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 to the Cosmic Event Horizon
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Abstract

Scholars have claimed repeatedly that Anaximander's notion of the ἄπειρον marks the first metaphysical concept, or even the first theoretical entity, in Western thought. The present paper scrutinizes this claim. Characterizing natural phenomena as ἄπειρος—that is, as being inexhaustible or untraversable by standard human means—was common in daily practice, especially when referring to landmasses and seas but also when referring to vast numbers of countable objects. I will deny the assumption that Anaximander's notion started off as being a theoretical answer to a specific philosophical question. That said, the aforementioned everyday notion of ἄπειρος could still lead to the development of theoretical concepts. Based on the observations Anaximander did with seasonal sundials, the inexhaustible landmasses and seas just mentioned became depicted on his world map by means of concentric circles. These circles then marked the bounds of experience and, by being fixed and finite, suggested the possibility of traversing beyond what is directly experienced. Evaluating claims from recent Anaximander scholarship, the paper ends with a brief comparison with concepts from modern physics which play an analogous role of demarcating the bounds of experience.

Anaximander's ἄπειρον: from the Life-world to the Cosmic Event Horizon

Norman Sieroka

Interest in Anaximander (c. 610-c. 547 BC) has increased in recent years. Exemplary illustrations are the monographs by Hahn 2001, Couprie et al. 2003, and Gregory 2016. This is partly related to Anaximander's relevance regarding two broad and closely interrelated questions about the historical development of Western thought. The first question concerns Anaximander's claim of nature being ἄπειρος, and how this claim relates to the origin of science and metaphysics. More specifically, the question is about whether Anaximander himself used the neuter noun ἄπειρον to denote an abstract concept or even to postulate a theoretical entity in a fully fledged metaphysical or

scientific sense. Within Anaximander scholarship there is indeed a considerable list of both affirmative and negative answers to this question.¹

The other, follow-up question is about how adequately to investigate the background and origin of pre-Socratic philosophy. Here recent work has shown important ways of contextualizing Anaximander's *ἱστορία περὶ φύσεως*, that is, his inquiry into the development of the world as a whole. Whereas these studies emphasize, for example, relations to ancient architecture, politics, and astronomy, I highlight relations to ancient map drawing, and specifically to how the bounds of what was empirically known and what was considered experientially accessible became depicted or rather 'symbolically mapped' by cartographical means.

Thus, the first question is about *historical content*, whereas the second focuses on *historiographical method*. Since a discussion of content presupposes an adequate method, I start with the second question, that is, section 1 is about the historiography of ancient thought, especially about the role of everyday experience and practice in this context. The central claims will be further supported and illustrated by reference to recent studies on Anaximander in which similar methods have been applied. And some follow up questions regarding methodology will be discussed at the very end of section 2.

Moving from method to content, conjectures about Anaximander's *ἄπειρον* being the first fully fledged theoretical concept will be the subject of sections 2 and 3. I will sketch a more refined picture both of what happened in antiquity and of how it compares to modern concept formation. Section 2 is about the function of the term *ἄπειρος* as a heuristic that would enable ancient actors to 'locate' the boundaries of their everyday world. Important evidence for this claim will be gained by having a closer look at the way Anaximander made use of seasonal sundials in order to depict, on his world map, landmasses and seas that are claimed to be *ἄπειρος*. Section 3 starts by considering how such a 'localization of an experiential horizon', as one might call it, could be 'completed' by means of postulating theoretical entities. Thus, this section tries to gain an understanding of the often-heard claim that Anaximander was the first to introduce a theoretical entity or abstract concept. However, this does not imply that I share this claim, nor that I take the later development to be already implicit or part of Anaximander's original notion. The end of section 3 then serves as a kind of case study, investigating what might, in modern physics, be viewed as a concept playing an analogous role to that of the *ἄπειρον*. And I might immediately add that this consideration of relations to modern physics is not just a hobbyhorse or idiosyncrasy on my part. Instead it is a direct reply to claims and challenges from recent Anaximander scholarship, which have opened up that thread (esp. Rovelli 2011).

¹ As regards recent contributions to this debate, see Rovelli 2011 versus Couprie and Kočandrlje 2013. Further scholars disputing a nominal usage of the term *ἄπειρον* by Anaximander include De Vogel 1957 and Duhren 2013. A standard reference for the claim that Anaximander's *ἄπειρον* is 'the first metaphysical idea' is Seligman 1962.

I. Continuous transitions: a historiography that takes account of everyday experience and practice

In Sieroka 2017 I drew attention to Anaximander’s notion of the ἄπειρον— denoting something infinite or, rather, indefinite—in relation to everyday experience and practice. I argued (i) that the term ἄπειρος was originally used to refer to natural objects experienced to be in(de)finite in the sense of being inexhaustible, countless, or untraversable; that (ii) Anaximander’s notion of the ἄπειρον relied upon this common usage; and (iii) that this becomes evident also from Anaximander’s world map, especially from its representation of landmasses and seas as bounded by (imaginary) horizons.² I developed and defended these claims, first, by means of investigating the widespread use of the adjective ἄπειρος and its cognates (ἄπείρων, ἀπείρατος, and ἀπείριτος), which, in turn, asked for a closer consideration of the early epics since they shaped to a great extent the common usage of words in the days of Anaximander. Second, these claims were underpinned by relating the Homeric and Hesiodian usage to other everyday experiences and practices. Finally, a third strand of support was provided by showing the close relationship between structural features and abstractions as instantiated on Anaximander’s world map, on the one hand, and both the common usage of the term ἄπειρος and certain Homeric and Hesiodian themes (particularly the myth of Oceanus) on the other. Thus, the overall claim was that, with regard to the genesis and early establishment of Anaximander’s notion of the ἄπειρον, it is crucial to investigate how this notion figured in everyday contexts (notably language use, mythological heritage, and cartography) as encountered by Anaximander and his contemporaries.

To be more specific about ἄπειρος and its cognates: Homer and Hesiod use the word to describe lands and seas when, from the perspective of the person standing or sailing upon them, no one knows where they end (see, e.g., *Iliad* i 350, vii 446, xxiv 342; *Odyssey* i 98, iv 510, v 46, x 195, xv 79, xvii 386; *Theogony* 109, 878). All the

² For present purposes, let me just add some important references in order to place these claims within Anaximander scholarship. Similar claims as (i) can be found already in Aristotle (*Phys.* 203b18-20 = DK 12A15) and have been made prominent especially by Kahn 1995. Claim (iii) has been made with reference to works by Couprie and Hahn (cf. above) and some works by Heidel (esp. Heidel 1921 and 1937). Regarding (ii), see the prominent predicative usage in DK 12A9 (φύσις ἄπειρος), in Aristotle’s *Phys.* 203a1-18 (which includes DK 58B28), as well as in testimonies by Simplicius and Alexander of Aphrodisias (see Wohrle 2012, Ar172, Ar173, and Ar81—cited and translated in Kočandrle and Couprie 2017, 41). Modern scholars emphasising the predicative usage of the term ἄπειρον by Anaximander (and questioning a nominal usage) include De Vogel 1957, Lebedev 1978, Fehling 1994, Duhrsen 2013, and most recently Kočandrle and Couprie 2017, 13-14, 29 31, 45. I might add that I agree with Kočandrle and Couprie 2017 not only regarding the predicative usage of ἄπειρος but also regarding its pervasiveness which is internal or intrinsic (rather than external) to the world (p. 85). However, I am hesitant about their exclusive attribution of ἄπειρος to nature (φύσις; pp. 51-53, 99). One reason for my hesitance is the close relation they draw to Heraclitus’s famous fragment 123—a relation that turns ‘inexhaustible nature’ into something hidden (cf. Hadot 2006 who criticizes such a turn quite generally). In contrast, my focus is with, one might say, particular constituents of nature (such as water, landmasses, and grains of sand) that are claimed to be inexhaustible already in Homer and also in various other sources. In fact, the expression ‘inexhaustible nature’ (ἄπειρος φύσις) might just be a shorthand for the fact that water, land, sand and so on are or might be inexhaustible. Or, to put it a little crispier: rather than suggesting that being ἄπειρος is a general part of nature, I like to suggest that parts of nature can be (experienced as being) ἄπειρος.

traveler or sailor sees is the land or water within the horizon. And since the horizon is itself unreachable, the land or sea appears to be potentially endless—it could, for all practical purposes, go on ‘forever’ and, hence, from the perspective of the agent, the land or sea might readily be called ‘in(de)finite’, ‘inexhaustible’, or ‘untraversable’. Notably, this interpretation gains further support from the way uninhabitable and inexhaustible landmasses and seas are depicted (or rather epitomized) on Anaximander’s world map, where the depiction itself became possible on the basis of Anaximander’s inquiries with seasonal sundials and his understanding of geometrical similarities and projection (see section 2).

Moreover, the term ἄπειρος is used in Homer and Hesiod in another nonspatial but still agent-indexed sense. Here the term denotes what one might call the ‘numerical inexhaustibility’ a person encounters when faced with a mass, swarm, or multitude of items far too numerous to count. It is in this sense that Homer uses ἄπειρος to characterize the amount of chain needed to bind a hero (δεσμοὶ ἀπείρονες, *Od.* viii 340) or the number of wild goats living in the land of the Lotus-eaters (αἴγες ἀπειρέσιαι, *Od.* ix 118). There is no technical or formal metaphysical sense in which the chains are infinite; nor, anachronistically speaking, is the number of goats claimed to be of cardinality \aleph_0 . Instead, it is all about natural objects encountered in daily life being inexhaustible and in(de)finite relative to human capacities.

Once one adopts this interpretation, a kind of Solomonian judgment is available in answer to another prominent issue regarding Anaximander. Apart from the adjective ἄπειρος as deriving from πέρασ or πεῖρα (limit, bound)—which is the word I have considered so far—there is a homograph ἄπειρος deriving from πείρα (experience, inquiry; see Frisk 1973). Correspondingly, some scholars claim that Anaximander’s term ἄπειρον might actually derive from this second homograph. Rather than drawing a strict etymological and especially connotational division, however, I suggest that the connotations of the two homographs may run together, especially when focusing on an agent-indexed everyday perspective.³ After all, it seems not so big a jump from considering untraversable areas and inexhaustible swarms of objects to claiming that there is something that goes beyond the experientially familiar. Thus, notwithstanding questions about proper etymology, when hearing the term ἄπειρος associations of both homographs would have come up. Besides, such common reverberations are consonant with what is depicted on Anaximander’s world map.

This leads me to some more general remarks about methodology. I suggested that the methodological starting point for accessing Anaximander’s notion should be everyday experience and practice. Such a starting point seems plausible, given that pre-Socratic philosophy encompasses all objects of experience and every, at least

³ See also Kočandrle and Couprie 2017, 16, who make a similar point by claiming that ‘that which is boundless or infinite is, as such, beyond our experience’. While I do agree with the gist of this comment, I do not think that ‘boundless’ or ‘infinite’ are good translations of ἄπειρος. ‘Infinite’ arguably loses track of the agent-indexed perspective and makes it sound like a kind of absolute or even mathematical infinity. ‘Boundless’ is problematic because it has a more specific usage today that would re-translate into ἀψόρροος (rather than ἄπειρος) see section 3.

nonartificial, subject of rational inquiry (Barnes 1979, 19); and it includes language use and map drawing as being prominent parts of everyday practice when it comes to encountering and expressing inexhaustibilities in the above sense.

The present methodology is similar to other approaches put forward recently in the context of investigating Anaximander and the pre-Socratic era more generally. Robert Hahn, for instance, defends what he calls an ‘experiential realism’, which emphasizes the importance of relating doxographic evidence to artifacts and cultural concerns, that is, he aims to consider the textual evidence we have in the light of everyday life and as based on lived bodily experience (Hahn 2010, 203-211, 229, 237-241). He contrasts this with what he calls ‘*metaphysical realism*’, which he takes to go along with the rather implausible assumption that ‘philosophy lives a supracelestial life beyond the confines of space and time’ (Hahn 2010, 2, 7, 180, 245-246). Also Graham 2006, 103, to give only one further example, aims to provide an interpretation taking account of and emphasizing Anaximander’s everyday context and world. However, of all Anaximandrian notions, it is the ἄπειρον that, according to Graham, cannot be covered by this method because the ἄπειρον, says Graham 2006, 42, denotes something external to everyday life. It goes without saying, given the claims from above, that I disagree with such an ‘externalist claim’. In fact, I take it that Graham’s interpretation would gain additional weight and comprehensiveness by acknowledging that ἄπειρος also applies to the everyday experience of things.

Thus, the historiographical method suggested here is based on the conceptforming role played by everyday experience and practice. Accordingly, the present approach might be called ‘phenomenological’ or ‘pragmatist’, focusing on how the development of philosophical concepts is shaped by what, in a phenomenologist tradition, would be called the ‘life-world’ (see, e.g., Husserl 1954). In relation to the pre-Socratic era and the beginning of Western philosophy and science, the concept refers, first, to ‘general’ experience rather than to cultural specifics—not the peak times of the Milesian market, but rather the cognitive capacities and the range of experiences all humans share (Lloyd 2009, 4, 155- 169, 182).

Second, adapting some Kantian terminology, the concept of the life-world refers to ‘intuition-based’ experience, that is, to the human encounter of the world ‘before’ there is a prominent split or division between intuitions and concepts, and hence before a concept-dominated abstract worldview prevails. Accordingly, the concept of the life-world is surely not without its problems when applied to the present century, where everyday experiences and parlance are so much infused with scientific abstractions (and technological innovations). However, things are different with regard to the beginning of Western thought. Here the phenomenological terminology, including all its spatial connotations, seems particularly apt to account for the prominent and increasing tension between the environment as encountered in daily life on the one hand and theoretical considerations on the other.

In the phenomenological literature, the famous anecdote from the *Theaetetus* of Thales falling into a well when gazing at the stars was used as the prime example with

which to illustrate this new split between being a competent actor in the life world and being a kind of alienated theoretician (Blumenberg 2015).⁴ However, such a split does not occur as a sharp break. It is not that, one day, Thales or Anaximander abandoned the life-world for an ivory-tower existence. And whoever aims to defend such a view should immediately keep in mind one further anecdote about Thales, apart from his falling into a well, namely, his economic gamesmanship when paying a deposit on all oil presses in Miletus before the harvest.

Accordingly, claims about Anaximander's notion of the ἄπειρον being the first metaphysical or scientific concept need to be qualified. In particular, it is not that with Anaximander there is a big and precisely datable break in the history from intuitive, pictorial, and mythological thinking to abstract, theoretical concept formation, and that therewith the beginning of modern science and philosophy becomes a single and precisely datable event (Kahn 1995, xiv, 133; see also Barnes 1979, 23, 37). Instead, one has to focus on the whole process of concept formation within the life-world and on shifts in emphasis and weight in the processes of understanding and explaining a wide range of, mostly natural, phenomena (Lloyd 2000 and 2004; cf. also Sieroka 2014, 67-75).

More specifically, I would like to suggest that an important aspect of the shift from straightforward everyday concepts toward more and more abstract terminologies can be explicated by looking at the usage, depiction, and connotations of ἄπειρος. Thus the remaining two sections explore some aspects of what this story might look like. They suggest that the notion of the ἄπειρον made people aware of the limits of the life-world and revealed possible ways for going beyond them by means of conceptual abstraction and theorizing.

II. Encountering in(de)finiteness: the ἄπειρον and its role as a pre-conceptual symbol

In order to explicate the claim that the notion of the ἄπειρον played an important role in the emergence of conceptual abstraction and theorizing, let me first take a step back and reintroduce (and slightly complement) a notion from Anaximander scholarship going back to Seligman 1962, namely, that of a 'pre-conceptual symbol' and a 'retrospective analogy'.⁵

4 In fact, Blumenberg uses Thales's (alleged) fall into the well as a kind of pre-conceptual symbol or archetypal image (cf. section 2) in order to show 'the metakinetics of the historical horizons of meaning and ways of seeing within which concepts undergo their modifications' (Blumenberg 2010, 5). This phenomenologically inspired way of writing history, called 'metaphorology', will be introduced more carefully at end of section 2, in order to then gain a better understanding of what (mis-)happened to Anaximander's notion of ἄπειρος in subsequent centuries.

5 The explication of the term 'pre-conceptual symbol' in the following paragraph is complemented by concepts and insights from Cassirer 1955. Moreover, the notion is akin to what Couprie recently called an 'archetypal image'. With regard to Anaximander, Couprie 2016 takes the notion of the cosmic tree to be an example in case. And similar to what has been stated above, he claims such images to 'refer to things from daily life' and also to 'reflect deeply rooted archetypes'. Notably, Couprie also makes repeated usage of the term 'phenomenological' in order to characterize his approach.

A pre-conceptual symbol is a concrete representation, usually a word, which is a direct expression of or for something (hence symbol) and that has a certain prefigurative suggestiveness (hence pre-conceptual). Concrete representations or symbols in this sense are, for instance, personifications, names, and onomatopoeic expressions, but also, for instance, voodoo dolls. In some cases a symbol has a suggestiveness that goes beyond its concrete actuality by being, as Seligman 1962, 138 puts it, ‘pregnant with a meaning which only later stages could make explicit’. That is, the symbol unfolds and generalizes its inherent meaning. Metaphorically speaking it gains an increasingly involved position in the semantic network of the given language. In particular, there will be more and more relational features the symbol stands for and less and less concrete and individual ones. Hence the symbol is no longer *pre-conceptual*. Whether such an unfolding of implicit presence or meaning will take place or not, can, of course, not be known in advance. However, whenever such an unfolding does take place, the symbol can in retrospect be read as an analogy (hence ‘*retrospective analogy*’). And some such pre-conceptual symbols and retrospective analogies turn out to be highly important for the general development of scientific inquiry.

Seligman introduces the notions of a pre-conceptual symbol and a retrospective analogy when discussing the role played by Oceanus in Homer and Hesiod as compared to the role played by water and related elements or concepts in pre-Socratic thinkers such as Thales and Anaximander. He suggests that Oceanus functions as pre-conceptual symbol and retrospective analogy in the sense that, with the benefit of hindsight, one can use Oceanus as a placeholder to explain the development of early Greek philosophy. This is a development that —if I am again allowed to complement and adapt Seligman a little—might be condensed into the following instant version: First, in the early epics, Oceanus starts off as being the ‘creator of everything’ (γένεσις πάντεσσι, *Il.* xiv 246). Then Thales makes a related claim, though here this creator is no longer a personalized god but the element water, that is, the de-personalized content of the ocean (see also Schadewaldt 1978, 63). Next, Anaximander shifts emphasis from water or the ocean to one of the ocean’s most distinguished features, namely, that of being in(de)finite in the sense of being inexhaustible and untraversable, demarcated only by an agent-indexed horizon (Gottschalk 1965, 53, Dancy 1989, 151, and Sieroka 2017). Afterwards, Anaximenes takes up this feature of something being in(de)finite to describe ἀή — which notably translates into moist rather than dry air—as an ethereal and all-pervasive substance. Hence, Anaximenes’s concept still carries both strong Homeric and Thalesian connotations, and it newly associates them with a whole range of everyday (life-wordly) phenomena such as dew formation and evaporation.

That said, it is, of course, very unlikely that Homer would have been conscious of the conceptual power of the notion of Oceanus or, more precisely, of the whole semantic field of ‘Oceanus’, ‘(untraversable) ocean’, ‘(inexhaustible) water’. This is why Seligman calls ‘Oceanus’ a ‘*pre-conceptual symbol*’. ‘Oceanus’ stands for something that has not yet gained a precise conceptual shape; rather, the name foreshadows an important inherent vision that would then be developed by later thinkers

such as Thales, Anaximander, and Anaximenes. It is this whole further life-worldly development that transformed the pre-conceptual symbol into what then appears to be a fully fledged metaphysical or scientific concept. One might even claim that the developmental shift is to be taken as a paradigm case of what Lloyd 1970, 8 calls ‘the practice of rational criticism and debate’, which for him marks one of the most important characteristics of the early Milesians and a ground-breaking feature in the rise of philosophy.

A central and often discussed feature in this development is, of course, the marginalization of numinous beings. Neither Thales nor Anaximander believed in a personalized ocean, that is, in an ocean being, a titan called Oceanus, the oldest son of Gaia and Uranos. There is evidence that Anaximander viewed natural phenomena not as divine case-to-case interventions but as forming classes of regular and maybe even determinable sequences of events (Naddaf 2005 and 2003, 35). This is not to say, however, that Anaximander did not retain several structural features or relational traits, which Homer would have attributed to Oceanus, in order to describe the ocean. And it is exactly due to focusing on these *structural* or *relational* factors that questions about mythological personification became marginalized and that, apart from the characteristics of ocean or sea, crucial features of other natural phenomena also came into view.⁶

So far I have restricted my discussion of pre-conceptual symbols to Seligman’s original case of Oceanus. My present focus, however, is with the notion of the ἄπειρον. Accordingly, the question to be answered now is whether the latter notion might be understood as a pre-conceptual symbol as well; and, if so, what might, in retrospect, have been the likely role of this symbol in the development of metaphysics and science.

As already mentioned, included among the things considered to be ἄπειρος were seas, landmasses, and collections of individual objects that were too numerous to count. For example, the sea beyond the Pillars of Hercules was thought to be in(de)finite or untraversable, and similarly the land beyond the Ister (i.e., the Danube) was considered in(de)finite in an agent-indexed sense of being inexhaustible and even uninhabitable (Herodotus, *Histories* v 9). Besides, one can easily imagine that, on a daily basis, a person in Miletus encountered many things ἄπειρος, that is, the uncountable grains of sand on the beach, the amount of water in the Mediterranean, etc. (Sieroka 2017).

Or, to put it differently: a person experiences a phenomenon to be ἄπειρος whenever one is brought to awareness of the futility of making a complete inventory. Accordingly, the experience of something being ἄπειρος is just the kind of ‘general and intuition-based’ experience mentioned above when introducing the notion of the life-world. This experience, of something being inexhaustible or exuberant, is not relative to cultural contingencies, and neither is it based on conceptual thought. The experience still has some important immediate (intuitive) character to it. And the term that describes this experience is, at this stage, ‘pre-conceptual’.

⁶ Of course, similar claims would apply also to the ‘pre-conceptual symbol’ (or, for that matter, ‘archetypal image’) of the cosmic tree as discussed by Couprie 2016.

Another phenomenological term comes to mind when describing the experience of the limits or boundaries of one's life-world: 'horizon' (e.g., Husserl 1954, 145, 164-165). It denotes the open, not to say 'indefinite', field of possible future experiences based on a present one, as when an experience opens up a particular space or scope of further possibilities, just as, for instance, the perceptual experience of seeing an object from one side already holds the promise of views from other perspectives.

Note also that the word 'horizon' derives from ὀρίζειν, which means to 'to demarcate' or 'to confine' and hence belongs into a similar semantic context as the ἄπειρον with its inherent limit or bound (πέρας; Frisk 1973, s.v. ὀρίζειν). Moreover, it also nicely describes the peculiar inherent tension in seeing an everreceding limit. There is the spatial horizon when traveling by sea or land, and there is also a sense in which there is a horizon to the grains of sand on a beach or the amount of water in the Mediterranean Sea. There is a limit that, for all practical purposes, a human agent cannot reach. In practice, these quantities are inexhaustible: any effort in counting or measuring will result in nothing else but more and more grains of sand or volumes of water coming into view.

Having mentioned the relation between the ἄπειρον and a spatial horizon, next it is helpful to consider Anaximander's world map (as reported about in, e.g., DK 12A1, DK 12A6, and Herodotus, *Histories* iv 36)—all the more so since, generally speaking, ancient maps can be understood as efforts in ἱστορία περὶ φύσεως. That is, maps can be understood as early (and not fully conceptual) means to present one's cosmological and philosophical convictions (Gehrke 1998, 182, Sieroka 2017). Such maps include not only the depiction of the part of the world that is experientially accessible but also its bounds (and beyond). Hence what usually happens is that the depiction of what is surveyed and known gets complemented in a speculative and constructivist fashion. Some scholars have even claimed that exactly this transition from what is directly given in perception to its constructivist completion is the fundamental characteristic of the whole pre-Socratic era (Schadewaldt 1978, 239). My claim is a weaker but related one, namely, that Anaximander's notion of the ἄπειρον (as it figures in his thought and on his map) marks such a transition and that this was of utmost importance for the further development and history of what, later on, one would call 'science'. It is this kind of constructivist completion that marks a crucial step toward (scientific) theorizing and away from what is given in the life-world. Notably, as with any pre-conceptual symbol, this is not to say that Anaximander intended or could have foreseen these further developments, but only that a certain later understanding allowed for and facilitated such a development.

On Anaximander's map, the most striking constructivist completions are the outer circular rims demarcating the earth and ocean. *Pace* Herodotus, these circular rims should not hastily be considered naive (Sieroka 2017). Although they are in part an inheritance from Homer (cf. Achilles's shield), they also represent a pre-conceptual exercise in projection. What is more, and as I will argue now, they even epitomize the notion of ἄπειρος.

At first glance, this might seem a rather counterintuitive claim; in particular, since circular rims are fixed. In contrast to horizons, they are not ever-receding. However, even though this is true, on Anaximander's map these fixed rims represent something that is otherwise described and experienced by the ever-receding horizons of what is taken to be the inexhaustible landmasses and seas of the inhabitable and the uninhabitable world.

In order to understand how such a representation becomes not only possible but even rather straightforward, it will be helpful to take a brief look at Anaximander's acquaintance with geometry and his inquiries using gnomons and seasonal sundials (that is, sundials used to investigate and indicate the solstices and equinoxes, etc., but not the hours). To begin with, the overall assumption that Anaximander's efforts in cosmology and map drawing can be closely related to his investigations using sundials and gnomons, is strongly supported by several testimonies that mention exactly such a close connection (DK 12A1, Suda s.v.; see also Hahn 2010, 146-147). What is more, Hahn 2010, 147-153 provided strong evidence that Anaximander placed a gnomon in the centre of a column drum when investigating (as is reported) solstices and equinoxes, and that Anaximander marked the lengths and directions of the corresponding shadows (of local noon) in such a way that the result would be concentric circles.⁷

Next, as Hahn 2017, 12, 15 has shown, an understanding of geometrical similarities that relate cosmic scaling and microcosmic projections can be attributed already to Thales. It is very likely that Anaximander would have known this, too—all the more so given that Anaximander is credited with having written an outline on geometry (ὄλως γεωμετρίας ὑποτύπωσιν ἔδειξιν, Suda s.v.). Together with the fact that Anaximander assumes the earth to have the shape of a column drum (DK 12A10 and DK 12A11), this then suggests that he would have taken the shadows cast by a gnomon on the column drum of his sundial to be geometrically similar to the shadows cast upon the earth itself. Thus, if Hahn's suggestion regarding the marking of the shadows on the sundial is correct, the οἰκουμένη would be represented as a circle—and not as a rectangle as in Aristotle's *Meteorologica*.

Thus, it is very likely that his sundial observations—together with certain convictions regarding the geometrical similarities between micro- and macrocosm—provided Anaximander with fixed circular rims that represent the bounds of the οἰκουμένη and of the uninhabitable world.⁸

Let me now come back to the general life-worldly significance of these circular rims. Given that a central feature of the lands and seas demarcated by these circular bounds is their vastness and their (agent-indexed) inexhaustibility, one would expect those rims to provide also a kind of projection of what is meant by things being ἄπειρος.

⁷ Further evidence for the idea that the result would be concentric circles is provided by Hahn's comparison with the dressing of the concentric joints of column drums for purposes of piling (called ἀναθυρόσις—'door framing').

⁸ Here Hahn's comparison with ἀναθυρόσις might get some further momentum, because the outermost rim or joint of a column drum would now find its cartographical counterpart in the Homeric Oceanus, depicted as the outermost ring on Anaximander's world map (cf. Hahn 2010, 153). Thus, all joints produced by ἀναθυρόσις (which are all concentric circles) would find their correlates on the world map.

And the tension between being ἄπειρος and being marked by a fixed rim might find its attenuation in the aforementioned notion of a horizon as experienced in daily life. This is because circular rims present an intriguing way of epitomizing the experience of an ever-receding horizon. Think of being at sea with nothing all around but water. Here a possible limit or boundary is provided only by the (circular) horizon itself. And apparently, it is the same (or rather geometrically similar) kind of limit that is cast on the column drum of a seasonal sundial and that would find its way onto the world map: circular rims.

The intriguing thing about these circular rims is that they turn something that extends far beyond the immediately accessible into something scalable. Geometrically speaking it is a projection with its typical perspectival contractions. And it is also a projection in the more metaphorical sense of creating a fixed image of something that seemed non-scalable beforehand. That what was claimed to go beyond the grasp of a human agent now appears as if it was reachable—especially if it got represented on a map. Landmasses and sea that are claimed to be ἄπειρος now find their demarcation and to some extent their conceptualization. In this sense, Anaximander's sundial observations and his map drawing will turn out to be of crucial importance for the further development of the pre-conceptual symbol ἄπειρον.⁹

Again, this is not to say that Anaximander is the inventor of projective geometry or that he consciously fostered these conceptual developments. Yet, the point of calling a symbolization pre-conceptual is not to say that the person creating it does so mindlessly. Rather, as already mentioned, it is to say that the person uses a concrete representation that has a strong prefigurative suggestiveness and that will allow a continuous expression of universal relations considered relevant; and this is exactly what happened in the case of the circular rims in relation to the term ἄπειρος. And retrospectively, this epitome of experiencing inexhaustibilities can be understood as opening up new possibilities regarding the introduction of theoretical concepts by means of abstraction and completion (see also Couprie 2003, 238).

To rephrase this important insight: Sometimes a class of things appears in such profusion as to overwhelm a person's capacity to take them all in and even begin to estimate their number. What one experiences at any moment is like the last moment and the next one: ever more water, ever more sand, ever more goats. Water, sand, goats as far as one can see, and the end is given not in terms of an objective limit but in terms of a horizon. In a sense, the horizon completes what one sees; it 'rounds off', as it were, one's experience. And, as soon as one moves, it becomes evident that this horizon marks the inherent and shifting limit of one's own capacity. The ever-receding horizon indicates that there is more and more to come if one was to move on. Thus, when looking to the horizon, the agent experiences a continuous and unending deferral of

⁹ This is not to deny that we lack evidence that Anaximander himself used the term ἄπειρος in relation to his map. Yet, it still shows how, based on knowledge about geometrical similarities, about map drawing, and about the (agent-indexed) inexhaustibility of natural objects, such as water, land, and grains of sand, one might conceptualize the bounds of immediate experience.

completion. It is in this sense that the horizon itself becomes the (projective) representation of an inexhaustibility. The horizon itself represents the ἄπειρον.

Note, once more, that my point is about life-worldly experience and convictions, not about whether one believes the relevant land or sea to be inexhaustible in an agent-independent sense. In fact, such beliefs can differ significantly: if one had previously been on the same itinerary across the Mediterranean Sea, one might at a certain point expect the Lighthouse of Alexandria to show up in the far distance in about an hour. But apart from that belief—apart from that conscious expectation about what will happen in about an hour—there is also some immediate experience, namely, that of ever more water showing up on the horizon, marking the momentary agent-indexed limit of what one experiences and marking a constant deferral of completion.

Thus, the term ἄπειρον describes not only the incomprehensible or inexhaustible amount of something, but also resonates with the experience of an inherent imaginary boundary or limit. And I like to suggest that this is a rather general life-worldly occurrence: objects or phenomena that cannot be experienced in a direct and exhaustible fashion find their completion in something like a horizon, that is, in some agent-indexed boundary indicating the limits of one's own human capacity. Moreover, the spatial horizon of the inhabitable and uninhabitable regions of the world could be made directly visible in topview, as it were, namely, by means of first making sundial experiments and then depicting the results on a map. By the same token, such a graphic representation in terms of a (finite) circular rim epitomizes the possibility of transcending the spatial bounds of the life-world, that is, the bounds of what is considered to be the inhabitable earth or οἰκουμένη. Thus, the experiential notion of a horizon helps to gain a speculative and all-encompassing picture of the world; and it does so by means of abstraction and (constructivist) completion.

The fact that Anaximander's map was about general conceptual concerns that transcend the immediate context of the life-world can be seen also from the fact that this map was not meant to be a serviceable chart. It was not meant to have a direct application within the Milesian life-world. In fact, it would have been highly dangerous for anyone to use it when sailing the Mediterranean Sea or hiking through the mountain range of Latmos, not to mention exploring the areas north of the Ister or to the west of the Pillars of Hercules.

Let me continue with two critical add-ons: first, one may think that focusing on relational features is a particularly modern way of approaching philosophical questions. However, it is indeed plausible to attribute a focus on relational features and on identifying structural similarities to Anaximander. Analogies are a mode of reasoning common to all people at all times (Lloyd 1966, 176). People in nonliterate societies use metaphors, comparisons, and similes in wide varieties of contexts, including naming, accounting for causes (especially of diseases), and describing cosmic, divine, and political order. Second, with the development of a written society—and remember that Anaximander is claimed to be the first to write down his philosophical considerations about nature in prose the use of structural analogies becomes much easier. Conceptual

considerations and philosophy are, of course, also possible in the absence of literacy—and indeed one of the most important means of conceptual thought in this context has been maps (Kupčik 2011, 15). However, the possibility of all the aforementioned shifts and developments is also closely related to the advance of writing. Whereas the personification of natural phenomena seems very important for an oral culture, especially as a mnemonic tool, a written text (or a drawn map) facilitates and gives space to systematic analyses by highlighting much more abstract (conceptual) relations in a stable fashion (see, e.g., Havelock 1966, Ong 1982, Goody 1977, 41-44, and Lloyd 2009, 23-25).

As for the second add-on, note that, even within antiquity, Anaximander's notion of things being ἄπειρος was not the only possible way to take, as it were, 'terminological hold' of the encounter with vast numbers of natural objects. About three hundred years later, Archimedes (c. 287-212 BC) in his *Sand Reckoner* introduces a different strategy of 'conceptually surveying' what seems inexhaustible by standard human means, namely, the number of sand grains that could be fitted into the universe (Heiberg and Stamatis 1972, 215-259). He introduces, in a coherent formal way, new numerals to enlarge the practical number range. Starting from certain contemporary assumptions about the structure of the heavens, he then gives an estimate of the size of the universe and of how many sand grains would maximally fit into it. That is, instead of describing things as being inexhaustible, Archimedes shows that well-defined numerals can be introduced to denote boundaries or upper limits, even in cases which lie far beyond the actual counting abilities of humans.

The point of this comparison with Archimedes is not to rank one strategy over the other—both are ingenious. The important point is the striking difference in attitude and aim—and the kind of precondition that might have made such a shift possible. Archimedes's strategy is rooted in his interest in mathematics and in providing formal descriptions and approximations of natural phenomena and technical devices. In this sense, he might be considered a child of his time, that is, of Hellenism (see Russo 2004). The Anaximandrian strategy, however, dates back to the archaic period. As mentioned above, it is pervaded by an everyday, rather than formal, kind of interest of coming to terms with the (agent- indexed) limits of the world as experienced.

However, even though their attitudes toward the possible existence and several main characteristics of 'inexhaustibility' might vary dramatically, the concentric rims on Anaximander's map and the numerical limits presupposed by Archimedes fulfil a similar function: they provide an (imaginary) closure for an (alleged) 'inexhaustibility'. And this is something that remained important and that, arguably, has been of great importance for later intellectual developments. It is Anaximander who opened up for a projection of what seems inexhaustible by human means or standards—what is ἄπειρος—onto some finite means (namely, his world map).

I take it that, regarding historical developments, pre conceptual symbols (such as the ἄπειρον) function similar to what Hans Blumenberg called 'absolute metaphors'. They are not clear cut or fully developed concepts, but still they function as means for

enhancing knowledge throughout (a certain period of) history. Such metaphors guide and enhance further theory formation by creating a life of their own. That is, they become independent of the state of affairs they were initially meant to illustrate. Not only was Homer unable to anticipate or know what would happen to his notion of Oceanus, it is also evident that much that happened to the notion in subsequent times even contradicts a lot of standard Homeric assumptions and convictions. And metaphorology is about writing exactly such a history of different understandings and interpretations, a lot of which can turn out to be severe (but nonetheless fruitful) misunderstandings.¹⁰

Examples for such a metaphorology in the context of the pre-Socratics are Blumenberg 2015 and Hadot 2006. The first book picks up the numerous and diverse re-interpretations of Thales's fall into a well. The second book provides a history of the different translations and understandings of Heraclitus's famous fragment 123 (φύσις κρύπτεσθαι φιλεῖ) from antiquity up until the twentieth century, always being aware of the fact that throughout time the metaphors and images involved have been 'profoundly modified' and that they 'have both expressed and influenced mankind's attitude toward nature' (Hadot 2006, xiii).

I suggest that something similar can be provided in the case of Anaximander's notion of the ἄπειρον and of some recent interpretations of it. Also in this case, what happened might be described as a profound modification, namely, an (over)-emphasis of one of the problematic Aristotelian interpretations mentioned above. I will explicate this in more detail in the next section. Accordingly, the aim of that section is no longer a contextualisation of Anaximander in a narrow sense, but a general attempt toward a metaphorology in the sense just mentioned. It is an endeavour as to how the notion of the ἄπειρον, functioning as a pre-conceptual symbol or, for that matter, an absolute metaphor, could start a life of its own and then occur again and again in different guises, including those that seem rather far away from what Anaximander himself might have thought. Thus, one might put it also this way: even if one disagrees for the most part with the following strand of interpretation of Anaximander (as, for example, I do), one still learns a lot about the historical importance of the notion of the ἄπειρον by tracing and reconstructing the development of this strand.

III. Transcending the bounds of experience: postulating theoretical entities

One of today's most eminent theoretical physicists, Carlo Rovelli, has recently written a book titled *The First Scientist* (Rovelli 2011), on Anaximander's ground breaking efforts in accounting for atmospheric phenomena, cosmology, evolution, etc. Rovelli's interpretation is not without its problems as, for instance, Couprie 2011, 111-114 has

10 As Blumenberg 2010, 5, puts it: absolute metaphors 'have a history in a more radical sense than concepts, because the historical transformation of a metaphor brings to light the metakinetics of the historical horizons of meaning and ways of seeing within which concepts undergo their modifications. metaphorology seeks to burrow down to the substructure of thought, the underground, the nutrient solution of systematic crystallizations.'

shown. This, however, is not the place to critically assess these, which concern a variety of topics. I confine my discussion to the notion of the ἄπειρον, its role in the development of the physical sciences, and its present analogues. Thus, while the previous section has been about the early movement toward a fully fledged concept of an ἄπειρον, the present section looks at the post-Anaximandrian influence that such a concept might have had with regard to science, especially physics.

A. Theoretical entities and their empirical core

One of Rovelli's main questions is about the sense in which, and to what extent, Anaximander's notion of the ἄπειρον shaped, or even anticipated, later developments in the natural sciences. Providing a rather stout-hearted and fullbodied answer, Rovelli writes:

Atoms, the electrical and magnetic fields of Faraday and Maxwell, Einstein's curved space time, ...Gell-Mann's quarks and Feynman's virtual particles, the wave function of Schrödinger's quantum mechanics, and the quantum fields that form the foundation of contemporary fundamental physics' description of the world—all these are 'theoretical entities' that... are postulated by science to account for the complexity of phenomena in a coherent way. They have precisely the same role and function as the ones assigned to the ἄπειρον by Anaximander. They are the descendants of Anaximander's vision.

(Rovelli 2011, 69)

This passage contains an implicit claim that concerns the general development of physics and with which I fully agree. However, before turning to that claim, let me expand on what I take to be the most disputable assertion in this passage, namely, the historical role and self-reflection attributed to Anaximander.

To begin with, given the historical evidence, it is difficult to ascribe to Anaximander a concrete 'vision' of the future development of the enterprise later called 'science'. If one is to use the term 'vision' in this context at all, then (as I have suggested above) one may talk about an 'inherent vision' encapsulated, as it were, in a pre-conceptual symbol such as ἄπειρον. But such an 'inherent vision' does not turn Anaximander's original usage and conceptual intentions into 'science' in a modern sense. Even though he likely believed natural phenomena to be de-personalized and to form regular sequences of events, Anaximander's *ἱστορία περὶ φύσεως* arguably fails to entail several elements that are considered crucial for the development and success of later exact science, such as mathematically formalized means for providing empirically accurate predictions. In fact, even though Anaximander's reference to numbers in cosmological contexts is striking (e.g., DK 12A10, DK 12A21, DK 12A22), it would be a doubtful move to take this reference as initiating a mathematization of physics. Rather

than depicting functional relations based on empirical evidence, these numbers are grounded in everyday knowledge and experience. First, there is, once more, a carryover of numerical lore from the early epics, especially Hesiod (see *Theogony* 722-723; cf. also Couprie 2003, 84-85, 211-218). Second, and more specifically, the proportions of the all embracing cosmic architecture—that is, the arrangement and distances of the heavenly bodies—prominently reflect the proportions of terrestrial architecture, especially temple-building (Hahn 2001 and 2003).¹¹

Yet, if one absolutely wanted to attribute a concrete Anaximandrian ‘vision’ of general abstraction and theorizing to some later ancient tradition or discipline, two options come to mind. First, given the close relation between ancient mapdrawing and an ancient ἱστορία περὶ φύσεως, one could argue that the most concrete vision of this type was elaborated by geographers, most vigorously by Hecataeus (c. 560-c. 480 BC) and later on Strabo (c. 63 BC-c. 23). On his world map, which was highly influenced by Anaximander’s, Hecataeus depicts regions and countries in terms of idealized geometrical shapes. Thus, once more the aim of such a map is not to produce a reliable chart. Instead, Hecataeus even goes as far as to introduce theoretical abstractions into geography in order to turn this discipline into what today one would call an exact science. The hope was that, by introducing idealized shapes, geography could be modeled by and developed along the lines of geometry. About five hundred years later, this hope can still be found in the work of Strabo, who claimed that geography is to be based on geometry and natural philosophy (von Fritz 1978).

The second option is that of Aristotle and the doxographic tradition. Indeed, Rovelli’s interpretation can be understood as a particular follow-up to an Aristotelian claim according to which the ἄπειρον is the inexhaustible and unobservable source standing behind all natural processes (*Physics* 203b18-20 [= DK 12A15]). Obviously, so Aristotle’s argument goes, we are surrounded by countless instances of natural processes of becoming and declining: animals are born, grow, and die; flowers bloom and wither; rivers flood and dry out; etc. Hence, there must be a source or ‘reservoir’ for all these processes and, for the sake of avoiding an endless regress, this source must itself be infinite, or rather inexhaustible. Note that, even if one adheres to this line of Aristotelian interpretation, Rovelli still seems to over-accentuate things by equating such a natural reservoir with an, as it were, ‘source of concepts’. The vocabulary Anaximander uses relies on physical terms, not mathematical or technical ones. These are words for things in nature and the life-world, and Rovelli overlooks the specific ways in which one often encounters an inexhaustible nature and, with it, the bounds of human experience itself.¹²

¹¹ As regards relations to everyday experience in other social and political contexts, see Naddaf 2003, 84-85 and 2005, 77-86.

¹² That is, I mean to dispute not only some of Rovelli’s concrete claims about Anaximander but also some of Rovelli’s general assumptions about later historical developments and their relevance for science. This is not meant to say that a look at later developments and their relation to Anaximander fails to be important. However, it is meant to say that, as far as historiographical method is concerned, a careful metaphorological approach (in the sense of Blumenberg and Hadot), which includes contextualizations and that avoids naive anachronisms, is much more promising and revealing.

Anyway, apart from these difficulties regarding Rovelli's interpretation, there is an implicit claim in his quotation with which I fully agree. Rovelli makes a very important point by emphasizing how the introduction of theoretical entities has been the most consequential methodological step for theoretical physics. The power of introducing entities that are not directly observable—but which can be treated in a formal manner in a symbolic system to derive experimental predictions—can hardly be overestimated. Thus, although the ἄπειρον can hardly count as a theoretical entity in the modern sense, Anaximander's use of the term may well form an important step toward the development of science. Let me explain.

As already argued, perceiving something to be ἄπειρος implies the recognition of a boundary or horizon. This is because there is a basic constancy to what one sees that goes along with a constant deferral of completion. And this deferral finds its representation in an, as it were, ever-changing (ever-receding) experiential horizon. The number of goats, to pick up an example from above, is practically inexhaustible; as one moves or counts, ever more goats show up (appear on the horizon), just as the horizons of land and sea continuously recede when one travels toward them. At the same time, experiencing such a horizon and knowing it to be an agent-indexed (imaginary) limit arguably paves the way for the introduction of entities that transcend and complement what is empirically accessible. Think again of Anaximander's map here and of the circular lines (horizons) of the earth and the ocean.

Employing, once more, some phenomenological jargon, what happens here regarding the ἄπειρον and the experiential horizon is an 'objectifying apperception' (*objektivierende Auffassung*, Husserl 1984, 358, 406). That is, the experience of things being inexhaustible or untraversable gives rise to a concept—it 'objectifies' itself—by means of transcending the, as it were, raw data of perceptual experience. 'Apperception' here refers to the fact that there is always a surplus content that is, one might say, 'co-given' in experience. Most notably, any horizon spanning the space of future possibilities marks such a surplus content. Thus, what gets objectified in the present context is the inherent limit of what is directly empirically accessible; and with it new possibilities for further (conceptual) objectifications are co-given, possibilities that then transcend the limit of the empirically accessible toward theoretical abstraction.

At this point it is tempting to consider the aforementioned interpretation—as suggested by Tannery 1904 and as taken up by Tumarkin 1943 and recently by Couprie and Kočandrle 2013, and Kočandrle and Couprie 2017, 59-61—according to which Anaximander's term ἄπειρον derives from the homograph meaning 'not acquainted with' or 'beyond experience'. For then, based on what I have claimed above, it would suggest that what lies *within* the bounds of experience would be the ἐμ-πειρον or ἐμπειρία (see Tumarkin 1943, 56-58). Thus, pretty much by definition, the ἄπειρον would be the nonempirical in the above sense of inexhaustibilities that transcend the capacities of human agents.

Think again also of Anaximander's world map, where one might view the inner region, given by the inhabitable and ordered world (the οἰκουμένη), as the kind of circle

of experiential acquaintance circumscribed by an imaginary line (horizon) that is itself a theoretical postulate in the sense of being an ideal element of chart projection. These common connotations would also fit the process of surveying and of, as it were, wresting the inhabitable and surveyed earth away from the uninhabitable and unmeasured ἄπειρον. Widening one's horizon means to widen, as it were, the ἐμ-πειρον. Moreover, etymological considerations further tie up this whole field of connotations. First, the term ἐμπειρία and the notion of being experienced carry several related and prominent connotations of traveling and surveying (Schadewaldt 1978, 169-170). Second, the term ἱστορία refers to a general investigation both by travel and by empirical means (Frisk 1973). And notably, it is such an ἱστορία that is represented on the map.

Again, this is just about likely reverberations of homographic semantic traces—not about the Tannery etymology being strictly correct. Why not assume that the reverberations of both homographs are in accord and that Anaximander's term carried connotations of both? In fact, even though most Anaximander scholars strongly oppose Tannery's etymology, connotations and reverberations of 'beyond experience' are rather common. Take, for instance, Kahn, Freeman, and Graham, who all reject the Tannery etymology but who still claim, respectively, that the ἄπειρον is 'unknown to us' (Kahn 1995, 237), 'removed from our perceptions by being out of reach' (Freeman 1966, 56) and 'inaccessible and mysterious, beyond empirical scrutiny' (Graham 2006, 34).

B. In(de)finite quantities in contemporary physics

So much for the possibly groundbreaking structural role played by the ἄπειρον in the context of fathoming the in(de)finite limits of the empirically accessible. Let me now turn to the more specific question of where or in what sense there might be current descendants of the notion of an ἄπειρον. Notably, answering this question is part and parcel of a phenomenologically inspired metaphorology. It is important to discuss such possible descendants in order to gain a broader and more reliable picture of what might have been triggered intellectually by the idea of there being bounds to what is accessible or exhaustible by human standards.

That said, my list of possible descendants will still be much shorter than Rovelli's, as I will restrict myself to concepts in contemporary physics that describe something in(de)finite or inexhaustible in the life-worldly sense introduced above. Here, two contexts might immediately come to mind, namely, operational problems with limiting values and, once again, cosmology.

As far as operational problems with regards to in(de)finite quantities are concerned, the most technically advanced example is perhaps the treatment of infinities in quantum field theory (see, e.g., Dosch et al. 2005). However, philosophically more striking and also closer to an everyday context is a different example, namely, the description of phase transitions. In everyday life one constantly encounters phase transitions in medium-sized objects, such as when ice melts or when water freezes. The theoretical description of these phenomena, however, presupposes the so-called

thermodynamic limit, that is, the physical system under consideration must be assumed to be infinite (more precisely: the physical system is assumed to consist of infinitely many particles). As the theory has it, there can be no phase transitions in finite systems (Callender 2001 and Batterman 2005).¹³ Arguably, it is a kind of pragmatist attitude that keeps physicists from being particularly concerned about this. Assuming that an ice cube weighs approximately 20g, it contains more than one mole ($\approx 6 \cdot 10^{23}$) of water molecules. Thus, from the agent-indexed perspective of a practicing physicist, the situation is similar to the Homeric encounter with the goats in the land of the Lotus-eaters: their number is not of cardinality \aleph_0 ; however, for all practical purposes, their number can be said to be in(de)finite. There simply is no distinction between an agent-indexed and an agent independent inexhaustibility of goats that could be practically relevant. Similarly, regarding the number of water molecules: there is such a vast number of them that, from an agent-indexed perspective, their number is in(de)finite. But then modern science makes a further theoretical move: this agent-indexed in(de)finiteness is now taken as legitimization to apply the thermodynamic limit; the number of water molecules finds its ‘completion’, as it were, in assuming the molecules to form a well-defined (countably infinite) set. Here I like to suggest that this further move is structurally similar to what happens on Anaximander’s world map: in(de)finite landmasses and seas find their completion in assuming them to form well confined (but inexhaustible) circles.

In(de)finite quantities also play an important role in modern cosmology. It is here, I suggest, that one can find the most direct descendants of Anaximander’s notion of the *ἄπειρον*, namely, concepts having to do with the bounds of experience in the sense of what is spatially (or rather spatiotemporally) accessible to us. As compared to the days of Anaximander, modern observational devices and theoretical insights from cosmology and astrophysics surely have pulled huge parts of the heavens into closer reach—but, once more, only up to certain agent-indexed (imaginary) limits and boundaries. The so-called cosmic light horizon or particle horizon demarcates that part of the universe from which information may have reached the earth since the big bang. In addition, the so-called cosmic event horizon demarcates that part of the universe from which information will ever be able to reach the earth in the future. Similar to Anaximander, this is about agent indexed or observer-dependent limits of what can and could ever be observed or experienced. These limits—notably called ‘horizons’ by modern physicists—are not identical with the agent-independent limit of the world or universe as a whole and, once more, they are surely not infinite in any modern mathematical sense.

Speaking of the (agent-independent) universe as a whole, there is a further prominent and allegedly related topic, namely, its overall shape. The universe as a whole might have a flat structure or might be formed like a saddle or like the closed surface of a ball. In the latter case, even though the universe would not be infinitely

¹³ In fact, one may wonder why it was only recently that philosophers of science started discussing this fundamental and astonishing discrepancy between everyday experience and theoretical description.

large, there would be no boundaries. One could, as it were, run forever in any direction without ever banging one's head into a wall. This specific sense of boundlessness, however, is to be distinguished from the in(de)finiteness that has been at issue above. In fact, Homer and Hesiod (and also Anaximander) had a different word for it. Instead of ἄπειρος, they would have called such a boundless structure of the universe ἀψόρρος ('flowing back into itself') or τελήεις ('ending in itself')—for these are the terms they use in order to describe Oceanus in view of the fact that it is a ring stream (*Il.* XVIII 399, *Od.* xx 65; *Theogony* 242, 959). A boundless structure is one in which, as it were, beginnings and ends coincide (Heraclitus DK 22B103; see also Sieroka 2017). It is not necessarily, nor even standardly, something that is untraversable or inexhaustible in the sense of ἄπειρος.

Conclusion

I argued that, similar to Seligman's example of the notion of the ocean, the notion of the ἄπειρον might be understood as a 'pre-conceptual symbol' and 'retrospective metaphor'. Just as Homer could not have been aware of the conceptual strength of the earth-circling ocean, Anaximander could not have been aware of the conceptual strength of the ἄπειρον for later philosophy and science. In retrospect, however, one may use Anaximander's term to explicate, as it were, the bounds of direct observation and of (finite and exhaustible) experience.

By the same token, the ἄπειρον is to be considered a crucial forerunner of those notions that transcend these boundaries. It is intriguing how the notion of the ἄπειρον—as epitomized and mediated by geometrical convictions, observations based on seasonal sundials, and map drawing—allows for pushing an experiential feature toward the horizon of an agent-indexed life-world, allowing following generations to traverse this boundary with the help of abstract concepts and postulated theoretical entities. It is the experience and acknowledgment of the limits and horizons of daily life that give rise to the introduction of abstract objects and theoretical entities that do not form a direct part of daily life in the οἰκουμένη—or, if I may use this suggestive phrase once more, which do not form part of the ἐμπειρία. Accordingly, it is the life-worldly experience of things being in(de)finite and inexhaustible that marks one of the origins of the great success and growth of later physics. And today—maybe inevitably or maybe ironically—there is a widespread faith that also this success and growth is itself ἄπειρος.¹⁴

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