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Architectural Technologies and the Origins of Greek Philosophy

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Abstract: In this essay on ancient architectural technologies, I propose to challenge the largely conventional idea of the transcendent origins of philosophy, that philosophy dawned only when the mind turned inside, away from the world grasped by the body and senses. By focusing on one premier episode in the history of western thinking – the emergence of Greek philosophical thought in the cosmic architecture of Anaximander of Miletus – I am arguing that the abstract, speculative, rationalising thinking characteristic of philosophy, is indeed rooted in practical activities, and emerges by means of them rather than in repudiation of them. The spirit of rational inquiry emerged from several factors but the contributing role of monumental architecture and building technologies has been vastly under-appreciated. In the process of figuring out how to build on an enormous scale that the eastern Greeks had never before tried, the architects discovered and revealed nature's order in their *thaumata*, the very experience with which Aristotle claims that philosophy begins. Ancient architecture and building technologies were on display for decades with monumental temple building. In front of Anaximander and his community, a new vision of nature spawned that, surprisingly, humans could grasp and command. The building of these *thaumata*, these objects of wonder, offered proof of the human capacity to control nature, and opened a new vision of our human rational capacity to understand the world and our place in it.

Keywords: Architecture, Cosmology, Imagination, Technology, *Anathyrosis*.

Challenging the Idea of the Transcendent Origins of Philosophy

In this essay on ancient architectural technologies, I propose to challenge the largely conventional idea of the transcendent origins of philosophy, that philosophy dawned only when the mind turned inside, away from the world grasped by the body and senses. One version of the conventional transcendent view is captured in the words of Jonathan Barnes in his influential book *The Presocratic Philosophers* when he dismisses historical and cultural context as relevant to understanding early Greek thought. In the first edition of his book, Barnes declared "Philosophy lives a supracelestial life, beyond the confines of time and space […]"[1] In the second edition, reacting to criticism on just this point, he replied that "In speaking slightingly of history I had […] in mind – studies of the background against which the Presocratics wrote […]. I doubt the pertinence of such background to our understanding of early Greek thought […]."[2] What Barnes and other proponents of this view embrace is a vision of rationality that is disembodied, and this is what is at stake in this essay. Now I am not disputing that there is much in early Greek philosophy, certainly in Plato and Aristotle, that identifies the highest objects of knowledge as accessible to the mind and not the body, such as Plato's Ideas, or Aristotle's identification of the highest human realisation in self-contemplation modelled on the Unmoved Mover, the thought that thinks itself. And I am not disputing that the origins of Greek philosophical thought are marked by a distinctive rationality entering into our self-searching. But, what I am arguing is that the origins of abstract and speculative philosophical thought, traceable to the Milesians, was generated through bodily experience and practical activities; the Milesians reached the conclusion that there was a single underlying unity, capable of altering without changing, and thus the experience of diversity was illusory. But, it was by means of sense experience, not its repudiation, that philosophical thinking began for the Greeks. This realisation has practical consequences for how we may help our students to become philosophical that I shall address briefly at the end of this essay.

By focusing on one premier episode in the history of western thinking – the emergence of Greek philosophical thought in the cosmic architecture of Anaximander of Miletus – I am arguing that the abstract, speculative, rationalizing thinking characteristic of philosophy, is indeed rooted in practical activities, and emerges by means of them rather than in repudiation of them. Ancient architecture and building technologies were on display for decades with monumental temple building. In front of Anaximander and his

[1] Barnes, 1982, p. xii. The first edition was published in 1979.

[2] Barnes, 1982, p. xvi.

community, a new vision of nature spawned that, surprisingly, humans could grasp and command. The building of these *thaumata*, these objects of wonder, offered proof of the human capacity to control nature, and opened a new vision of our human rational capacity to understand the world and our place in it.

I now turn to unfold a slice of this story – more abundant details are provided in my already published studies that extend architectural context to include ancient wheel-making, the functioning of the bellows, seasonal sundials, mathematical diagrams connected to architectural techniques and tunnel-digging engineering projects, industrial textiles, and more[3] – that places Anaximander's abstract and speculative philosophical thought in the historical and cultural context of temple building, just the kind of context that the "transcendent origins" thesis dismisses. Only after that, I return to summarise what such a study allows us to conclude about the conventional model that philosophical thought begins by rejecting the body and senses, and the lessons this new approach offers for how we can also help our students to become philosophical.

Anaximander, Temple Architecture, and the Architecture of the Cosmos

Anaximander identified the shape and size of the earth by analogy with a column-drum. He likened its shape to a flat cylindrical disk (τῷ … σχήματι τὴν γῆν κυλινδροειδῆ),[4] the same conception found in both Homer and Hesiod.[5] But Anaximander described it κίονι λίθῳ παραπλήσιον,[6] "like a stone column," that he further specified as 3 times as wide as it was deep (ἔχειν δὲ τόσουτον βάθος

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[3] Cf. Hahn, 2001; Couprie, Hahn & Naddaf, 2003; Hahn, 2010; 2017. All of these were published in the Ancient Philosophy series of the State of New York University Press. Cf. also Hahn, 2016.

[4] Ps.-Plut. *Strom.* 2; DK12 A10.

[5] Cf. Hahn, 2001, p. 169-178.

[6] Hipp. *Ref.* 1.6.3.

ὅσον ἂν ἔιη τρίτον πρὸς τὸ πλάτος),[7] and so the analogy he drew was with a column drum. Column-drum construction was new to eastern Greece in the 6th century BCE as architects moved from wood to stone architecture. In wooden architecture, the roof of the temple – the god's house – was held up by the available timbers, but when they sought to increase the monumentality of the temple, the available trees could no longer support the heavier roof and upper orders. Inspired by the multi-columned temples in Egypt to which the eastern Greeks had access, the introduction of stone columns would resolve the problem of carrying the heavier load but now the architects were saddled with a new problem of delivering dozens of full-length columns to the building site often many kilometers away from the quarry. Since the stone columns would each weigh tens of thousands of tons, the challenges of delivering monolithic columns safely were insurmountable; the architects' solution was to deliver column drums from the quarry to the building site, and then install and finish the columns on site. The next problem was to figure out how to guarantee stability of the column, stacked by drums. Moreover, while we have examples of 3x1 column drums from archaic temple columns, there was no metrological rule for drum size, some of which are 2:1, 4:1, even 5:1, though column bases seem to have been metrologically determined, sometimes 3:1. The architect was constrained only by the total height of the column from base to the column capital, and not the size of the drums leading to it.

The introduction of column drums in eastern Greek temples in the 6th century BCE solved the problem of delivering stones to the building site but now created another new challenge to make the drums invisible upon completion of the column, to create the impression that the columns were monolithic as had been the earlier trees. To achieve the aesthetic goal and guarantee column stability, the architects invented two new but interrelated techniques – *anathyrôsis* and *empolion* – to install the drums. *Anathyrôsis* is the technical term for the ancient method of dressing the joints of stone

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[7] Ps.-Plut. *Strom.* 2; DK12 A10.

blocks in dry stone construction (no mortar); a narrow band of the circumference of the column drum is carved to a plane, a labor-saving technique to avoid having to dress the entire drum surface. The interior of each drum is counter-sunk to assure that no part of the drum protrudes, and on this prepared surface, a similarly prepared drum will be seated. The empolion is the dowel, made of wood or metal, fit into a rectangular or circular hole at the drum's center, that allows for each new drum to be aligned with the one already in place at the time of installation.

To guarantee the uniformity of the circular drum, t*o make sure that the distance from the drum center to the circumference is uniformly equidistant*, additional circular marks are etched into the drum face between the center and the *anathyrôsis* band to control the measurements. As each drum is lowered into place by means of ropes around the *bosses* protruding from each drum (to be removed when it is finished in place), this technique was developed to avoid any chipping along the edges. Once the two massive stones are brought into contact, any additional movement is potentially damaging, and so to be avoided.

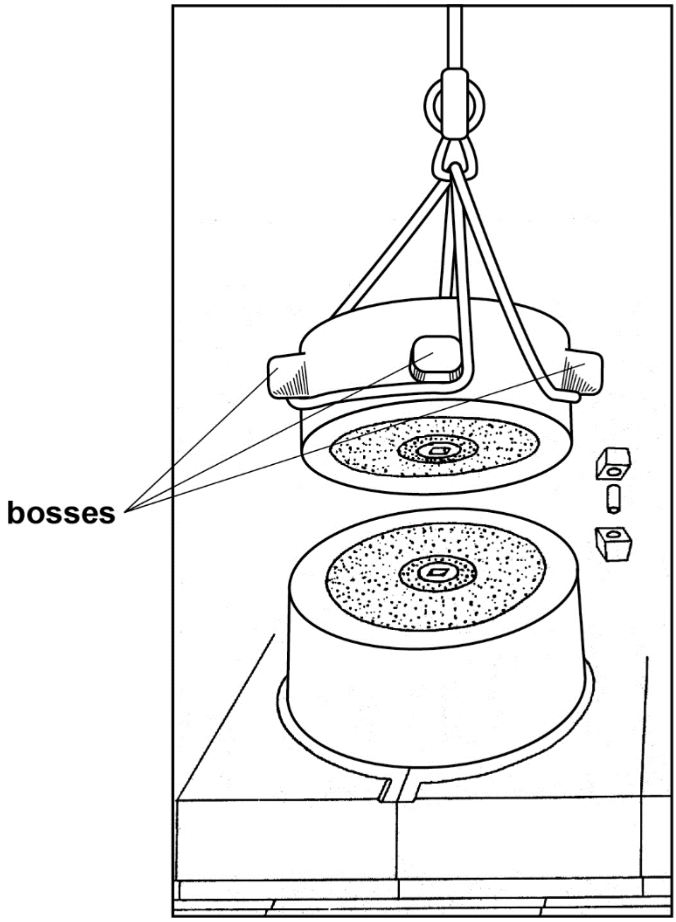

Figure 1: Display of *anathyrôsis* and *empolion*, and lifting device for installation of column drums.

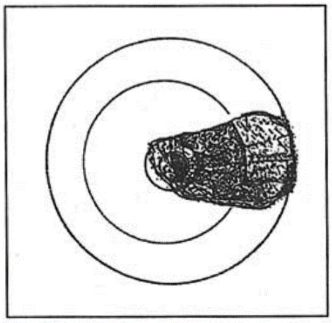

Figure 2: From archaic Temple of Apollo with round *empolion*.

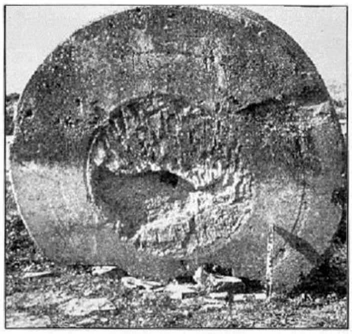

Figure 3: From Samos Dipteros II at Didyma with round *empolion* with rectangular *empolion*.

In the surviving doxographical reports, Anaximander imagined the cosmos in cosmological terms, as did Hesiod before him. This means that the cosmos, at the beginning, was not as it is now, and so stages of development must be supplied to give an account of how it got this way; an important difference is that while Hesiod delivers a mythological cosmology, Anaximander's is naturalistic. For Anaximander, in the beginning there was a cold moist earth at the center, and a hot and dry fire surrounded at the extremities, like bark around a tree [ὡς τῷ δένδρῳ φλοιόν].[8] A vortex-like motion spins

[8] Ps.-Plut. *Strom.* 2; DK12 A10.

everything eternally,[9] and in that spinning, the original fire broke off into three concentric wheels.[10] The heat from these fiery wheels caused evaporation from the moist earth and that moist air became compressed (literally, *felted*, like compressed wool) around the wheels which is why we do not see wheels at all ([sc. τὰ ἄστρα εἶναι] πιλήματα ἀέρος τροχοειδῆ, πυρὸς ἔμπλεα, κατὰ τι μέρος ἀπὸ στόμιον ἐκπνέοντα φλόγας).[11] What we see as the sun, moon, and stars – they are not heavy bodies for how should we then explain rationally why they do not fall? – are merely apertures or puncture holes in those fiery wheels, sometimes described by the terms στομίον or ἐκπνοή,[12] a mouth or breathing hole like in/on a dolphin. The hylozoistic cosmos is alive by breathing – fire – nourished or fed (sc. τρέφεται) by the moist air that surrounds each wheel.

According to Aristotle, Anaximander posited the remarkable idea that the earth remained in the center of the cosmos, held up by nothing; it remains there because it is equidistant from the heavenly extremes ([…] ὁμοιότητα … πρὸς τὰ ἔσχατα ἔχον). Hippolytus reports on the same idea but describes the reason as "similar distances from all things" [διὰ τὴν ὁμοίαν πάντων ἀπόστασιν].[13] And so, just as the center of the column drum had to be equidistant from the extremes – the circumference – to account aesthetically for the uniform appearance and stability of the column, so also is Anaximander's earth from its extremes. When we try to reflect upon the images that these words conjure – temple-architecture and cosmos – we remind ourselves that the earlier temple was surrounded by a colonnade of available trees, the stone columns are now part of the petrified forest, and the whole cosmos takes on the form of a cosmic tree. On the left is a cross-section of a tree trunk, and on the

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[9] Cf. Hipp. 1.6.3 (DK12 A11) for the eternity of motion, and the discussion in Kirk-Raven, 1957, p. 126ff.

[10] DK12 A11; Hippolytus reports that the heavenly wheels broke off from the original surrounding fire.

[11] Aët. 2.13.7; DK12 A18.

[12] Cf. Hipp. *Ref.* 1.6.4-5 for "breathing hole", and Aët. 2.13.7 for "mouth".

[13] Hipp. *Ref.* 1.6.3.

right, is a cross-section of column-drum *anathyrôsis* and *empolion* on a fluted column.

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Figure 4: Cross-section [plan view] of tree trunk.

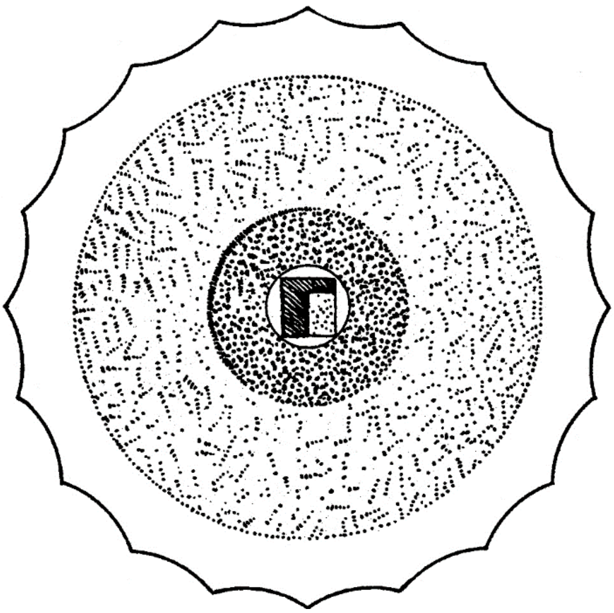

Figure 5: Cross-section [plan view] of column drum displaying *anathyrôsis* and fluting.

Did Anaximander imagine this cosmic picture? What evidence do we have of Archaic Greek *imagination*? The evidence from the doxographical reports suggests clearly that Anaximander watched the architects at work. While his interests in applied geometry seem to have been robust – making a model of the cosmos [σφαῖρος], a seasonal sundial [σκιοθήρης], a map of the inhabited-earth [πίναξ], and reputedly wrote an outline of geometry [γεωμετρίας ὑποτύπωσις][14] – he may well have participated as consultant with the architects – we can be confident that he watched them work in his own Milesian backyard, at the temple of Apollo at Didyma. There are two critical techniques of imagination by means of which the architects successfully produced their *thaumata*, their objects of wonder: (i) an elevation view and (ii) a plan view of the building. The *elevation view* is familiar to everyone since it's the experience we have of a building as we approach it, the way it looks as we walk around it; and it is likely that there was a model of the finished project by means of which the architects secured the approval of the patrons, despite the fact that so far no such models have ever been discovered, perhaps because they were made of impermanent materials.[15] The *plan view*, however, is different because it projects an imaginative view that no one actually experiences – floating 90-degrees above the building – but it is by means of which the construction is successfully carried out one layer at a time. While we do have evidence for plan view imagination in Greece, at the temple of Apollo at Didyma detailed by Haselberger – the plans are inscribed on the surviving walls and stairs – this is the Hellenistic temple (circa 4th century BCE) and not the archaic temple, though this evidence suggests that if plans were useful and important in later construction they were almost certainly of equal or greater importance when monumental stone building began more than two centuries earlier in Didyma in

[14] The model, sundial, and map are attested to both in DL 2.1-2 (DK12 A1) and in the *Suda* (DK12 A2).

[15] Cf. Hahn, 2001, Ch. 3 on ancient Egyptian and Greek model making.

the 6th century.[16] Moreover, I have already argued at length that the techniques for monumental stone architecture in eastern Greece were imported from Egypt thanks to the Milesian trading colony in Naucratis, in the Nile Delta. And we do have evidence from Egypt that pre-dates the 6th century that suggests thinking in terms of plan view (and elevation) had a long history in Egypt from where the techniques and inspiration for multi-columned temples were plausibly inspired. Consider these examples from Egypt, below, all of which suggest that architects and building teams routinely imagined their constructions from plan view:[17]

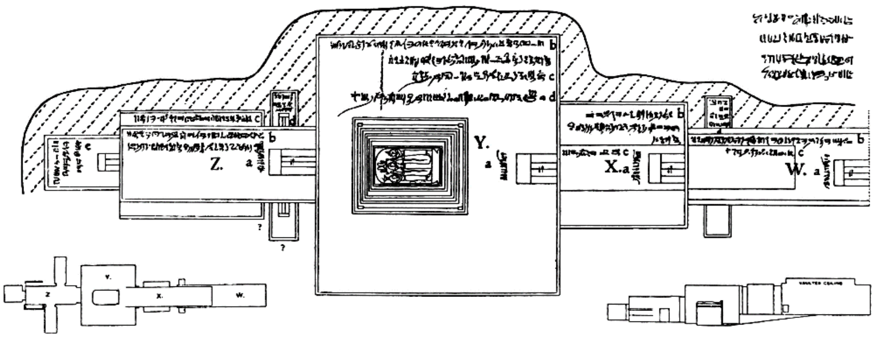

Figure 6: Dimensioned plan, tomb of Ramesses IV, Valley of the Kings, Luxor (mid-12th century BCE).

[16] Cf. Haselberger, 1985, p. 126-132. Cf. also the discussion in Hahn, 2001, p. 116-120.

[17] Cf. the detailed discussion in Hahn, 2001, p. 97-131.

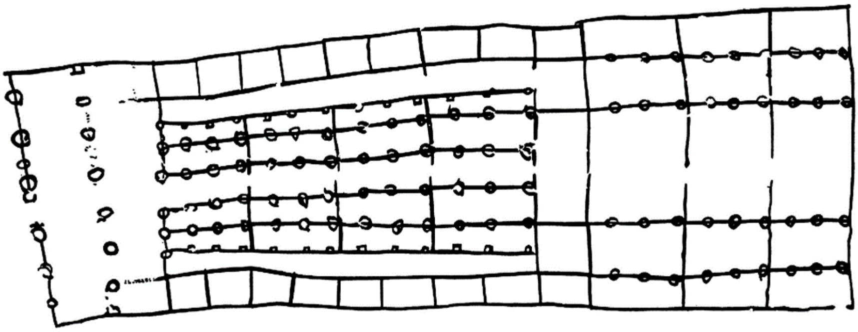

Figure 7: Planned sketch of multi-columned temple, from Quarries of Sheikh Said (New Kingdom, c. Amarna Period, 14th century BCE).

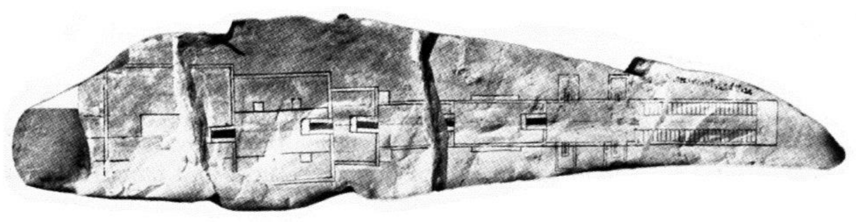

Figure 8: Plan sketch tomb of Ramesses IX on limestone shard, circa 1100 BCE.

The architects needed both views, and Anaximander was in a position to imagine with the architects, the house of the cosmic power in these two points of view. Had he done so, it should come as no surprise that he imagined the cosmos from both points of view as well, since he would then have imagined the cosmos built in stages, like the house of the cosmic power – but now the house that is the cosmos, in architectural terms.

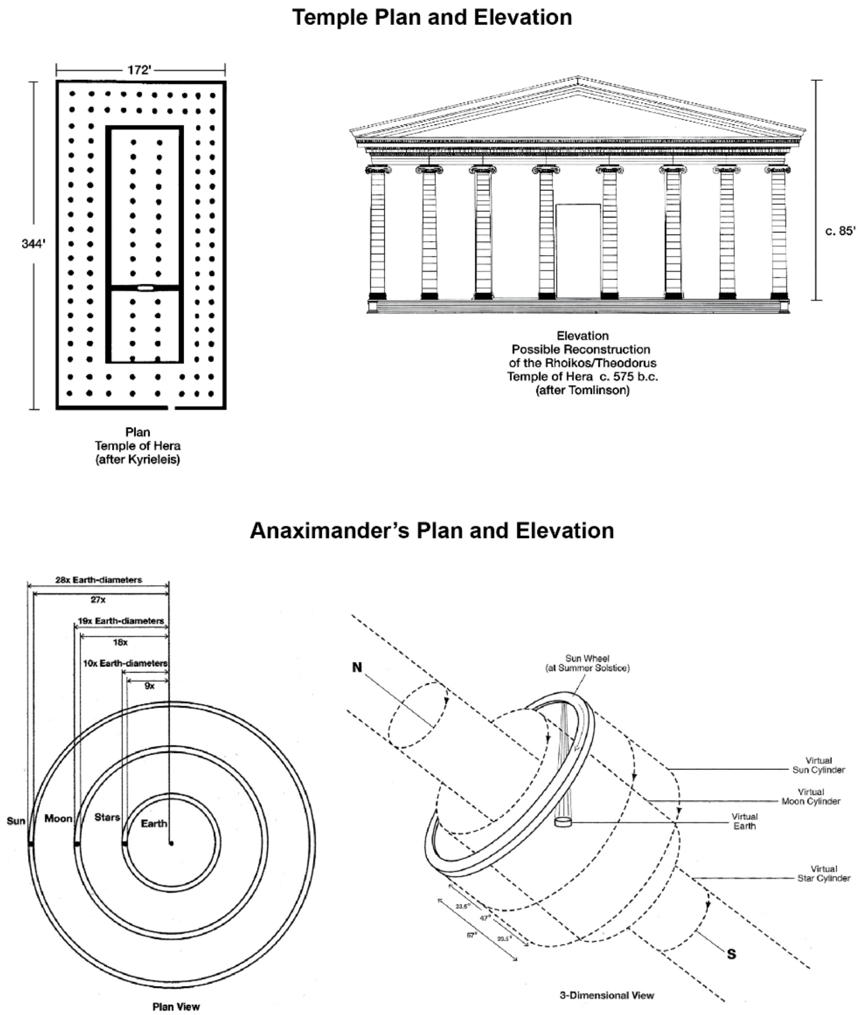

Figure 9: Above: plan and elevation of archaic temple; below: horizontal cross-section [plan view] of Anaximander's cosmic picture and elevation view.

When we place these two views side-by-side a new light shines on the importance of ancient architectural and building technologies for the development of abstract, rational philosophical thinking. On the left, we have a plan view of Anaximander's cosmos, displaying the three wheels of sun, moon, and stars; on the right, we have a drum-face dressed with *anathyrôsis* and round *empolion* from a reconstructed drum from the archaic temple of Apollo at Didyma – it looks remarkably suggestive of Anaximander's cosmos in *plan view*.

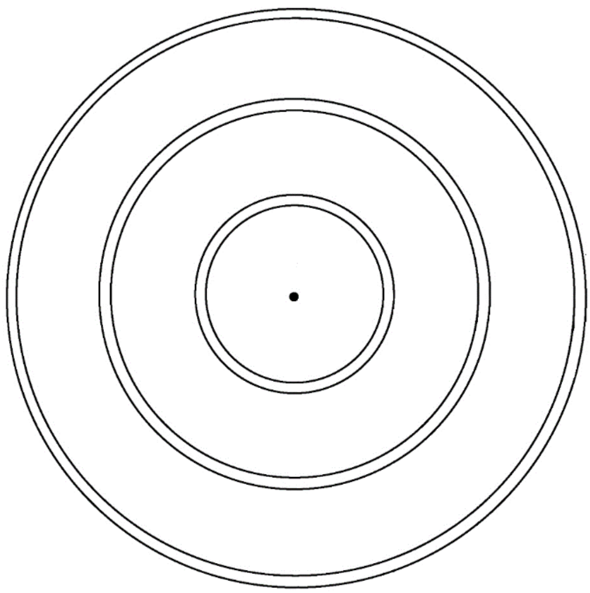

Figure 10: Anaximander's Cosmos in Plan View.

Figure 11: Column-drum *Anathyrôsis*.

Just to be clearer about the elevation view of Anaximander's cosmos: with the cold and moist earth at the center, as a flat cylinder, the heavenly wheels, whose rims are hollow, are filled with fire, and encased in moist, felted, evaporated air. The illustration below displays a series of virtual cylinders, one inside the other, the composite elevation view on the bottom right:

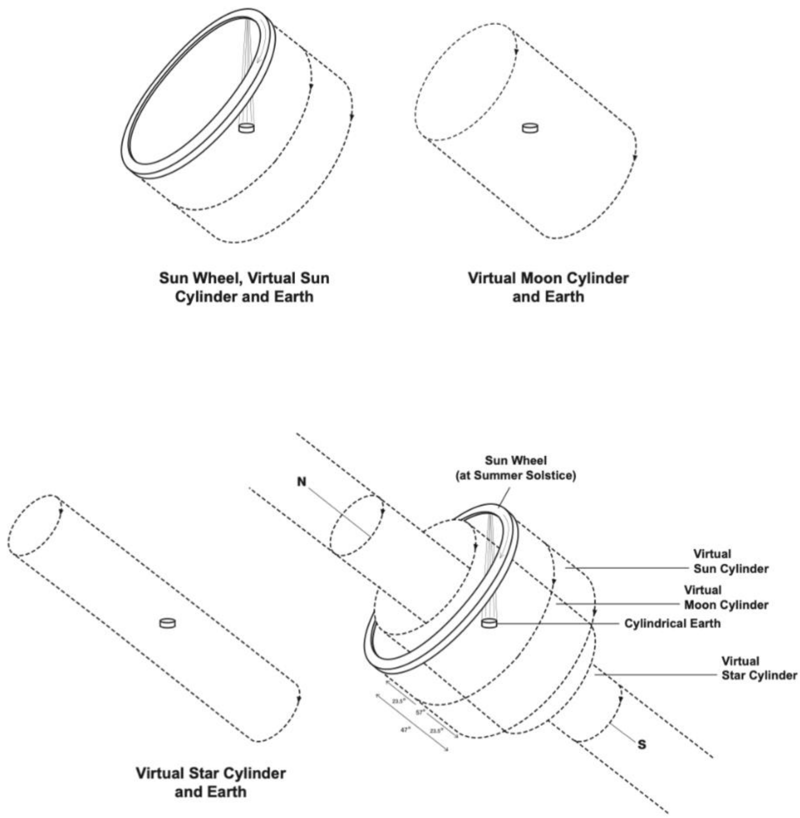

Figure 12: Dissection of Elevation View.

Moreover, by considering that Anaximander imagined the cosmos from more than one point of view, we resolve an objection sometimes raised about Aristotle’s testimony. How could the earth be equidistant from all extremes ([…] ὁμοιότητα … ὁμοίος πρὸς τὰ ἔσχατα ἐχον) as Aristotle reports in de Caelo[18] if Anaximander had imagined the cosmos only in *elevation*? But, had he also imagined the cosmos in plan, the earth does appear equidistant or similarly-distant from the extremes. If we reflect for a moment on how to answer the question “Where was this archaic Greek standing when

[18] Arist. *Cael.* 295b10-14.

he imagined to cosmos?” the answer is that he imagined himself standing outside the cosmos (wherever that might be!), laterally and vertically. Of course, the report that he made a σφαῖρος – a model of the cosmos, perhaps the first planetarium – emphasises further that he was able to imagine the cosmos by standing or placing himself outside of it, looking in.

Additionally, there is another way to suggest architectural influence and inspiration on Anaximander’s cosmological imagination. In one report, by Hippolytus, we learn of Anaximander’s theory about the shape of the earth: τὸ δὲ σχῆμα αὐτῆς (sc. τῆς γῆς) γυρόν, στρογγύλον, κίονι λίθῳ παραπλήσιον; the earth’s shape was like a stone column – drum-shaped – γυρόν and στρογγύλον, terms that some commentators regarded as unnecessary duplications.[19] But when we actually look at archaic column drums, and grasp something fundamental about how to place each in the constructed column as we already discussed, it becomes clear that the terms describe two distinct building techniques. The earth/column-drum is στρογγύλον, *round* at the circumference (i.e. the distance from the circumference to the drum’s center must be consistently uniform), and it is γυρόν, or *concave*, to assure that there is no chance for one drum to protrude and hence rub against the next drum set on top, and so endanger the stability of the construction.

[19] Cf. Kirk-Raven, 1957, p. 134.

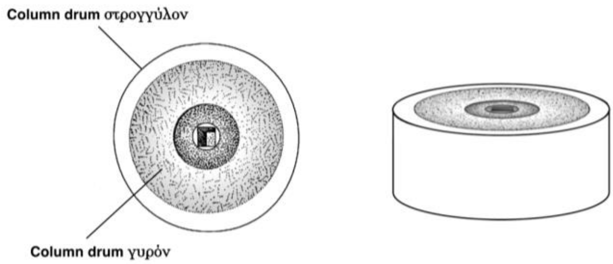

Figure 13: Left: plan view of column drum displaying "round" at circumference, and "concave" through the middle; right: elevation view.

Another important connection between Anaximander's rational, cosmic, speculative thought and the architect's is the shared idea of *modular* thinking, but it was Anaximander who learned this from the architects, and not the other way around. We know from the architect and historian Vitruvius, in his *Ten Books on Architecture*, that the success of monumental temple building requires the selection of a *module*, a *One over Many* – calling on a familiar phrase to describe the search embraced by the earliest Greek philosophers – in terms of which the other architectural elements are reckoned as multiples or submultiples.[20] This technique insures that the gigantic building will display the planned aesthetic effects when the parts are expanded proportionately. Vitruvius tells us that ***the module for the archaic architects was column-diameter***.[21] In determining the dimensions of

[20] Cf. Hahn, 2003, p. 105-121, to see the details how the sizes of architectural elements are reckoned as multiples or submultiples of the module in the archaic temple of Artemis at Ephesus.

[21] Vitr. 3.7. Cf. Hahn, 2010, Ch. 2 for a detailed exploration of where, precisely, on the column was the module. Since it seems clear that even in archaic times, some effort was made to obtain optical correctness, to make the column seem straight from the distance, it had to be tapered as the column became taller. This technique came to be known by the term "*entasis*." The philosophical point that could not have been lost on the Milesian philosophers was that for something to appear to be a certain way, it could not be the way it appeared to be. And so, architecture and building techniques offered an exemplar of the importance of distinguishing between "seeming" and "being," appearance and reality. [This point is pivotal when we realise that despite the obvious differences in appearances of the things we experience, the Milesians reasoned that there was nevertheless a single

the stylobate, the surface upon which the columns would be set, the architect began with column diameter, and the spacing between the columns, and by successive addition determined the length and width of the stylobate, or given the limitations of the size of the sylobate to begin with, achieved a comparable result by successive division.[22] In the Ionic theory of proportions, column height is 9x the lower column diameter, the entablature height is 1/6 the column height, the architrave height is 1/12 the column height, etc.[23] Thus, all the measurements of the architectural elements are ultimately reducible to column diameter. And so, when Anaximander likens the shape and size of the earth with a column-drum, and reckons the distances from the cold and moist earth to the dry and hot heavenly wheels of stars, moon, and sun in earthly, that is, in column-drum proportions, he is not only making use of the architect's modular technique but moreover he is using the architect's module! Anaximander came to imagine the cosmos in architectural terms because he came to view it as cosmic architecture, an architecture built in stages, just like the temple. While the architects transfixed their communities with their *thaumata*, celebrating the power of the god in its symbolically meaningful cosmic house, and literally changing the horizon in terms of which the eastern Greeks came to view their own place, Anaximander did them one better by urging his community to imagine the *thaumata* that is our cosmos as a built house. Our cosmic house, Anaximander explains was built by nature, through the natural

underlying unity of which all these difference were only appearances.] But the identification of the module was not open to this ambiguity though its precise identification was open to doubt if column diameter is not uniform throughout the column, and "column diameter" was the module both for the archaic architects and Anaximander, where precisely was the column measured to expose the module? There has been much debate about this, but suffice it to say for our purposes here, the module appears as a measurement on the "lower" column diameter.

[22] Cf. Hahn, 2010, esp. p. 67-72.

[23] Cf. Hahn, 2003, p. 108-16. There are debates among architect-archaeologists over the exact rules of proportions. For example, the ones just given were Wesenberg's "correction" to Krischen. Krischen had claimed that column height, for example, was 10x, not 9x, the lower column diameter. But whether it is 9x or 10x the selection was poetically meaningful in terms of archaic culture.

interactions of hot and cold, wet and dry, while the house of the god was built by man who is able to grasp and control nature in a manner that was worthy of marvel.

Let us be clear, then, about Anaximander's innovations in cosmic speculation over those by Homer and Hesiod. Homer offers no numbers to suggest the heights of the heavens, but he seems to place the earth equidistant from the highest heavens and the lowest depths of Tartarus.[24] Hesiod, who shares with Homer placing the earth midway between the extremes, advances this conception by adding a numerical reckoning of these distances. When a brazen anvil is released from the highest heavens it would fall 9 days and nights finally reaching the earth on the 10th. If the gates of Hades were opened and the anvil allowed to fall again, it would continue for 9 days and nights finally reaching the depths of Tartarus on the 10th.[25] These numbers fit well in the context of the numbers and proportions we know from archaic Greek sources: we begin the *Iliad* in the 9th year of the war informed that it will end in the 10th; Odysseus takes 9 years to return from the Trojan War, finally arriving home in the 20th; in measuring the cosmos. The archaic formula to express great distances, lengths of time, and abundance of quantity was '9' and the topper was '10' = '9 + 1'.

Anaximander had assigned distances to each of the heavenly wheels: 9/10 to the star wheel, 18/19 to the moon wheel, and 27/28 to the sun wheel, the diameter of each wheel is 1 earth/column-drum (= 1 module). There seems to be no way to explain these numbers as part of observational data, however these numerical assignments fit well the archaic poetic formula. Anaximander's cosmic numbers of 9 (+1) to the stars, +9 (+1) to the moon, + 9 (+1) to the sun fits seamlessly into that picture of numbers.[26] We can see also that they exhibit a geometrical progression: the earth is 3x1, the distance to the

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[24] Homer Iliad 8.13-17: Zeus warns the gods and goddesses on Olympus not to interfere with his plan for the Trojans lest they be thrown to the murkiest depths of Tartarus as far beneath the ground as the highest heavens are above.

[25] Hesiod, *Theogony*, 721-726.

[26] Cf. Hahn 2010, p. 60-86.

stars x3, to the moon x6, and to the sun x9. Thus, the geometrical progression reads 9, 18 27 in multiples of 3. But this progression of cosmic distances (not wheel size) could also be expressed, with each wheel being 1 module in diameter: 3x3+1 to the stars, 3x3x2+1 to the moon, and 3x3x3x+1 to the sun. Strikingly, we have evidence from the 6th century of roof design that exhibits just this pattern for laying out the roof tiles that I have discussed in detail elsewhere.[27] Just as the architects used a module in terms of which the other architectural elements were reckoned as multiples or submultiples, it can also be shown that the design formula for one part of the building, for instance the ground plan, is the same formula for setting out the elevation and even the roof tiles. And if Anaximander thought through the structure of the heavens in terms and formulas by which the architects produced man-made heavens (the roof of buildings), might he have reckoned analogously his own cosmic architecture?[28] While Anaximander's cosmic numbers were not driven by observational data but rather by poetic formula, the architectural influence and reflection is still present: the height of Ionic columns – the column symbolically separates heaven and earth – was reckoned as 9 or 10 times the lower column diameter.[29]

[27] Cf. Hahn, 2003, p. 135-149.

[28] Cf. Hahn, 2003, p. 130-148 where the details for setting out the architect's design formulas are provided and followed through the ground plan, elevation, and roof tiles.

[29] Cf. Vitr. 3.7.

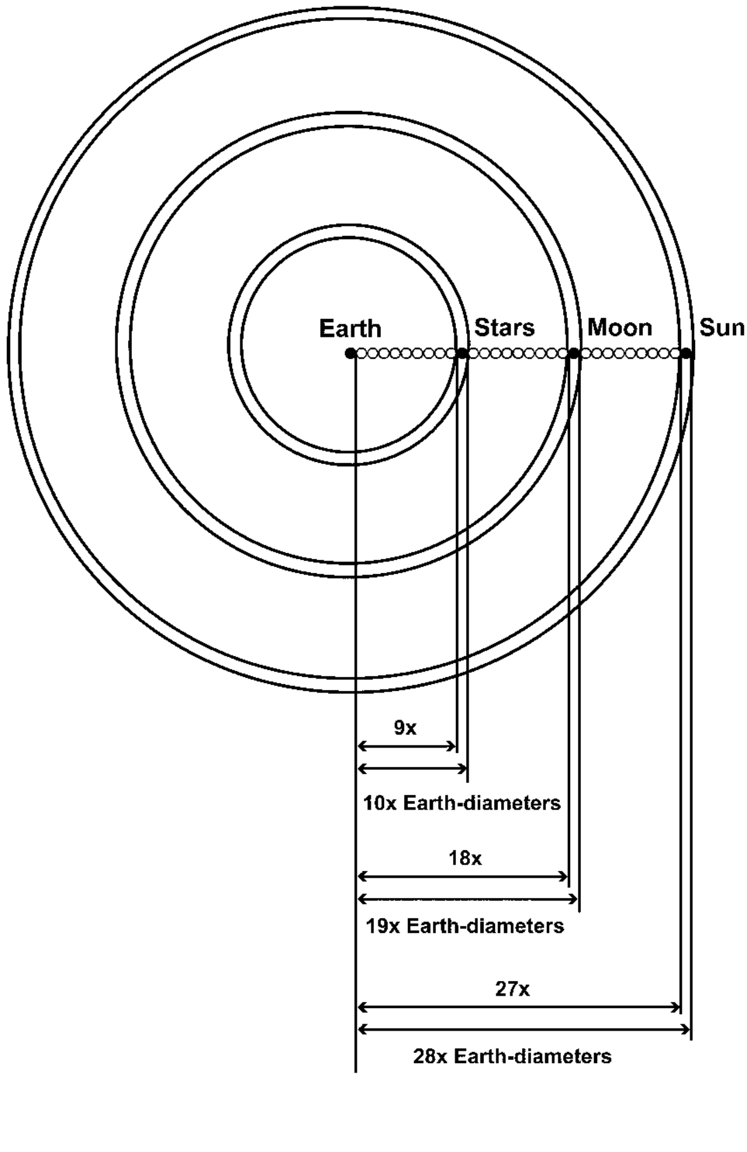

Figure 14: Cross-section [plan view] of Anaximander's cosmic picture.

Let us conclude this exploration by touching on one additional theme – the writing of prose treatises. Anaximander is credited with writing the first philosophical book, a treatise written in prose. How might we explain that innovation? It is plausible that he was inspired by the architects. From Vitruvius we learn that the archaic architects wrote prose treatises, Theodorus and Rhoikos on the temple of Hera at Samos, and Chersiphron and Metagenes on the temple of Artemis at Ephesus. We have a story preserved that when architects at the temple of Artemis at Ephesus encountered problems, they consulted with the architects of the Heraion. Perhaps this experience urged the architects to write prose treatises, celebrating their achievements and offering guidance to would-be temple builders by supplying the rules of proportion they followed and various inventions that solved their construction problems. Since we know that Anaximander published his book – that is, he likely left a copy in the Temple of Apollo at Didyma as a votive – the year before he perished, we can place Anaximander's book in 547 BCE. Since the Heraion was begun not later than 570, and the Artemision 560, the architectural treatises were likely completed sometime close to 550.[30] The choice of prose for writing an architectural treatise makes sense if the treatise is to be useful to architects and builders. Besides the roughly contemporaneous Pherecydes of Syros, a θεόλογος not a φυσιόλογος, we have no other mention of prose writing in the mid-6th century BCE other than that by the ἀρχιτέκτων and Anaximander the φυσιόλογος.

Conclusions

Aristotle identifies the Milesians – Thales, Anaximander, Anaximenes – as the first philosophers. They were not the first *tout court*, but they were the earliest thinkers of whom Aristotle knew that could count as "philosophers." The case we have explored is that the monumental temples, and building technologies employed in them, revealed how the architects came to grasp and control nature

[30] Cf. Hahn, 2001, Ch. 2.

rationally. Anaximander was stimulated, within and by means of this historical and cultural context, to imagine the cosmos as cosmic architecture, an architecture built in stages – a natural, not mythological, cosmology – by analogy with the architects. He likened the shape of the earth with a 3x1 column drum, dimensions that could have been seen in his backyard at the temple of Apollo at Didyma; its shape was both round at the circumference and concave through its surface face, just like the architect's technique of preparing a drum for installation. He imagined the cosmos in modular terms, selecting the architect's module – column diameter – to measure out the distances to the stars, moon, and sun in earthly [column-drum] proportions, just as the architect measured out the dimensions of the stylobate, and the other architectural elements, in terms of column diameter. He reasoned that they must be fiery wheels, not solid bodies, otherwise they would certainly fall from the sky. Anaximander's placing the stars closer to us than the moon or sun was likely a rational inference; where there is more fire (= sun) then the object is further, since fire goes up, and since the stars seem to have less fire, because they are less bright, they must be closer. He imagined the cosmos from more than one point of view, taking the inspiration from the architects, as he thought out rationally how to explain his remarkable vision that the earth remains in homeostasis, aloft in the middle of the cosmos held up by nothing, He preserved his rationalising of the cosmos in a prose treatise, just like the architects. Only a jaundiced eye would fail to see how architectural and building technologies deeply affected Anaximander's abstract, speculative, rational picturing of the cosmos. And while our exploration of the cosmic numbers suggests that the archaic poetic shorthand 9+1, +9, +9 indicated far, farther, and farthest of distances to the heavenly wheels – and not observational data – those numerical assignments were different but analogous to the architect's selection of multiples and submultiples of modular measurements – column diameter – for the temple's column height [9x the column diameter]], the entablature height as 1/6 the column height, the architrave height as 1/12 the column height, and so on for other architectural elements.

The conventional view – transcendent origins – that Greek philosophy began by rejecting the body and senses is misleading, no matter how important were the developments that led to a vision that there were unchanging objects of knowledge that were accessible only to the mind and not the body, since all objects of the senses are forever changing. The spirit of rational inquiry emerged from several factors but the contributing role of monumental architecture and building technologies has been vastly under-appreciated. In the process of figuring out how to build on an enormous scale that the eastern Greeks had never before tried, the architects discovered and revealed nature's order in their *thaumata*, the very experience with which Aristotle claims that philosophy begins. And let us not forget that it is Aristotle who informs us that these Milesians also explored and posited that there was a single underlying unity from which all appearances emerge: for Thales it was ὕδωρ, for Anaximander ἄπειρον (or ἄπειρα φύσις),[31] and for Anaximenes ἀήρ. Thus, the very same philosophers who were engaged in practical activities of measuring heights of pyramids and distances of ships at sea, diverting rivers, making sundials and charting the stars for navigation, making models of the cosmos, maps of the inhabited earth, and imagined the cosmos by means of architectural techniques, they also *rationally inferred, beyond observation and practical experiences, an underlying reality – capable of altering without changing*. Despite the obvious fact that things look different – the fire at the stove, the air we breathe, the liquid in the cup, the hard marble stone – the Milesians were able to rationally infer an underlying unity not immediately apparent. It was through bodily experience, not the repudiation of it, that abstract, speculative philosophical thinking sprang forth, not like Athena fully armoured from the head of Zeus, but in stages beginning with a deepening exploration of the world through our senses.

[31] Cf. the thoughtful study by Kočandrle & Couprie (2017). They argue that ἄπειρον was mistakenly attributed to Anaximander and that the appropriate way to describe Anaximander's thought is ἄπειρα φύσις or Unlimited Nature.

There is a valuable lesson here for those who wish to become philosophical, and for philosophers who are trying to help their students to become philosophical. One avenue that is under-explored in contemporary public education, at least in the United States and it seems widespread throughout western Europe, would be to provide more hands-on practical experiences for our students. Our educational systems take our children of high school age and divide them into either "those headed for university" or "those headed for technical and vocational careers." The technical and vocational careers path supply just the kinds of practical experiences that positively fuel abstract and speculative thinking, so long as the instructors, besides teaching "techniques," also emphasise the principles that lie behind those techniques, principles discoverable/confirmable upon reflection. Perhaps more "enlightened" technical and vocational training – emphasising principles *after* learning techniques – for "those headed for university" would help our university students, and technical/vocational" students, become more philosophical?

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