniently placed giant planet to deflect potential impactors, a large natural satellite to stabilize the spin of the planet, plate tectonics to enable carbon-silicate regulation cycle, etc. Since each of these requirements is prima facie improbable, the probability of their conjunction is simply the product of individual probabilities – which must be a stupendously small number. It might seem, especially to an eager sceptic, that here is a perfectly sound way of producing negligible probabilities – perhaps not that small as the combinatorial ones alleged by creationists and IDers for abiogenesis (reviewed by Carrier 2004), but still small enough to ensure that Earth's biosphere is a unique phenomenon in the Galaxy, if not within the cosmological horizon. This would ensure that our SETI efforts are in vain, and the astrobiological enterprise would be reduced essentially to astro-*micro*biology – studying possible alien prokaryotes and extremophiles. While the rare-Earth hypothesis has provoked enormous discussion and played an important catalysing role in our thinking about habitability, it turns out that there are many problems with it. I shall discuss briefly some of the problems (the ones dealing with probabilities) in Sect. 4; before that, it is important to take another look at the cosmological background against which the universal cosmic evolution and development unfold.

3 Cosmological Degeneracy of Probabilistic Inference

Modern cosmology in a sense intervened to make the matters more complicated by suggesting not only a spatially infinite universe but, in fact, a whole ensemble of universes, known as the *multiverse*, arising as a natural consequence of the most generic form of cosmological inflation (e.g. Linde 1992; Carr 2007). Other best modern physical theories, in particular, the string theory in its current form of M-theory, offer at least similar predictions about the multiverse. Probabilistic reasoning in the multiverse context is an extremely controversial and sensitive issue, since metrics and measures are poorly defined, and the notion of typicality is quite non-trivial to comprehend (e.g. Hartle and Srednicki 2007; Page 2008). If the inflation is indeed eternal, we expect the multiverse to be infinite in both spatial extent and in the number of bubble universes; hence, we need adequate weightings in order to be able to calculate the probability of any particular feature.

Consider, for instance, the controversial matter of how improbable is abiogenesis, reviewed by Carrier (2004), as mentioned above. Many authors, some of naturalist and others of creationist bent have offered estimates of extremely small probabilities, ranging from 10^{-35} to $10^{-2,000,000,000}$. Clearly, a straightforward inference from these minuscule probabilities, *without any background assumptions*, leads many to favour supernaturalistic or at least exotic accounts for the origin of life on Earth.[5] On the other hand, *framing* the problem in an adequate cosmological context enables us to overcome this particular local bias. A counterweight to such framing is the ‘problem’ of Lucretian-style arguments suggesting that in cosmologies with either infinite spatial sections or with infinite number of cosmological domains (i.e. the multiverse), probabilities do not make real sense, since everything possible under the laws of nature will occur an infinite number of times (see Mash 1993 for a rather cogent philosophical criticism of applications of these arguments to SETI).

An example of such an approach is a study by the Russian-American computational biologist Eugene V. Koonin on the relationship of the cosmological model of eternal inflation to the puzzle of abiogenesis on Earth.[6] He concludes that only the multiverse of eternal inflation guarantees that the highly improbable steps related to life’s origin will inevitably occur. Therefore, problematic issues like ‘irreducible complexity’ or unproven ribozyme-catalysed RNA replication could be completely sidestepped – *somewhere* in the multiverse abiogenesis could proceed by chance, and we need just to apply anthropic (self-)selection to conclude that one of these places is called Earth. Irrespectively of specifics of Koonin’s scenario, one thing is radically new here; as he writes: ‘The plausibility of different models for the origin of life on earth directly depends on the adopted cosmological scenario’. From our point of view, the overarching infinity of habitable worlds suggested by inflationary cosmology cancels any degree of improbability of abiogenesis; by analogy, this will be the case with any other allegedly improbable ‘critical step’ in the evolutionary development leading to intelligent observers and technological civilizations. (An argument in the opposite direction has been made by Monton 2004, although it relies on some of the rare-Earth discourse and commits the same mistake of conflating logical and physical independence.)

Therefore, cosmology has a double role to play in the assessment of probabilistic inference about the origin of life and intelligence: it both complicates (the lack of consensus about typicality and the default measure of probability) and simplifies (Koonin’s argument and the analogous Lucretian arguments which could be made about noogenesis, technological civilization, etc.) the discussion. As far as our epistemic state on abiogenesis and noogenesis is concerned, the impact of cosmology tends to shift it towards agnosticism: we are sampling many Hubble volumes to be certain that at least one biosphere is produced with certainty, in accordance with our current empirical knowledge – which does not tell us whether there are indeed law-like process of biosphere emergence.[7] One might speak about the *degeneracy* (in the technical sense) of probabilistic reasoning when embedded within the cosmological

[5]Such as the directed panspermia of Crick and Orgel (1973).

[6]Koonin (2007).

[7]Note that Koonin’s argument does not say anything about the likelihood of success of our astrobiological endeavour: if anything, it might make us more *pessimistic* as to whether we are likely to find an independent abiogenesis within our cosmological horizon. However, it strongly refutes the idea that non-naturalistic factors are *necessary* for abiogenesis.

context: generalization of local probability calculations could lead to multiple, mutually exclusive conclusions.

This is highly instructive and somewhat unexpected point: what we should conclude about the chances of success of our practical SETI *observations* (for example), depends on the arcane cosmological assumptions about the multiverse. While the fact that odds of and in themselves should not determine conclusions or dictate action has been known since the inception of probability theory, the *context* of astrobiology/SETI studies is sufficiently strange that the sceptics have so far all too often managed to promote their view based on unfavourable odds only. The point needs to be taken into account when formulating a more general research programme outlined in the concluding section.

4 Extrasolar Planets, Galactic Habitable Zone, and Inductive Probability

The discovery of a large number of extrasolar planets since 1995 has dramatically changed our views on life in the universe and gave rise to the astrobiological revolution of the turn of the century. In spite of several false alarms which preceded the discoveries of Queloz, Mayor, Marcy, and Butler, it was still possible – up to 1995 – to argue or imply that the Solar System is either unique or a very rare occurrence in the Galaxy (or, indeed, the visible universe). This (proto)sceptical hypothesis has been clearly refuted – and in the way which Simpson and some of his followers wrongly predicted to lie in the distant future.

That was just the beginning of the new Copernican story. For a brief period early in the studies of extrasolar planetary systems, it was thought that most of them contain 'hot Jupiters', i.e., giant gaseous planets in very close orbits around their parent stars. Such planetary configuration has thought to be hostile to life, since the inward migration of gas giants would have destroyed stability of orbits of hypothetical terrestrial planets in the circumstellar habitable zone (e.g. Dawson and Johnson 2018). Many sceptics – including the 'rare-Earth' authors like Ward and Brownlee – have reasoned during that period that such empirical results corroborate their views.

Today, we know that 'hot Jupiters' are *exception, rather than the rule*. They have been first discovered in large relative proportion due to simple observation-selection effects, which have now been studied and understood in sufficient detail (Johnson et al. 2010). That minor episode in the recent history of planetary science – that anti-Copernicanism of the rare-Earth school tried to co-opt 'hot Jupiters' for the purpose of decreasing the probability of finding habitable Earth-like planets elsewhere in the Galaxy – should give us pause, however. What if *all* rare-Earth prerequisites for other complex biospheres are in fact similar cases: the progress of science will eventually show them to be generic cases, rather than exceptions? Are there any inherently small probabilities relevant for the evolution of complex biospheres at all?

Part of the problem with rare-Earth perspective originates in its misuse of counterfactual reasoning: Ward and Brownlee and their supporters tend to compare Earth within the real Solar System with the counterfactual Earth without (for instance) Jupiter, but with everything else in the Solar System staying the same – as if someone had removed Jupiter by magic! This is clearly wrong counterfactual thinking to use; instead, one should think about the evolutionary developmental process of the Solar System formation and subsequent evolution which could result in a configuration without Jupiter – but it is unclear whether such process could lead to existence of Earth in the first place. This problem with the implicit – and violated – ceteris paribus clause in the rare-Earth thinking has been noted in Chyba and Hand (2005) and Ćirković (2012, esp. Chapter 6). Here, I wish to add an additional and related problem which directly impact probabilistic inference: namely that the rare-Earth proponents fail to distinguish between logical independence and physical independence of their various proposed requirements. Not only the probability of some requirements cannot be evaluated outside of their proper context which is evolutionary, developmental, and historic, but it is highly doubtful whether their conjoint probability is simply the product of component probabilities. The probability of Earth's retaining stable rotation axis is equal to the probability of Moon-creating impact plus the probabilities of all the other ways for Earth to have stable axis (for instance, by continuing to spin much faster, e.g., in 8 hours or so such as it was in the time of our planet's accretion) – but both these alternatives are physically connected to the existence of Jupiter and other effects on the larger scales *and* to plate tectonics and other effects on the smaller scales. Thus, while these requirements are logically independent (in the sense that there are possible worlds in which the interaction is so small to be negligible), but are not physically independent in the specific historic case of our Earth. Therefore, we need a different and more complex method of calculating the compound probability.

Hence, the outcome of the debate on the validity of various 'rare-Earth' arguments is still very much open – that very fact should give pause to sceptics, since their case has initially seemed unassailable, almost self-evident. This is confirmed by the work done on the Galactic Habitable Zone, in both spatial and temporal domain, since the pioneering work of Lineweaver (2001) and Lineweaver et al. (2004). In recent years, we have witnessed an explosion of interest in the topic, on both theoretical (Behroozi and Peeples 2015; Zackrisson et al. 2016) and numerical (Vukotić et al. 2016; Forgan et al. 2017) level. These studies confirm that habitable planets in the Milky Way comprise a large statistical set on which important and testable analyses could be made. In other words, astrobiological studies of habitability have outgrown the early, childhood phase of philosophical preference and moved in the direction of quantitative solidity characterizing mature scientific fields.

Finally, there is a general argument against using probabilistic models based on conjunction of a priori improbable occurrences, which has been known in a vague form since Pascal and has been most beautifully described by Stanislaw Lem in one of his mock essays, a very real review of two fictional books, *De Impossibilitate Vitae* and *De Impossibilitate Prognoscendi*, by a fictional author Cezar (or perhaps

Benedykt) Kouska.[8] The fictional author uses his own ancestry to "prove" that the theory of probability is unsound:

> A certain army doctor, during the First World War, ejected a nurse from the operating room, for he was in the midst of surgery when she entered by mistake. Had the nurse been better acquainted with the hospital, she would not have mistaken the door to the operating room for the door to the first-aid station, and had she not entered the operating room, the surgeon would not have ejected her; had he not ejected her, his superior, the regiment doctor, would not have brought to his attention his unseemly behavior regarding the lady (for she was a volunteer nurse, a society miss), and had the superior not brought this to his attention, the young surgeon would not have considered it his duty to go and apologize to the nurse, would not have taken her to the café, fallen in love with her, and married her, whereby Professor Benedykt Kouska would not have come into the world as the child of this same married couple.

After elaborating in some humorous detail (an understatement!) on other such apparent coincidences leading to the author's birth, and their generalization from human genealogy to the very evolution of our species, Lem poses the key ironic question:

> Each man is, as it were, the first prize in a lottery, in the kind of lottery, moreover, where the winning ticket is a teragigamegamulticentillion-to-one shot. Why, then, do we not daily feel the astronomically monstrous minuteness of the chance of our own or another's coming into the world?

Not only it is impossible in retrospect to prove that a particular evolutionary outcome was particularly probable or improbable *in isolation*, but we need to understand whether events are physically dependent or not.

Clearly, in the case of one's ancestry, the problem with probabilistic reasoning is that the chains in the link are obviously – to the point of satire – not only not independent, but clearly linked in an inherent and genetic (in the philosophical sense) manner. How is it exactly different, however, from the reasoning beyond the rare-Earth hypotheses or some of the usages of the Drake equation, except that the context is less understood and hence the probabilistic 'shortcut' looks more plausible? Consider for instance items in the Drake equation – thing such as Sun-like stars, habitable planets, the origin of life, the origin of technological civilization, etc. are supposed to have only one direction of causal dependency: the origin of life depends on the existence of habitable planets, but not on the origin of technological civilization, etc. However, this simplistic view is, on deeper insight, simply *wrong*: persistence of habitable planets can depend on their being actually inhabited (e.g. through the 'Daisyworld-like' feedbacks), advanced technological civilizations are capable of increasing the number of habitable planets through terraforming, etc. It is in fact an excellent confirmation of the fruitfulness of the evo-devo approach to astrobiological complexity: nonlinearity and feedbacks accompanying the developmental side of the story obviate the simplistic conjunction

[8] Lem [1971] (1999), pp. 141–166. The same brilliant anthology contains the famous essay "The New Cosmogony" which proposes a novel and radical solution to Fermi's Paradox (cf. Ćirković 2018).

of probabilities which characterizes the initial state of complete ignorance. In this sense, the most fruitful approach is exemplified by the study of Scharf and Cronin (2016), which sets a quantitative framework for studying probability of abiogenesis as a function of a number of parameters outlining an 'island' volume in the overall parameter space.

5 Discussion: An Outline of the Research Programme?

The purpose of the present work is certainly not to argue that the probabilities of abiogenesis and noogenesis are high; it would be quite naive to draw such a conclusion, abstracting away Lucretian arguments, such as Koonin's. The question of absolute probabilities of such evolutionary steps is exceedingly complex and cannot be posed separately from the development of the overall *astrobiological theory*, which would enable such calculations and predictions from something at least much closer to the 'first principles'. The prospects of such a theory got immensely brighter in recent years, with works cited above such as Lineweaver et al., Behroozi and Peeples, Scharf and Cronin, Zackrisson et al., and others at the frontline. Such a future theory is likely to be Copernican, but not as a matter of general principle or abstract assumption; instead, Copernicanism will be an output – or a prediction – of the theory.

Instances of confirmation of Copernicanism include, for instance, empirical evidence that the Solar system is not an extraordinary rare occurrence (as, for instance, per old catastrophic cosmogonic hypotheses) – instead, planetary systems are definitely very frequent occurrences in the Galaxy. Sun is a fairly typical star, and the Milky Way is quite similar to millions of other large spiral galaxies. If there are claims to the contrary, the burden of proof is obviously on those uttering such claims. As to the spatial location and sets of objects concerned (Sun-like stars, terrestrial planets, etc.) there has been no reason so far to challenge Copernicanism on the empirical basis. It is true that some of the anti-Copernican claims of, for example, 'rare-Earth' theorists cannot be empirically falsified as yet, due to technical insufficiencies – e.g. the atypicality of Moon-like giant satellites of habitable planets – but that only means that the issue is still open and should not cause any Bayesian probability shift so far. Future generations of instruments will be able to test those aspects of Copernicanism which evade our empirical falsification (or corroboration) as yet; until then, however, we have no compelling reason to assume the sceptical position as default.[9]

[9] In parallel with Carrier's (2004) Class I error (citing obsolete sources), one should note that SETI sceptics like Kukla (2010) continue to cite Simpson, for example, in spite of his glaring failure to predict the relevant technological developments, since he argued that observations of extrasolar planetary systems are 'far beyond any reasonable extrapolation' of our astronomical capabilities. There are many such instances in the sceptical discourse, warranting further historical analysis.

Quite to the contrary, we have seen some reasons above for formulating a research programme investigating the consistency, motivations, and ramifications of the sceptical discourse. As we have seen, the early sceptical estimates are hardly better than open creationism; while 50 years ago they might have been justified, after 1995 and the astrobiological revolution, they should have revised. The revisions should naturally proceed in the Bayesian manner: new observational data and theoretical elaborations ought to cause a probability shift among different hypotheses about the existence of life and intelligence beyond Earth. Therefore, the question which needs to be answered within the proposed research programme is: *Has there been such a shift?*

Since prediction of outcomes is inseparable part of any research programme, I hereby express the following prediction, stemming from this cursory study: the cursory overview of the sceptical position indicate that there has not been such a Bayesian probability shift. In turn, this lack of Bayesian shift towards greater optimism in regard to extraterrestrial life and intelligence in sceptical circles support the hypothesis that scepticism has not been based on probabilities in the first place. Instead, the alleged low probabilities have been used at best as *post festum* justifications for pessimistic conclusions made in advance of any probabilistic analysis; at worst, they have been – and in many circles still are – fig leaf covers for an extrascientific and supernaturalist ideological agenda. The fact that some believers in extraterrestrial life and intelligence have been overly enthusiastic about probabilities even after the failure of the original SETI optimism of the ‘founding fathers’ (e.g. Aczel 1998) does not change the essential intellectual bankruptcy of the sceptical probabilistic inference. While not all SETI sceptics have been openly motivated by such an agenda, offering the indirect support or even finding such views legitimate topics for science and philosophy has been damaging enough. It is a high time for such abuse of probabilistic inference to end.

Acknowledgements The author wishes to thank Branislav Vukotić, Mark Walker, Jelena Dimitrijević, Anders Sandberg, George Dvorsky, John Smart, Slobodan Perović, Karl Schroeder, Aleksandar Obradović, Milan Stojanović, Goran Milovanović, Damian Veal, and Srdja Janković who offered helpful suggestions. Dušan Pavlović has kindly helped in obtaining some of the literature. The author acknowledges financial support from the Ministry of Education, Science and Technological Development of the Republic of Serbia through the projects #ON176021 and #ON179048.

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