



THEMED COLLECTION:  
THE TURN TO LIFE, PART 1  
DEBATE

## The possibility of life

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In a 2012 critique of John D. Barrow's *The artful universe*, I explored the problems inherent in attempting to predict what can and cannot happen—what is and is not possible—in the universe, with special reference to the emergence of life, consciousness, and culture. In the present essay, I revisit my arguments in light of new works that have appeared on this topic. I also argue that such cosmic debates have counterparts in familiar anthropological dilemmas, such as those that developed around the idea of “totemism.”

Keywords: life, mind, culture, universe, totemism, fire, possibility, randomness, luck

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**Spock:** Random chance seems to have operated in our favor.

**Dr. McCoy:** In plain, non-Vulcan English, we've been lucky.

**Spock:** I believe I said that, Doctor.

—“The Doomsday Machine,” *Star Trek: The Original Series*

Life is stunning in its actuality, but we are not content to leave it at that. A quirk of the human species is that we want to understand *whatever is* not just as actuality but as possibility. The more instrumental of human endeavors, such as engineering, strive to turn possibility into actuality in their efforts to give us useful new things. But less practical intellectual pursuits, both mythological and philosophical, just as often move in the opposite direction, beginning with actual states of affairs and asking what conditions or ingredients were necessary to make them so. Actuality, possibility, and necessity, for Immanuel Kant, formed a trichotomy of categories—those of modality (1965: 113)—leading into distinct kinds of cosmological quandaries: Are we necessary? Is a Creator necessary? What *else* might have happened? Could it, or we, or the Creator be different than they actually are? Should we feel gratitude? Kant lived at a moment when the nature of the physical cosmos was caught in contesting claims from mythico-religious and scientific authority. In our time, authority concerning the physical cos-

mos, at least among academics, has been given much more to science, but the consequence of the shift in authority thus far is less a resolution of the old quandaries than new formulations of them.

In an analysis in 2012 (Schrempp 2012: 35–71), I considered the ways in which the actual, the possible, and the necessary are entangled in recent arguments by Cambridge mathematical astronomer John D. Barrow, in *The artful universe* (1995, 2005), about the human place in the cosmos, and ended up largely rejecting his claims. My purpose in the present article is to revisit my earlier analysis of Barrow in light of three books that appeared shortly after I published my critique; one of these books contains arguments that support my position, one offers examples that might be tapped by Barrow, and the third, written in a sort of wait-and-see attitude, might be claimed by either. I seize on the opportunity for revisitation less to further my original argument than for the opportunity it affords for exploring some of the new turns in contempo-





rary cosmological debates that are continually thickening. In many ways these debates, for which the three books considered here form the “tip of the iceberg,” reflect a return to the spirit of metaphysics, a discipline that Kant—and many scientists since—see as inimical to science. But as Kant implied in the opening lines of his *Critique of pure reason*, just as human reason is powerless to resolve metaphysical quandaries, so is it doomed to fall into them. Although the cosmological context adds a distinctive flavor, the basic methodological dilemmas raised in such quandaries, I will suggest, have local counterparts in anthropological theories, in such venerable topics as totemism.

Barrow, along with many other contemporary scientific cosmologists, is impressed by the extent to which Earth, and indeed the entire cosmos, are fine-tuned to support the emergence of life and of a being with our intellectual capacities. He cites instance after instance of cosmic values and dimensions, especially of size and mass that, if altered even slightly, would rule out the possibility of life as we know it. Barrow carries his vision of cosmic fine-tuning into the topic of the emergence of human consciousness and culture by creating a modern version of an ancient myth: culture originates through the domestication of fire and advent of cooking. Into the fire myth scenario Barrow has woven new—or at least newly inflected—themes such as the claim that brain expansion flowed from nutritional benefits unlocked by cooking (a claim also advanced more recently by bioanthropologist Richard Wrangham and food journalist Michael Pollan, whose arguments I have also discussed [e.g., Schrempp 2016: 47–71]). Barrow’s analysis leaves one with the feeling that a being capable of accomplishing the domestication of fire, and thus of developing advanced conceptual abilities and culture, would have to be (at least approximately) our species, *Homo sapiens*. For example, we are just the right size for the task. A smaller being would not be able to approach and manage the fire, and would build a fire so small that that it would fall below the temperature necessary to maintain ongoing combustion. Moreover, it turns out that the heat produced by a fire of the size conveniently maintained by a human being is about right for heating a cave large enough to house that being.

Barrow’s is an innovative, nominally scientific, myth-infused version of the view that popularly has come to be known as the “Goldilocks” cosmos—no values too large, none too small, everything just right. Although Barrow is silent on the matter in *The artful universe*, the Goldilocks

cosmos holds an obvious attraction for those who think that the cosmos could have arisen only from a divine plan. Given the degree of fine-tuning necessary for the emergence of life and mind, the possibility is simply too small, it is argued, that these came to be through random process. Multiverse theory offers a possible nonteleological explanation of the Goldilocks effect; that is, that in the vast or infinite number of universes somewhere, by random chance, one would occur that offered the conditions possible for the emergence of life and mind—we occupy that one. Barrow is skeptical of multiverse theory (2005: 53). I concluded that Barrow’s claims are built on flawed reasoning, and argued that the vision Barrow offers of humans as the pinnacle of nature amounts to a new variation on the standard anthropocentric vision that, as Claude Lévi-Strauss suggests (1969), underlies and engenders the fire-myth everywhere.

The first of the three new books I will consider is *The improbability principle: Why coincidences, miracles, and rare events happen every day* by David Hand (2014). In this work Hand reveals a number of ways in which events that seem highly improbable are less so than they might seem. Two of Hand’s arguments, although developed quite differently, converge with my arguments contra Barrow. The first has to do with a kind of parochialism that can creep into arguments that attempt to rule out the possibility of alternatives to the actual. In my original analysis, I pointed out that Barrow’s claim that we are the right size to domesticate fire is constrained by a lack of imagination. The small fire-maker Barrow imagines is limited to a miniature *Homo sapiens*—a Tom Thumb fire-maker—whose tiny fire would fall below the minimum size necessary to support ongoing combustion. But what if, instead, we imagined a *tribe* of tiny fire-makers who together stoke a larger fire and heat the cave, which might turn out to be as suitable for a tribe of small fire-makers as it is for a single *Homo sapiens*. Contra Barrow, I put forward a number of imagined scenarios of small fire-makers of alternative design to *Homo sapiens*, and argued that Barrow’s conclusion about his doomed Tom Thumb fire-maker amounts to nothing more than “a foregone conclusion since changing one key variable in a system of interrelated parts while insisting that the others remain constant will necessarily introduce disequilibrium” (Schrempp 2012: 70). Barrow changes just one variable—the overall size of the fire-maker—without considering any of the other alternatives one can imag-



ine in the design or social structure of the fire-making being.

In *The improbability principle*, Hand does not discuss fire-makers or the origin of culture, but at one point he deals with parallel fine-tuning arguments in the macro-evolution of the cosmos. One of the possibilities he considers is that other universes might be organized around cosmic constants different from those of the universe we inhabit, and the claim made by some scientific cosmologists that any such variations would rule out the possibility of life since life depends on carbon. Carbon in turn is produced in stars, and any variance from the constants that rule our universe would preclude the production of stars. Confronting such claims, Hand says:

One weakness of most fine-tuning arguments is that they focus on one constant at a time. It might well be that changing any one of them, *while keeping the others fixed*, does indeed lead to an overwhelming number of universes which would not permit stars to form or to have sufficiently long lifetimes for life to evolve. But what happens if we change two (or more) together? (2014: 215)

Hand reports (2014: 217) that studies have suggested that by varying three constants at the same time, rather than just one in isolation from others, alternative configurations emerge in which stars are once again possible. And to this I add: Who knows what else might be possible?

While it may seem quite distant, the methodological issue of the moment in both my critique of Barrow's fire-maker and Hand's arguments about the evolution of stars has a close-to-home precedent in a landmark critique offered by Franz Boas of social-evolutionary theories of totemism. Boas pointed out that while social evolutionist thinkers claimed to be following the classical dictum of "like causes, like effects," in fact they were starting with "like effects"—ethnographic evidence they read as indicating similar social institutions occurring worldwide—and inferring "like causes"; that is, a unilinear course of development for all of these instances. Boas pointed out that even if one accepts the principle that like causes necessarily produce like effects, one cannot infer from this the reverse. He used evidence of different historical courses giving rise to totemism to illustrate the point:

The conclusion is certainly justified that the psychical conditions of man favor the existence of a totemic orga-

nization of society, but it does not follow that totemic society has developed everywhere in the same manner. Dr. Washington Matthews believes that the totems of the Navaho have arisen by association of independent clans. Capt. Bourke assumes that similar occurrences gave origin to the Apache clans, and Dr. Fewkes has reached the same conclusion in regard to some of the Pueblo tribes. On the other hand, we have proof that clans may originate by division. I have shown that such events took place among the Indians of the north Pacific coast. Association of small tribes, on the one hand, and disintegration of increasing tribes, on the other, has led to results which appear identical to all intents and purposes. (1982: 274; see also Stocking 1974)

The three topics discussed above form a progressively nested sequence: the emergence of carbon and thus the possibility of life (Hand); the emergence of consciousness and culture (my critique of Barrow); the emergence of the specific human cultural institution of totemism (Boas). At issue is a methodological problem that transcends and unifies all three cases of purported evolutionary emergence: how to work back from actuality to possibility. At different levels, the critical point raised by Hand, me, and Boas are the same: until proven otherwise, one must assume that a given state of affairs can emerge *in different ways*; or, in other words, the actual may map to multiple routes of its possibility. If one wants to prove that the actual is coterminous with the possible in a particular case, one must open up *all* of the variables available in that case and somehow rule out the possibility of alternative configurations in which a given end might be realized.

In another strand of his argument, Hand explores the ways in which probability is influenced by decisions, conscious or unconscious, about what is allowed to count as a coincidence. The most obvious cases—what Hand calls the law of "near enough"—concern conscious decisions to widen a target. We decide, for example, that we will consider as coincidence not just people born on the same day but on adjacent days or during the same week; such relaxations of borders dramatically increase the odds for coincidence. While there is nothing too surprising in this example, Hand calls attention to more subtle, unconscious mental shifts we may make that allow coincidences to seem less likely than they really are. We hear that someone has won a lottery for a second time, and we consider this to be astonishingly improbable; in reality, the occurrence may be less improbable than we think. When we hear about the event, we may well conceptual-



ize the coincidence as the odds of *this* person winning *this* lottery for a second time on *this* day. However, we would have the same reaction if *any* person won *any* lottery for a second time on *any* day—a coincidence with considerably greater odds than the one we had initially conceptualized. The degree of likelihood is thus drastically influenced by the breadth or narrowness of what we are willing to count as a match; it is imperative that we be aware of (possibly unconscious) coexisting formulations that may, subtly yet vastly, influence the assessment of the likelihood of the particular occurrence that we are analyzing.

Hand's insights about shifting conceptualizations are directly relevant to a problem that I attempted to describe in Barrow's approach to the evolution of culture: specifically, that Barrow uses culture in two different ways that implicitly pose two vastly different-sized targets for what counts as culture (Schrempf 2012: 52–54). When he is talking theoretically about the evolution of culture, Barrow's notion of culture is quite abstract: he means ideas, information, and symbols that can be passed on through language as opposed to inheritance as instinct. But when he is engaged in showing how fine-tuned the human organism is for culture—through a series of vignettes that convey the impression that our species in its present configuration is necessary for the evolution of culture—his concept of culture is narrow, anthropocentric, and concrete: culture is books, tools, and wheels. He points out that none of these concrete cultural artifacts would work for a small being; for example, a book would not work at the micro scale because its pages would stick together. As in the examples discussed by Hand, there are in Barrow's analysis two different-sized targets for what counts as culture. When offering the proof of our fine-tuning, what counts as culture is defined so narrowly that culture all but necessitates *Homo sapiens* in its present configuration as its inventor. As in the Tom Thumb fire-maker, the target of the proven is considerably smaller than the target of the claimed. When we are asking about the possibility of life on a cosmic scale, just how big of a target do we confront? While there is no clear answer, some considerations relevant to this issue will emerge toward the end of this essay.

The second new book to be considered is David Waltham's *Lucky planet: Why Earth is exceptional—and what that means for life in the universe* (2014). Like Barrow, Waltham emphasizes the many fine-tunings upon which earthly life as we know it depends; again

like Barrow, many of Waltham's examples point to matters of size and mass. The cosmos and biosphere are full of delicate balances that would be thrown off by even minor alterations of seemingly marginal factors. Unlike Barrow, Waltham organizes such structural considerations under a theme that is temporal in nature. In the face of evidence that stars and planets often undergo dramatic, apocalyptic transformations in temperature and climate, Waltham's particular obsession is how it is that Earth managed to have “four billion years of good weather” (2014: 123), a duration necessary for life as we know it to evolve. His analyses, although often quite speculative, are surprising and interesting. For example, he says his calculations reveal that an only slightly larger version of our moon would have led to an unstable axis for Earth and ensuing climatic chaos, but if the moon had been smaller, Earth would spin faster and thus have had more frequent and severe ice ages. “The true Earth-Moon system sits in a sweet spot between the life-destroying fates of frequent, severe glaciation or climatic chaos” (2014: 176).

Waltham's claims about fine-tuning, while resonating with Barrow's, are less problematic than Barrow's. Waltham offers no improvement over Barrow in terms of the methodological problem raised above—that is, the possibility that the same ends might be realized in more than one way; but, then, the spirit of Waltham's analysis is less apodictic than Barrow's. Barrow seems to want our actuality to exhaust the universe's possibility for intelligence and culture, while what Waltham means by “lucky” is more modest: something like that the conditions suitable for life to appear must be quite rare. Exactly how rare we do not yet know, and Waltham concludes with a plea for research that might answer that question. Waltham explicitly recognizes two main contending explanations for Earth's comparatively long streak of life-favoring weather: the Gaia hypothesis of James Lovelock, which holds that the earth is a living organism with feedback mechanisms for maintaining proper temperature, and Goldilocks, which Waltham uses as synonymous with luck. Early in his work (2014: 13), Waltham mentions but does not pursue another possibility; namely, divine providence: so *in toto* there are three contenders—God, Gaia, and Goldilocks—and Waltham puts his money on the third.

Waltham's analysis too is myth-infused, but quite differently than Barrow's. If Barrow's fine-tuning arguments culminate in a new version of an anthropocentric myth, Waltham's mythology is geophilic, with a notable



bias toward the female gender. He dramatizes his theoretical preference through a closing chapter that juxtaposes the two leading contenders as females—"Gaia or Goldilocks?"—and repeatedly refers to Earth as "she" (cf. *Guys and Dolls* on Broadway: "Luck, be a Lady!"). His attitude recalls Boas's classic, and also gendered, characterization of a polarity within the physical sciences. On one hand there is the physicist, who is impelled by systemization and elegant abstractions.

The cosmographer, on the other hand, holds to the phenomenon which is the object of his study, may it occupy a high or low rank in the system of physical sciences, and lovingly tries to penetrate into its secrets until every feature is plain and clear. This occupation with the object of his affection affords him a delight not inferior to that which the physicist enjoys in his systematic arrangement of the world. (Boas 1982: 645)

For everyday purposes, the earth *is* flat; and at least for our little corner of the cosmos, Waltham may be right that we *are* lucky. Or perhaps some other phrasing would be less parochial: we inhabit a region in the cosmos in which the effects of random chance gave rise to a rarely occurring set of conditions that allowed the emergence of life, consciousness, and scientifically meaningless concepts such as luck. Paul Davies's (2007) language is more effusive: we hit the "cosmic jackpot."

If one wants to insist that a certain state of affairs could have come to be in only one way, or that given a certain set of ingredients only one state of affairs is possible, then one must rule out all other possibilities, a variation on the classic bugaboo of trying to prove a negative. In challenging Barrow's ruling out of a small fire-maker, as discussed above, I pointed out that he had not given any serious effort to imagining ways in which a small fire-maker, differently configured, might succeed. This is a case in which rigor requires not reining in of imagination but the mobilization of it. But just how one would scientifically go about imagining scenarios alternative to the actual—whether to promote or, as in the case of Barrow, to defeat them—is a question that I did not pursue. However, the year after I published my critique of Barrow, there appeared (by luck?) a book that explores just this issue, David Toomey's *Weird life: The search for life that is very, very different from our own* (2013). Toomey describes how scientists, in searching for extraterrestrial life, are forced to imagine the possible forms that might be taken by that which they are search-

ing for. Their quest blends the categories of actuality and possibility in a novel way: they are actually empirically investigating the possibilities that they attempt to imagine in advance. On a cosmic scale pathetic, their search efforts, on an earthly scale, are grand, involving cutting-edge technologies such as advanced telescopes and space probes. The best-known program was SETI (search for extraterrestrial intelligence), spearheaded by the late Carl Sagan.

Here I will summarize some of the arguments I explore in more detail elsewhere (Schrempp 2015) in a folkloristic assessment of Toomey's work. Two provocative issues jump out from Toomey's work. One is the relation between this new scientifically defined imagining of alternative forms of life/intelligence on the one hand, and on the other hand, the archaic tradition of folkloric imagination that has given us an extravagant world catalog of monsters and other "others." One might want to believe that the scientific imagining of cosmic others is disciplined by science's accumulated knowledge about the nature of matter; however, the certainties diminish when one deploys this knowledge in the context of a cosmic evolution that many scientists regard as ruled by contingency (cosmic evolution might have happened differently), emergence (the principle that combinations of elements can give rise to unpredictable new properties), and the possibility of multiple universes built from different constants. Countering the inclination to rein in imagination—and shaking one's confidence that present-day science is accomplished enough to negatively predict the occurrence of life—are recent discoveries of forms of life on Earth existing in temperatures and other conditions formerly assumed to exclude life, such as *Riftia* tube worms that inhabit hydrothermal vents between pieces of lava. Such surprising life-forms collectively have earned the name of "Extremophiles."

The difference between scientifically and folklorically imagined alternative life is certainly not absolute. For, like scientifically imagined alternative life-forms, prescientific monsters, too, have often been imagined with a sense of realistic design constraint; for example, typically with organs of locomotion, sensation, and nutrition. Perusing Toomey's samples of exotic scientifically imagined alternative life—living desert varnishes, clouds organized as neurotransmitters, hydrogen-breathing dirigibles—it seems possible that the effect of accumulated scientific knowledge has been less to rein in traditional folkloric monsterological imagination, than to give it new energy. Indeed, of the three new books considered here,



Toomey's is the most full of mythological resonances. For example, at its most technical, weird life for Toomey means life that is not part of LUCA (last universal common ancestor), a hypothesized single microbe that metabolized nearly four billion years ago and that most evolutionary scientists suspect to be the common ancestor of all earthly life. However, some scientists think that life on Earth began more than once. "It follows . . . that if a second beginning had occurred under even slightly different circumstances, a different sort of life would have resulted" (2013: 33).

A mythologist cannot but think of Greek poet Hesiod's *Theogony*, a grand poem that fit all of the gods, and thus all of the cosmic forces relevant to human life, into a genealogical synthesis. It is notable, however, that Hesiod opted for two great cosmic lines that never meet, one from Gaia (Earth), the other from Chaos, whose descendants interfere with rather than harmonize easily with human life. Émile Durkheim and Marcel Mauss (1972) imply that genealogy is ultimately at the base of any attempt to speak of the unity of a set, biological or social—whether in an obvious way, or transmuted into scientific abstractions such as the concept of a "genus."

The other, more fundamental issue raised by Toomey's book is the very definition of life, for nothing brings to the fore problems of defining a given entity so much as the physical search for it. Different specializations within biology, Toomey points out, tend to define life in different ways: "A physiologist might call life 'a system capable of eating and metabolizing'; a molecular biologist might call it 'a system that contains reproducible hereditary information coded in nucleic acid molecules'" (2013: 65). Philosophers attempt to define life "by what it does," which gives rise to other sorts of quandaries: "The problem is that any reasonably complete list of an organism's functions is bound to include some that are performed by things that are nonliving, and—just as problematic—some nonliving things perform functions that some living organisms cannot perform" (2013: 65).

How different might life have been? The more basic one gets, the more divergent become the possibilities. Some scientists think that silicon- as opposed to carbon-based life is a realistic possibility (Toomey 2013: 88–96). Many think that the search for weird life rightly emphasizes the presence of a liquid medium, but water may not be the only medium that would work (2013: 84–86). In one sense, such speculations may lend a sort of spiritual support to my critique of Barrow: it is parochial, if not arrogant, to attempt to rule out the possibilities of life

in advance. On the other hand, even though absence of evidence is not evidence of absence, there is this much for Barrow: so far, the search for weird life has turned up nothing very promising let alone any alternative fire-makers.

Life, in yet another way, thus may be like totemism, which in turn, in Lévi-Strauss's famous analogy, "is like hysteria" in that once we are persuaded to doubt the possibility of isolating distinguishing criteria, then we begin to doubt the existence of a unitary phenomenon at all (1963: 1). Lévi-Strauss thought that Alexander Goldenweiser's dismantling of "totemism" was suggestive: what eluded definition as a discrete, objective social institution yet bore scrutiny as partially overlapping manifestations of broader tendencies in human thought. Hence "totemism" conceptually still exists nowadays, along with many or most cross-cultural anthropological concepts, in that quasi-status designated by encasing theoretical terms in quotation marks. Contemporary anthropological interest in the different ways in which various human societies draw lines relevant to "life," notably between something like animate vs. inanimate being, suggests that "life" too, provisionally at least, belongs in the pool of anthropological quasi-concepts. The picture presented in the three recent books just considered, and indeed in many others of their ilk, is that contemporary cosmological science, while enriching the problem of life, thus far can help us only to the extent of offering the thought, simultaneously vexing and consoling, that the problem of defining "life" is not just local but cosmic.

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