

DEFICIENCY IS THE MOTHER OF INVENTION: LACKING THE VITRUVIAN MAN

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Vitruvius is a full-figured text. Bodies proliferate endlessly—as touchstones of measurement, as images of ideal proportions,¹ as analogies for building, empire, discipline, or text²—and they dance just as deftly around the scholarship.³ If we had to pick a metaphor by which Vitruvius lived in writing, we could do no better than *corpus*. He is perhaps antiquity’s greatest embodiment of body. But what I would like to argue in this article is that the Vitruvian body is not uniform; not alone; not ideal; and as an instrument of scientific discovery, it is not enough. It is lacking—and it *needs* to lack.⁴

Let us begin with our mandatory starting point, which brought all of us needy bodies together round a table in the first place. The first thing I noticed about passage 3.1, and the last thing I will say about it, is that the gold standard of proportionality⁵ in temple building—the human body—is introduced with curious phrasing:

namque non potest aedis ulla sine symmetria atque proportione rationem habere compositionis, nisi uti ad hominis *bene figurati* membrorum habuerit exactam rationem.

(Vitr. 3.1.1)⁶

No temple can have any compositional system without symmetry and proportion, unless, as it were, it has an exact system of correspondence to the likeness of a *well-formed* human being.

Presumably, *nisi uti ad hominis membrorum habuerit exactam rationem* would have done the job just as well. When Vitruvius, or other ancient authors, or

1. See Oksanish (2019), 94f., 144f.; Riggsby (2016).

2. Formisano (2016), 151f. and *passim*.

3. The body in Vitruvius has been well surveyed by McEwen (2003), who covers all of these metaphorical usages; but Oksanish (2019) has shown there is still a lot left to say on the matter.

4. Interestingly, the Vitruvian text itself has often been cast as an entity inherently lacking, e.g., it does not equip us with enough knowledge to do the job; or it is a stylistic failure (see Rowland, Howe, and Dewar [1999], 15); or it never tells us what we want it to tell us about contemporary architecture (Wallace-Hadrill [2008], 144). For the deliberate gaps in Vitruvius’ text as revealing of ‘tacit knowledge’, see Cuomo (2016).

5. Although for a compelling against-the-grain reading, taking 3.1 as a space of bodily asymmetry (rather than symmetry) leading to the full-on dismemberment to come, see Laterza (2018), 198.

6. Text here and elsewhere is from the Loeb edition (Granger [1931]), translation from Rowland, Howe, and Dewar (1999).

some of us generally ableist moderns, talk of ‘the human body’, we usually mean a particular culturally conditioned and idealized version of the human body. So why the *bene figurati*? Why spell out that this is not just any human body, but the limbs of a human specifically ‘well-designed’?⁷ There is something a little desperate about that lunge of overdetermination. Just in case we were in danger of darting off, pencil in hand, and drawing up plans for an Ionic temple in the image of a short-statured friend, Vitruvius covers his bases: no, not *that* kind of human body, *this* kind of human body, the exact proportions of which he then goes on to describe in some exhausting detail. As with most standards that are held up as natural or obvious, these ones require an excessive (and suspicious) amount of articulation and policing.

The second problem I noticed emerges when we draw back to look at the body in context—when the body of 3.1, in effect, becomes not enough. Certainly, 3.1’s body is certainly held up as an ideal of a sort—that much is fairly uncontroversial.⁸ But only a few Vitruvian pages earlier, in the important preface to book 3, the human body looks very different:

Delphicus Apollo Socratem omnium sapientissimum Pythiae responsis est professus. is autem memoratur prudenter doctissimeque dixisse, oportuisse hominum pectora fenestrata et aperta esse, uti non occultos haberent sensus sed patentes ad considerandum. utinam uero rerum natura sententiam eius secuta explicata et apparentia ea constituisset! si enim ita fuisset, non solum laudes aut uitia animorum ad manum aspicerentur, sed etiam disciplinarum scientiae sub oculorum consideratione subiectae non incertis iudiciis probarentur, sed et doctis et scientibus auctoritas egregia et stabilis adderetur.

(Vitr. 3.praef.1)

Apollo of Delphi proclaimed in an oracle of the Pythian priestess that Socrates was the wisest man of all. Socrates, in turn, is recorded as having said, sensibly and knowledgeably, that human hearts should have been transparent and open, so that their feelings are not hidden, but rather open for inspection. Indeed, if only Nature had followed his advice, and had made them clear and open to view! In that case, not only would the praiseworthy qualities and the shortcomings of human souls be observable at close range, but, in addition, knowledge of the various disciplines, set out before our own eyes, would no longer be put to the test by uncertain judgments; instead, the truly learned and truly wise would acquire a preeminent, unshakable authority.

7. Of course the metaphor is also there to validate ‘fashioning’ as a natural and architectural process—thanks to the anonymous reviewer for clarifying that.

8. Although see Laterza (2018), 196–8, for qualification of this view.

Far from the articulation of an ideal, Socrates' view of the body frames it as something that nature has *failed*.⁹ Apt enough for someone who was himself renowned for being not quite easy on the eyes—all mind and no body¹⁰—Socrates supplements the body by slipping a few improvements for next time into nature's suggestions box.¹¹ In some ways, this moment is the inverse and the cancellation of the body as model for building in 3.1: here the body is explicitly *not* a model for building, but something inferior to a building, something that fails to live up to the standard of a building in lacking the handy features of open windows. In other words, the building is a model for the body, but it is a model to which the body can never quite live up—for you can build a building, but you cannot build the body; the body is already built. Nevertheless, Vitruvius briefly indulges himself the counterfactual, slyly slipping in a very familiar bodily expression (*ad manum*, 'at close range') to get us used to the idea of a fully transparent, light-filled, fenestrated human form, whose knowledge levels can be checked at the scrutineer's glance.

Which is it then, *the* Vitruvian body? Perfect or imperfect? Complete or deficient? The answer, as with most ideological contradictions, is that it is both. And as with most things Vitruvian, the answer is context-sensitive. The body always needs environment to function. When the body appears *qua* visual metaphor—as a standard of proportion, or, as Oksanish has written of so well, as a figure that can be apprehended synoptically, an incarnation of *breuitas*—it is usually a force for selectivity and non-comprehensiveness, and as such, explicitly ideological in its constraints.¹² Relatedly, Marco Formisano has written of the body as a force of dismemberment rather than unity in Vitruvius; he charts how often the text fails to act as an organic sum, and how its parts sometimes grate against its whole.¹³ More recently, Giovanna Laterza has nicely borne out this conclusion for the relationship between the hypothetical windowed body of 3.preface, and the reality of book 3's textual body, which ends up anything but transparent.¹⁴ But this article will treat a slightly different incomplete body in context. This body will be deployed not as a visual image for mimesis and/or cognitive apprehension, or a metaphor for text, but as a material organism with particular environmental needs. This body—particularly the bodies of Dinocrates, Vitruvius, and Archimedes below—will also serve as an instrument of active scientific discovery: the

9. On the structuring potential of this open window imagery, its importance in the construction of scientific discourse, and its meaning in the context of book 3, see Laterza (2018).

10. Cf. Oksanish (2019), 182f., and Daniel Anderson in this issue. Laterza (2018), 195, citing Rigoni (1974), 453, notes a tradition that takes Socrates as symbol of a dichotomy between interiority and exteriority, but explains the choice of Socrates more as motivated by the need to set up an opposition between two competing epistemic models.

11. On the relationship between nature and human design in Vitruvius, see Roby (2013). On the problems of identifying a true 'man of *scientia*' thrown up by this passage, see Oksanish (2019), 146f.

12. Oksanish (2019), ch. 3; and cf. Oksanish (2016)—e.g., 278, 'Vitruvius's aim is comprehensibility, not comprehensiveness.'

13. Formisano (2016), 159.

14. Laterza (2018), 196–8.

thing we can use to gain knowledge. I want to argue that this body lacks perfection, indeed, must lack in order to gain. If we picture the Vitruvian body as a cognitive tool rather than visual form, its deficiency becomes the mother of our invention.

Design Flaws

The best way to continue tracking these Vitruvian bodies, and their role in generating knowledge, is to track back—to book 2’s famous preface. Here, Vitruvius gives us a little fable about architecture and its relationship to power.¹⁵ The bodily beautiful architect Dinocrates is seeking to get on the books of Alexander the Great. When Dinocrates’ nepotistic connections in the inner court are taking too long to win him an introduction to Alexander, the architect takes matters into his own hands: *ab se petit praesidium* (‘he sought assistance from himself’, 2.praef.1). If you want something done right, do it yourself. Dinocrates initially gets Alexander’s attention by strutting his perfect body in front of the general so that he cannot miss him:

fuerat enim amplissima statura, facie grata, forma dignitateque summa. his igitur naturae muneribus confisus uestimenta posuit in hospitio et oleo corpus perunxit caputque coronauit populea fronde, laeuum umerum pelle leonina texit, dextraque clauam tenens incessit contra tribunal regis ius dicentis. nouitas populum cum auertisset, conspexit eum Alexander.

(Vitr. 2.praef.1f.)

He was a very tall man, handsome, with a fine face and immense dignity. Trusting, then, in those gifts of Nature, he went back to his inn, undressed, and thoroughly oiled his body. Crowning his head with a poplar wreath, draping his left shoulder in a lion skin and brandishing a club in his right hand, he strode before the tribunal where the king was hearing petitions. When the crowd began to take notice of this novelty, Alexander, too, looked Dinocrates’ way.

Dinocrates truly turns heads, and Alexander cannot help noticing this artwork of an Adonis attracting all eyes; in Formisano’s terms, ‘Dinocrates allegorizes corporality itself.’¹⁶ But Dinocrates is not just a pretty face on the outside. His aesthetic perfection completely informs his inner world, and prompts him to design the outer world effectively in his own image:

15. The passage has long been seen as key, especially as an articulation of Vitruvius’ anti-architect: see Oksanish (2019), 148–78; Wallace-Hadrill (2008), 149; Courrént (2011), 23; Nichols (2017), 5, on Dinocrates as typical Vitruvian ‘straw man’ or, 63–5, a foil with Horatian overtones of self-aggrandizing; and for complement and complication, Formisano (2016), 156–8.

16. Formisano (2016), 157.

admirans ei iussit locum dari, ut accederet, interrogauitque, quis esset. at ille: ‘Dinocrates’, inquit, ‘architectus Macedo qui ad te cogitationes et formas adfero dignas tuae claritati. namque Athon montem formaui in statuæ uirilil figuram, cuius manu laeua designauit ciuitatis amplissimæ moenia, dextera pateram, quæ exciperet omnium fluminum, quæ sunt in eo monte, aquam, *ut inde in mare profunderetur.*’

(Vitr. 2.praef.2)

Impressed by the young man, the king ordered the crowd to make way for him to approach the tribunal, and asked who he was. ‘Dinocrates’, he answered, ‘an architect of Macedon, who brings you ideas and plans worthy of your renown. I have, for example, a project to carve all Mount Athas into the image of a man. In his left hand I have represented the walls of a spacious city; in his right, a libation bowl where the waters of all the rivers that run on that mountain will gather together *and plunge into the sea.*’¹⁷

Just as Dinocrates himself is all form (*forma ... summa*), so his blueprint seeks form above all (*forma dignitateque summa > formas ... dignas tuae claritati; cf. formaui*).¹⁸ But this is total aesthetic surplus; form without function (the opposite of modernism). In Platonic terms, the mimesis is excessive, the copies recursive: Dinocrates’ design pictures not just the figure of a man, but the ‘figure of a statue of a man’ (*statuæ uirilil figuram*). What is more, this is the form of a man who is deeply unaware of human need (and that claim applies to both Dinocrates and the statue). For this gigantic, over-designed mountain colossus has a bowl in his right hand to dam the rivers and collect their water, only to supply this precious resource to ... the sea. Again, this is ridiculously unnecessary; aesthetic excess gone haywire. Everyone knows that river water does not need help getting to the sea. That is precisely what it does of its own accord.¹⁹ But Dinocrates, getting carried away by the loveliness of form, chooses to have a big sculpted man do nature’s job for it, and completely forgets the human community’s needs in the process. For everyone (and particularly Vitruvius and Augustus) also knows that populations require a water supply which actually supplies water, rather than squandering it into the infinite body known as the sea.

Depressingly, like most posh and incompetent people, Dinocrates ultimately lands on his feet and wins entry to Alexander’s entourage, despite his faulty

17. The Loeb translation ironically misses the crucial *ut inde in mare profunderetur* but Rowland, Howe, and Dewar (1999) remedy the omission.

18. On the echo chamber of *forma* here: Formisano (2016), 157; Oksanish (2019), 161.

19. Indeed Dinocrates’ plan could be seen as a perverse literalization of the classical function of *techne* or *ars*, to pull off exactly what *physis*/nature accomplishes on its own (thanks to the anonymous reviewer for this point).

design. But not before Alexander has pointed out a fatal flaw.²⁰ Nor is it this obvious problem with the water supply. It is another equally grave failure to cater to basic, material human needs:

delectatus Alexander natione formae statim quaesiit, si essent agri circa, qui possint frumentaria ratione eam ciuitatem tueri. cum inuenisset non posse nisi transmarinis subuectionibus: ‘Dinocrates’, inquit, ‘adendo egregiam formae compositionem et ea delector. sed animaduerto, si qui deduxerit eo loco coloniam, forte ut iudicium eius uituperetur. ut enim natus infans sine nutricis lacte non potest ali neque ad uitae crescentis gradus perduci, sic ciuitas sine agris et eorum fructibus in moenibus affluentibus non potest crescere nec sine abundantia cibi frequentiam habere populumque sine copia tueri. itaque quemadmodum formationem puto probandam, sic iudicio locum inprobandum: teque uolo esse mecum, quod tua opera sum usus.’

(Vitr. 2.praef.3)

Alexander, delighted with the idea, inquired immediately about the nature of the plan—were there farmlands to furnish this city with a regular supply of grain? When the king learned that food would have to be imported by sea, he said, ‘Dinocrates, I appreciate the ingenuity of this plan, and I am charmed by it, but I also recognize that if someone were to found a colony there, his judgment would be found wanting. Just as a newborn baby cannot be nourished and grow without its nursemaid’s milk, so neither can a city grow without farmlands and the flow of their produce within its walls. Without abundant food, no city can maintain a large population nor, without resources, safeguard its people. As much, therefore, as I think that the design is to be commended, the choice of the site is to be condemned. Still, I want you with me, because I intend to make use of your talents.’

Alexander is seduced by the form (*formae* × 2),²¹ but immediately spots the practical lack (indeed the very same one that Rome was facing at the beginning of the principate):²² this city is without an indigenous grain supply. Dinocrates

20. For Dinocrates’ other faults here, see Oksanish (2019), 153f. In Oksanish’s reading (2019), 155f., Alexander is also made to fall short of his implicit counterpart here, i.e., Augustus.

21. And seduction might be just the right metaphor here: see Oksanish (2019), 164f., on the erotic implications of Alexander being taken in by Dinocrates’ form.

22. A large part of Rome’s grain supply was sourced from Egypt and came through Alexandria, the very city here mentioned. Most dating estimates put Vitruvius somewhere around 27–22 BCE (Rowland, Howe, and Dewar [1999], 3–5); Oksanish (2019), 5, positions *De arch.* somewhere soon after 27 (cf. Baldwin [1990]). If it came out towards the later end of the 27–22 range, it would have been synchronized perfectly with some crippling famines in Rome (in 23 and 22) and therefore launched amid a particularly hot topic of grain supply; see Geue (forthcoming).

has made a pretty thing, but he has completely forgotten about the material constraints within which every urban planner must work: humans need to be fed. Interestingly, Alexander uses the analogy of the helpless child to make the oversight clear here: just as an infant cannot go on without nourishing milk, so a human population cannot grow ‘without abundance or supply’ (*sine copia*). Alexander draws attention, that is, to the human as a collective entity which is constitutionally lacking—it cannot get by without certain environmental factors in place to sustain it. It needs help. Alexander—drawn perhaps in the image of a sensitive and benevolent ruler à la Augustus—pays attention to this; note the term *animaduerto* (cf. *animaduertit* in next passage), the keystone verb of noticing and perception of the outside world,²³ which will become important for us in a second. Alexander cognitively attends to the body’s needs, and so acknowledges that that body lacks.

Dinocrates, however, completely misses this—and that is precisely, I would argue, because of his perfect physical form, which grants him access to a kind of honorary aristocratic class position (cf. *nobilitatem* below). Dinocrates has never experienced any sort of need, neither physical nor financial; he turns heads when he walks past, and his formidable social connections make it strictly unnecessary for him to win this paid commission from Alexander. He could in fact afford to do an unpaid internship, for he will always be ok. Because he lacks the sense of need in looks or patronage, he is also definitively blind to the material needs of a human population—for Dinocrates, grain and water just appear naturally, they are taken for granted, pure aesthetic excess. But never fear. There is an architect in the house who *is* attuned to the needs and wants of humanity, as one who has experienced those needs and wants directly himself: none other than Vitruvius himself. He ends the Dinocrates anecdote:

ita Dinocrates a facie dignitateque corporis commendatus ad eam nobilitatem peruenit. mihi autem, imperator, staturam non tribuit natura, faciem deformauit aetas, ualetudo detraxit uires. itaque quoniam ab his praesidiis sum desertus, per auxilia scientiae scriptaque, ut spero, perueniam ad commendationem.

(Vitr. 2.praef.4)

So Dinocrates, because of the beauty of his face and the dignity of his physical presence, came with high recommendation to this privileged status. But to me, Emperor, nature did not grant imposing stature, age has ruined my face, and bad health has carried off my strength. Therefore, because I am bereft of such defences, it is through the help of my expertise and my writings that I shall—as I hope—attain your approval.

23. On Vitruvius’ distinct emphasis on direct observation as a driver of scientific leaps, cf. Rowland, Howe, and Dewar (1999), 17.

Vitruvius' appearance is the opposite of Dinocrates', the anti-form (*deformauit*) to his all-form. He is a man sorely in physical need—short, old, weak, deserted by the 'defenses' (*praesidiis*) which Dinocrates 'secured from himself' (*ab se petit praesidium*).²⁴ But the implicit logic here is that these desertions, these deficiencies, actually equip Vitruvius to be a better architect. He is not pretty, nor does he have an independent source of income. But it is the fact that he *needs* that drives him on; he has to work at architecture to compensate for his inherent physical and financial infirmity. His body needs help, and this makes him a better architect.

The things that will help Vitruvius get that prestigious, elusive *commendatio*—his own private 'reinforcements'—are the *auxilia scientiae* and *scripta*. Most scholars take this to mean his own learning and writings, which he can sell on the patronage market for a price. But I would prefer to read those objects—lacking any possessive pronoun to locate them securely—as the resources of other architects, philosophers, and writers on whom Vitruvius often shows himself to depend. Vitruvius is not only a better architect because he lacks physically and financially. He also lacks intellectually. He leans on the *scripta* of his predecessors like a baby suckling at the teat, or a grown human needing food or water. The body of his knowledge also lacks, and it can only be activated within a nourishing tradition.

Brain Nourishment

Water and grain: two absolute *condiciones sine qua non* of the ancient Mediterranean body. In the Dinocrates-Alexander story, these are exactly the things missing from Dinocrates' aristocratic-aesthetic jamboree of a 'design'. There, they figure literally as the indices of the human body in need. In the next section, I would like to chart their metaphorical valence as substances which enable the human's intellectual advance. For these very material needs supply the metaphors by which Vitruvius figures the nourishment of knowledge; and in Archimedes' case, one of them—water—actually becomes the medium and means by which knowledge is flung forward, when the individual body is simply not enough.

Come the preface to book 7, the Alexandrians are back again—but this time it is the next generation. In the context of paying tribute to predecessors and maligning slimy plagiarisers, Vitruvius rolls Ptolemy Philadelphus onto the stage. Ptolemy wins an extended mention for his reorientation of royal funds towards intellectual as well as physical prowess, from body to mind. He sets up a

24. Of course Vitruvius' self-presentation here rests on a huge 'physio-ethical' discourse in which ugliness or defect can be rhetorically paired with stellar moral character; see Oksanish (2019), 170–5. But that move also required a fair bit of discursive work, given the 'Thersites problem'; see Oksanish (2019), 183f.

competition to support literary production at Alexandria, and that competition is aimed to keep the volumes ticking over into the library:

reges Attalici magnis philologiae dulcedinibus inducti cum egregiam bybliotheecam Pergami ad communem delectationem instituissent, tunc item Ptolomaeus infinito zelo cupiditatisque incitatus studio non minoribus industriis ad eundem modum contenderat Alexandriae comparare. cum autem summa diligentia perfecisset, non putavit id satis esse, nisi propagationibus inseminando curaret augendam. itaque Musis et Apollini ludos dedicavit et, quemadmodum athletarum, sic communium scriptorum uictoribus praemia et honores constituit.

(Vitr. 7.praef.4)

The Attalid kings, introduced to the manifold charms of literature, had established the great library of Pergamum for the delight of all; then, likewise, Ptolemy, with boundless zeal and spurred by ambitious desire, had striven with no less passion to compete by establishing the library at Alexandria. Yet what he accomplished with the utmost devotion he thought insufficient unless he took care that, by sowing seeds, it be increased and extended. And so he dedicated games to the Muses and to Apollo and established prizes and honors for the victors among the public writers, just as usually happens with athletes.

The extended sense here is that, just as it was seen as the ruler's responsibility to sort out agriculture, distribution, and the food supply—*curaret augendam* cannot help but remind us of Augustus both in *augere* and the subtle evocation of the *cura annonae*²⁵—so the ruler should see to it that the fields of literature are constantly producing new nourishment for the brain (cf. *propagationibus inseminando*, 'by sowing seeds'). The library lacks, the library is 'never enough' (*non putavit id satis esse*); so better to keep adding to it over time. Here intellectual production takes on the language of agricultural production; Ptolemy, adding the next grains of Alexandrian 'civilization' to the pile of Alexander-Dinocrates' initial founding, moves from taking care of a human population's basic needs to filling their cultural wants.

Vitruvius goes on to tell the dual stories (positive and negative *exempla* respectively) of the intellectuals Aristophanes and Zoilus, with Ptolemy's reward of the former balanced by his punishment of the latter: Aristophanes knows/respects the past and can pick a plagiarist from a line-up; Zoilus disrespects the past, by slandering Homer. But when Vitruvius comes to reflect on

25. This section is of course a reflection of contemporary Roman epistemic imperialism—see Nichols (2017), 25.

how all of this applies to his own relationship with predecessors,²⁶ he reaches for the second branch of our metaphors of basic need, namely, water:²⁷

ego uero, Caesar, neque alienis indicibus mutatis interposito nomine meo id profero corpus neque ullius cogitata uituperans institui ex eo me adprobare, sed omnibus scriptoribus infinitas ago gratias, quod egregiis ingeniorum sollertiis ex aeuo conlatis abundantes alius alio genere copias praeparauerunt, unde nos uti fontibus haurientes aquam et ad propria proposita traducentes facundiores et expeditiores habemus ad scribendum facultates talibusque confidentes auctoribus audemus institutiones nouas comparare.

(Vitr. 7.praef.10)

But I, Caesar, have neither substituted my name on a text while altering the indications that it is another person's property, nor have I sought approval for myself by slandering another's work; instead I offer infinite thanks to all writers, because, with outstanding wisdom and talent, they have prepared abundant riches drawn from the ages, each of a different type, from which we, as if drinking in water from a spring, and adapting them to our own enterprise, will have more eloquent and ready proficiency in writing, and trusting in such authors we will dare to provide new precepts.

In fact the metaphors here are slightly mixed and a little desultory. Let us try to unpack them briefly. Vitruvius thanks the writers of the past for 'overflowing' (*abundantes*, a bit like Dinocrates' mountain man's cup above) with the best intellectual aids, gathered up over a long time. These writers afford 'resources' or 'supply'—*copias*—i.e., precisely the stuff to which Alexander gestured above, in pointing out that which humans could not do without (*sine copia*, 2.praef.3).²⁸ But lest we mistake these for agricultural resources—the more usual meaning of *copia*—Vitruvius plunges us back into the water: these intellectual resources, these written supplies, are like water drawn from a spring and deployed towards our own ends. In a sense—though the connection is subtle—this passage almost reverses the Dinocratean catastrophe of 2.praef. Whereas there we had water diverted from the rivers and funneled out into the sea, here we have the water supply being channeled properly:²⁹ used for drinking, as

26. On which see Nichols (2017), 7f.; on Vitruvius' engagement with Greek knowledge in particular, see Nichols (2017), ch. 1, and (2018); and for Vitruvius' relationship to Greek culture in general, see Wallace-Hadrill (2008), 144–210.

27. For the moves between these metaphors in this section, cf. Nichols (2017), 35f.

28. Cf. *cum ergo et parentium cura et praeceptorum doctrinis auctas copias disciplinarum*, 'When therefore I had increased my store of knowledge through both parental care and teacher instruction', Vitr. 6.praef.4.

29. Vitruvius is likely channelling the streaming together of water metaphors and literary tradition, as well as drawing on the Roman legal universe of water rights: see the classic Volk (2010) on this

nourishment for body and soul, as if it were irrigated via a perfectly engineered aqueduct.³⁰ Here the bodily needs of the prospective city in 2.praef. are rerouted into mental needs; intellectual activity, again, is figured as basic nourishment. In the context of Vitruvius acknowledging his debts to predecessors, he is effectively saying that his work is completely dependent upon the water supply of tradition.³¹

Bodies in Need

Over the next two books—8 and 9—the basic material needs of the body come back in force, especially that of water. Book 8 is entirely devoted to the important question of water. Vitruvius ain't no Dinocrates; his books direct water into all the right channels. The big topic of the universal solvent is introduced, however, in combination with all the other 'elemental' forms of material sustenance for life: air, earth, fire.

animaduertimus uero non solum nascentia ex his esse procreata, sed etiam res omnes non ali sine eorum potestate neque crescere nec tueri. namque corpora sine spiritus redundantia non possunt habere uitam, nisi aer influens cum incremento fecerit auctus et remissiones continenter. caloris uero si non fuerit in corpore iusta comparatio, non erit spiritus animalis neque erectio firma, cibique uires non poterunt habere coctionis temperaturam. item si non terrestri cibo membra corporis alantur, deficientur et ita a terreni principii mixtione erunt deserta ... itaque ex his, si quid forte deficit in corpore spiritus, ad restituendum aer adsignatus id praestat. apparatus autem ad auxilia caloris solis impetus et ignis inuentus tutiorem efficit uitam. item terrenus fructus escarum praestans copiis superuacuis desiderationibus alit et nutrit animales pascendo continenter. aqua uero non solum potus sed infinitas usu praebendo necessitates, gratas, quod est gratuita, praestat utilitates.

(Vitr. 8.praef.2f.)

We observe, indeed, not only that all creatures have been begotten of these elements, but also that none can be nourished without them, nor grow, nor sustain themselves. Without the infusion of breath, bodies cannot have

convergence in the proem to Manilius book 2 (thanks to the anonymous reviewer for the hint). There is also an investment in dispelling plagiarism, common to both Vitruvius and Manilius here (Volk [2010], 192f.)—the fluid swirls of water bring up the possibility and impossibility of originality. Volk (2010), 195, argues nicely that Manilius is polemically flexing against Vitruvius by 'repudiat[ing] all literary tradition and insist[ing] on his own absolute originality.'

30. See book 8 and König (2016).

31. Cf. Nichols (2017), 40, 'Roman *auctores* create a contemporary culture utterly reliant on the past.' For Vitruvius' respect for tradition, cf. Rowland, Howe, and Dewar (1999), 18.

life, not unless inflowing air creates continuous respirations and contractions. And if there were not a proper supply of heat for bodies, they would not have vital spirit nor firm uprightness, and the energy of food would be unable to attain the temperature of digestion. If the parts of the body are not nourished by earthly food, they will fail, for they will be deprived of their proper component of the element earth. ... Thus, for example, if by chance a body is short of breath, it is air, assigned to restore the lack, that supplies what is missing. So, too, the force of the sun's heat stands ready to help us, and the discovery of fire makes life more secure. Likewise, the fruits of the earth, offering attractions in supplies sufficient for the most bottomless desires, sustain and nourish animals by ceaselessly feeding them. Water, offering endless necessities as well as drink, offers services all the more gratifying because they are gratis.

Note again that crucial *animaduertimus*, the act of empirical attention to the world beyond the self, so important both in the first and the third person in Vitruvius.³² Here we see again the same needy and dependent body as Alexander presented to Dinocrates above. This body will actually lose its characteristic human form (*erectio firma*) if it lacks heat, just as it will lose life in the absence of air. Everything bodily here is characterized by defect and deficiency (*deficientur ... defit*). Luckily, nature gives us these necessities in abundance (*copiis superuacuis*; cf. *infinitas ... necessitates*). The body may be fragile and needy—but at least it is well provisioned by nature. Such a rosy outlook on the bottomless natural supply of the human's basic needs raises a big question for us: if the body has everything it requires free of charge and on tap, can it really be said to lack? And if lack there is, does that lack really power advances in knowledge, as I have been arguing? Vitruvius has one more answer for this paradox, I think—and the only way for us to get it is to jump in the bath with Archimedes.

So far we have seen the body not as a static entity serving as an abstraction of form, but as a dynamic thing working in time, a vulnerable assemblage of flesh requiring nourishment to grow and change (note how *crescere* features prominently in both Alexander and Vitruvius' science). Across books 7 and 8, that nourishment works both literally and metaphorically, physically and intellectually: humans are dependent on water to survive, yes, but they are also dependent on the springs of tradition to thrive enough to write world-changing architecture treatises. Both of these dependencies are synthesized, I think, in Vitruvius' famous

32. The verb is crucial in Vitruvius, and almost deserves its own study. It appears programmatically of Vitruvius himself at 1.praef.3, 3.praef.1, 3.praef.3, 4.praef.1, 5.praef.3, 6.praef.6, 7.praef.11, 14, 8.praef.2, 9.praef.1—so endemic as to be a real signature move of Vitruvius' authorial positioning in the prefaces. It is also an observational act ascribed to many third-person models throughout, e.g., early humans (2.1.1), or the inventors of the measurement system in 3.1.7f., or the architect Callimachus in 4.1.10, or Aristippus the philosopher in 6.praef.1, the judges of the poetry contest in 7.praef.6, Ptolemy himself in 7.praef.8, Archimedes in 9.praef.10, Euripides in 9.1.13, or technology forefathers in 10.praef.4. The frequency speaks for itself.

account of paradigmatic scientific discovery, the Archimedes episode in book 9. At this point, we see the body very much come into its own, the scientific tool I mentioned at the beginning. But it is a tool requiring a literal immersion in its environment to function. Archimedes in the bath becomes the ultimate anti-Dinocrates of the overflowing cup, and the ultimate complement to Vitruvius sipping at the springs of tradition: the man who puts water to the use of the mind.

In keeping with the close relationship of water and grain in the Dinocrates episode—when we expected Alexander to notice the former, he gave us the latter—book 9 opens with the metaphor of intellectual harvest. Vitruvius is wondering why famous intellectuals are not afforded the same prizes as athletes—for athletes just build up their own bodies, but intellectuals provide ‘infinite benefits’ (*infinitas utilitates*, 9.praef.1; cf. *infinitas necessitates ... utilitates* above), and lay the groundwork for many others to learn and sharpen their minds.³³ Sporting personality Milo of Croton does nothing for humanity; but as for Plato et al., well, these guys are properly providential:

quid enim Milo Crotoniates, quod fuit inuictus, prodest hominibus aut ceteri, qui eo genere fuerunt uictores, nisi quod, dum uixerunt ipsi, inter suos ciues habuerunt nobilitatem. Pythagorae uero praecepta, Democriti, Platonis, Aristotelis ceterorumque sapientium cotidiana perpetuis industriis culta non solum suis ciuibus, sed etiam omnibus gentibus *recentes et floridos edunt fructus*. e quibus qui a teneris aetatibus doctrinarum *abundantia* satiantur, optimos habent sapientiae sensus, instituunt ciuitatibus humanitatis mores, aequa iura, leges, quibus absentibus nulla potest esse ciuitas incolumis.

(Vitr. 9.praef.2)

What good does it do humanity that Milo of Croton was undefeated, or the others who were champions of this kind, other than that, so long as they were alive, they held distinction among their own fellow citizens? The valuable precepts of Pythagoras, on the other hand, of Democritus, Plato, Aristotle, and the other sages, cultivated by daily industry, not only *produce ever fresh and nourishing fruit* for their own fellow citizens, but indeed for all the nations. And those who from an early age enjoy an *abundance* of learning develop the best judgment, and in their cities they have established civilized customs, equal justice, and those laws without which no community can exist safely.

As with Ptolemy and the libriculture above, so here: the importance of intellectual benefaction is transported through recourse to a metaphor of basic human need; we need Pythagoras, Democritus, Plato, and Aristotle as much as we need a good

33. See Oksanish (2019), 179.

harvest. Two of these four (Pythagoras and Plato) will have their mathematical contributions discussed at length in the rest of 9.praef. But it is actually the metaphorical slippage of *abundantia*—abundance, but also liquid ‘overflow’ (cf. *abundantes* above)³⁴—which prepares us for a lengthy excursus on a slightly less expected intellectual model for Vitruvius: that old naked prophet of the eureka moment, Archimedes.³⁵

As always with Vitruvian intellectuals, Archimedes’ discovery of density measurement happens in a very material context of politics and patronage. Hieron, tyrant of Syracuse, contracts a craftsman to make him a fancy gold crown. He measures out the precious matter precisely, the craftsman knocks it up, but when the crown comes back to Hieron, so does a report that the craftsman had sneakily subbed in the same amount of silver, and made off with the gold. Hieron gets his best guy Archimedes on the case. But this thinker does not just lock himself away in a study to ponder the question. He remains a body in the world. And he happens to take that body to the baths, which is why and where the breakthrough happens:

tunc is, cum haberet eius rei curam, casu uenit in balineum, ibique cum in solium descenderet, *animaduertit, quantum corporis sui in eo insideret, tantum aquae extra solium effluere*. itaque cum eius rei rationem explicationis ostendisset, non est moratus, sed exiit gaudio motus de solio et nudus uadens domum uerius significabat clara uoce inuenisse, quod quaereret; nam currens identidem graece clamabat εὕρηκα εὕρηκα.
(Vitr. 9 pr. 10)

Now Archimedes, once he had charge of this matter, chanced to go to the baths, and there, as he stepped into the tub, *he noticed that however much he immersed his body in it, that much water spilled over the sides of the tub*. When the reason for this occurrence came clear to him, he did not hesitate, but in a transport of joy he leapt out of the tub, and as he rushed home naked, he let one and all know that he had truly found what he had been looking for—because as he ran he shouted over and over in Greek: ‘I found it! I found it!’ (*Eurêka! Eurêka!*)

Archimedes performs the key Vitruvian act of empirical observation, the turning of the mind to the world: *animaduertit*. And what he notices is that his body, immersed in the bath, displaces a proportional amount of *water* outside the bath. We could take this *eureka* moment in so many ways, as a culmination of so many of the aquatic motifs we have tracked so far. Firstly, it is a scientifically fruitful rerun of Dinocrates’ useless statue: whereas there the water simply

34. Cf. also Vitruvius’ language of benefit (*fructuum summa*, ‘total profit’) from his education in 6.praef.4f., as well as his disavowal of the wrong kind of *abundantia* (6.praef.5): wealth.

35. On the birth of this important myth of scientific discovery in antiquity, see Courrént (2008).

overflowed the big cup and fell into the ocean (cf. *profunderetur*, 2.praef.2, with *effluere* here), here we have a very measured overflow of water collected and activated towards the progress of knowledge. It is as if Archimedes hops into Dinoscrates' *patera* and shows him how water could be harnessed for intellectual as well as bodily benefit. Secondly, we get a perfect visualization of the delicate balance between individual and collective that is scientific advancement. Just as Vitruvius' intellectual body had relied on drinking the springs of tradition to nourish his writings, so Archimedes relies on a body of water to make the breakthrough; we could almost read that *quantum corporis sui in eo insideret, tantum aquae extra solium effluere* as 'when it comes to scientific discovery, body and world are worth the same; the individual needs to be immersed in something bigger than the self.'³⁶ Thirdly, and relatedly, the body is finally realized here as a true vehicle of intellectual progress.³⁷ But it is precisely a body performing its basic daily business:³⁸ using water to wash itself in the bath. Unlike the slightly abstruse and abstract theoretical discoveries of Pythagoras and Plato, this act of invention—perhaps *the act of invention*—stems from a body in time, and a body in need.

John Oksanish has written compellingly on the mind-body dyad in Vitruvius;³⁹ glossing him, we could say that Vitruvius frames the contributions of the intellectual world (including his own) as a kind of supplement to the inherently defective body he displays in 2.praef.⁴⁰ That implicit metaphysical ranking would make Vitruvius into a good (yet fairly standard) Platonist scorning the perishability of the flesh for the eternity of ideas. And in some ways, he is.⁴¹ But I would like us to see something even more interesting in the relationship between Vitruvian body and mind. In the scheme I have sketched above, the defective body of humankind is not just something that has to be repaired or redeemed through the compensatory efforts of intellectual endeavor. The defective body is actually the spur, the prompt to new knowledge. It is Vitruvius' frailty and poverty that make him an architect attentive to human needs. It is the fact that he needs a regular sip of water that makes him visit and revisit the springs of tradition. And it is Archimedes' trip to the bath for everyday maintenance which soaks him in the filthy water of epiphany. The human intellect leaps and soars because of, not despite, its bodily limitations. We lack, therefore we think, therefore we are.

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36. Cf. Oksanish (2019), 181, 'Because of his attention to matters *other than* his physical self, he is able to take advantage of the opportunity that was provided by chance.'

37. On the body as 'tool of scientific discovery rather than one for personal gain or self-aggrandizement', see Oksanish (2019), 181, citing Jaeger (2008), 17–31.

38. And a very Roman business at that: see Wallace-Hadrill (2008), 169–89, for Vitruvius' ideological investment in baths as markers of Roman identity (contrasted with the Greek gymnasium).

39. Oksanish (2019), ch. 5.

40. Cf. Oksanish (2019), 184.

41. On the close relationship between 6.praef. and Plato's *Symposium*, see McIntosh (2014).