

Pavle Stojanović*

University of Belgrade, Faculty of Philosophy, Department of Philosophy

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ATANASIJEVIĆ ON THE DIVISIBILITY OF THE ATOM IN EPICURUS AND THE EARLY ATOMISTS

Abstract: In 1927, Ksenija Atanasijević published her book *L'Atomisme d'Épicure* in Paris. It offered a systematic and insightful analysis of Epicurus' philosophy. Among its original contributions was the claim that the origins of Epicurus' theory of 'the minimum' (τό ἐλάχιστον) can be found already in the views of the earlier atomists, Leucippus and Democritus. At the time, this was a bold, rare, and controversial claim. Indeed, one of the early critics of Atanasijević's interpretation was Branislav Petronijević, her former professor and mentor. The task here will be to explore Atanasijević's thesis and the arguments she used to support it, as well as to evaluate Petronijević's criticism. My analysis will aim to show that Petronijević's objections fail to present a serious challenge to Atanasijević's thesis. On the other hand, it will also reveal certain weaknesses in the way Atanasijević formulated and defended her thesis.

Keywords: Epicurus, Ksenija Atanasijević, Branislav Petronijević, 'the minimum' (τό ἐλάχιστον)

Epicurus held that there are only two types of things in the universe, atoms and void. Atoms are tiny, imperceptible bodies that form larger, perceivable compound bodies around us. The reason for believing in the existence of atoms was that it is impossible to endlessly divide bodies into ever smaller pieces. Therefore, as their very name suggests, atoms are 'uncuttable' (ἄτομοι), in the sense that it is impossible to further break them down physically into smaller bits of matter. However, in his *Letter to Herodotus*, Epicurus discusses another type of division:

[...] we must not only do away with cutting into smaller and smaller [bits] to infinity, so that we may not make everything

* ORCID iD: 0009-0000-8108-539X • e-mail: pavle.stojanovic@f.bg.ac.rs

weak and in our conceptions of the compounds be compelled to grind away things that exist and let them go to waste into the non-existent, but also we must not suppose that in finite bodies there is traversal to infinity, even if [the bits] get smaller and smaller.

[...] οὐ μόνον τὴν εἰς ἄπειρον τομὴν ἐπὶ τοῦλαττον ἀναιρετέον, ἵνα μὴ πάντα ἀσθενῇ ποιῶμεν καὶ ταῖς περιλήψεσι τῶν ἀθρόων εἰς τὸ μὴ ὄν ἀναγκαζώμεθα τὰ ὄντα θλίβοντες καταναλίσκειν, ἀλλὰ καὶ τὴν μετάβασιν μὴ νομιστέον γίνεσθαι ἐν τοῖς ὀρισμένοις εἰς ἄπειρον μὴδ' ἐκπὶ τοῦλαττον. (Epic. *Her.*, DL 10.56 = LS 9 A₂₋₃)

Epicurus here makes a clear distinction between the infinite physical division of bodies on the one hand, and the ‘traversal’ (μετάβασις) or the theoretical¹ division into infinity, on the other. He denies the possibility of not only the former, but of the latter as well, and based on the arguments in §57, it appears that the latter was rejected because denying only the former was not sufficient to solve certain complications caused by the paradoxes famously attributed to Zeno of Elea. Namely, first, if compound things consist of an infinite number of parts, then as sums of these parts they would be infinite in size, which they clearly are not. Second, in order to cross a certain distance, one needs to cross an infinite number of smaller component distances (i.e., to reach the goal, one first needs to cross half the distance, then half of the remaining half, then half of the remaining quarter, and so *ad infinitum*), which is impossible. Finally, even if this were somehow not problematic on the physical level (for instance, because of the existence of physically indivisible atoms), it still seems that infinite theoretical divisibility would remain an issue because one would need to complete an infinite number of mental operations by counting partial distances to infinity in order to be able to conceive reaching the final destination in one’s mind.²

Epicurus appears to have been motivated by such concerns when he argued that theoretical divisibility must also have a limit:

- 1 Here I follow Furley (1967, pp. 3–6) in using the term ‘theoretical’ to include all the alternative expressions (such as ‘notional’, ‘mathematical’, ‘geometric’) that have been employed by other scholars to refer to this sort of divisibility in this context.
- 2 For a classical analysis of the link between Zeno of Elea’s paradoxes and Epicurus’ discussion in *Her.*, DL 10.56–7 see Long and Sedley’s commentary on LS 9 A (LS vol 1, p. 41). As they point out, the first two problems roughly correspond to Zeno’s paradoxes in KRS 316 and 318, while the third is found in the pseudo-Aristotelian treatise *On indivisible lines*, starting at 968a18; while the author of the text attributes this argument too to Zeno, this attribution is uncertain.

For it is impossible to conceive how [there could be traversal], once someone says that something contains an infinite number of bits or bits of whatever size you like. And how could this magnitude still be finite? For obviously these infinitely many bits are themselves of some size, and however small they may be the magnitude consisting of them would also be infinite. And since the finite body has an extremity which is distinguishable, even if not imaginable as existing per se, one must inevitably think of what is in sequence to it as being of the same kind, and by thus proceeding forward in sequence it must be possible in such a way to reach infinity in thought.

οὕτε γὰρ ὅπως, ἐπειδὴν ἅπαξ τις εἶπη ὅτι ἄπειροι ὄγκοι ἔν τινι ὑπάρχουσιν ἢ ὀπηλικοί οὖν, ἔστι νοῆσαι· πῶς τ' ἂν ἔτι τοῦτο πεπερασμένον εἴη τὸ μέγεθος; πηλικοί γάρ τινες δηλὸν ὡς οἱ ἄπειροί εἰσιν ὄγκοι {καὶ} οὔτοι. ἐξ ὧν, ὀπηλικοί ἂν ποτε ὦσιν, ἄπειρον ἂν ἦν καὶ τὸ μέγεθος. ἄκρον τε ἔχοντος τοῦ πεπερασμένου δι-αληπτόν, εἰ μὴ καὶ καθ' ἑαυτὸ θεωρητόν, οὐκ ἔστι μὴ οὐ καὶ τὸ ἐξῆς τούτου τοιοῦτον νοεῖν καὶ οὕτω κατὰ τὸ ἐξῆς εἰς τοῦμπροσθεν βαδίζοντα εἰς τὸ ἄπειρον ὑπάρχειν κατὰ τοσοῦτον ἀφικνεῖσθαι τῇ ἐννοίᾳ. (Epic. *Her.*, DL 10.57 = LS 9 A₄₋₆)

Even if we assume that matter is not infinitely divisible physically due to the existence of atoms, one could still conceive of the atoms themselves being composed of 'bits' or parts, in which case the Zenonian problems mentioned above arise again, this time on another level. Epicurus therefore argues that a finite magnitude cannot contain infinitely many parts, but must instead consist of a limited number of constituent magnitudes. In other words, there must exist an absolute 'minimum' (τὸ ἐλάχιστον), the theoretically smallest possible magnitude. Thus, although atoms, as the smallest physically indivisible objects, can be thought of as containing smaller theoretical parts, these parts cannot be infinitely small but must have that minimal theoretical magnitude. This ensures that, first, compound things are not infinite in size, second, that it is possible to complete crossing any distance, and finally, that we avoid initiating an endless mental process each time we think about compound things.

One of Atanasijević's most original and controversial claims in her book is that this 'doctrine of the minimum' ('la doctrine du minimum') was not invented by Epicurus, but that it was already in some form, explicitly or implicitly, present in – and taken over from – his atomist predecessors, Leucippus and Democritus. Extant sources sadly do not explicitly attribute such a view to these earlier philosophers, and since absence

of evidence is not conclusive evidence of absence, the case both for and against this claim must unavoidably be indirect. Undeterred, Atanasijević makes an effort to bolster her case and offers two main arguments to support her thesis.

First, she points out that for Leucippus and Democritus atoms are not mathematical points (Atanassiévitch, 1927, p. 36). By this, she appears to mean that atoms are not partless, and that they are spatially extended, i.e., have a certain magnitude. The early atomists believed that atoms have many different shapes and sizes, so they must have also believed, just like Epicurus did, that the atoms consist of smaller parts which, although not separable physically, can be distinguished theoretically (Atanassiévitch, 1927, pp. 36–7). Presumably, the idea here is that if, for instance, we have an angular-shaped atom, it is possible within it to distinguish in thought (although not physically to separate) a vertex from the arms of one of the atom's angles.

Second, Atanasijević argues (Atanassiévitch, 1927, pp. 38–9) that her case is further confirmed by the fact that Epicurus tried to refute Democritus' position that there is an infinite number of shapes and sizes of atoms by invoking the existence of minima in the atom. Namely, unlike Epicurus, for whom the size of atoms must always be below the threshold of our ability to directly perceive them, Democritus allowed for the possibility of a single atom being as large as a world, which is taken to be a logical consequence of the thesis that the number of shapes and sizes of atoms is unlimited. Epicurus apparently reasoned in the following way. If there is a minimum theoretical constituent magnitude in the atom, then the only way to produce infinitely many shapes of atoms is to infinitely increase the number of these constituent magnitudes. If there is an infinite number of shapes of atoms, then some of them will inevitably be large enough to be perceivable. However, atoms cannot be that large, so the number of different shapes of atoms must therefore be finite, which in turn implies that the number of constituent parts in the atom must also be limited (Lucr. 2.478–99). What is crucial here according to Atanasijević is that in arguing this, Epicurus “did not create a new theory; he only limited the number of parts in the atom” (“n'a pas créé une nouvelle théorie; il a seulement limité le nombre des parties de l'atome,” Atanassiévitch, 1927, p. 38).

At this point, it would be beneficial to pause and revisit Atanasijević's thesis in order to clarify it better. Namely, Epicurus' theory of the minimum can arguably be broken down into the following three ideas:

- (1) although indivisible *physically*, atoms admit to being divided *theoretically* into smaller constituent parts;

- (2) although divisible theoretically, atoms still cannot be divided into infinity: there is a *limit* that is the smallest conceivable magnitude, the minimum (τό ἐλάχιστον);
- (3) this minimum also applies in the case of the structure of space, time, and motion.

Though interrelated, these claims are distinct because it is possible to accept (1) without holding – and even while rejecting – claims (2) and (3), as well as to hold (1) and (2) jointly without *eo ipso* subscribing to (3). Obviously, any proper evaluation of Atanasijević's thesis, that the fundamentals of Epicurus' doctrine of the minimum can already be found in Leucippus and Democritus, would require elucidating which of these claims exactly she has in mind. This would determine not only the nature of evidence needed to argue her case, but also the strength and substantiability of the thesis itself.

Now, Atanasijević is quite transparent in respect to (3), readily admitting that it is in all likelihood Epicurus' original development (Atanassiévitch, 1927, p. 39). However, among the remaining claims, it is not as clear whether she attributes to the early atomists both claims (1) and (2), or only claim (1). Her first main argument, that Leucippus and Democritus conceived of atoms as having parts, can only be used to establish that they (explicitly or implicitly) subscribed to claim (1), but nothing more. The point of the second argument seems to be that the early atomists already maintained (1), and that Epicurus merely built on that existing foundation by adding (2). This suggests that Atanasijević's thesis actually attributes to Leucippus and Democritus only claim (1), that atoms are theoretically divisible into smaller constituent parts, without ascribing to them claim (2), which would be Epicurus' later development, just like claim (3). If so, then it would be somewhat misleading to formulate this as the strong claim (which we may call the Strong Interpretation) that Epicurus inherited from the earlier atomists his doctrine of the minimum; rather, a more modest claim (let us call it the Weak Interpretation), that Epicurus inherited from them the idea of the theoretical divisibility of the atom, would seem more appropriate. Still, adequately proving even this latter claim would be a significant and valuable contribution to our understanding of Ancient atomism. Which of these two versions of her thesis Atanasijević actually intended unfortunately remains uncertain because her arguments and formulations are not precise enough to make a clear determination.

One of the harshest critics of Atanasijević's book, as we have mentioned before, was Branislav Petronijević, and the main point of contention was precisely the thesis discussed above. In a rather scathing review

of *L'Atomisme d'Épicure*, Petronijević rejects Atanasijević's claim that Epicurus' doctrine of the minimum has a predecessor in early atomism. Petronijević's argument is worth quoting in full:

As it has become known recently, the main difference between Epicurus and Democritus' atomist doctrine consists in the following two points: (1) while according to Democritus atoms are indivisible (in the sense of being undivided), according to Epicurus atoms are composed of minima which represent indivisible mathematical points, and (2) while according to Democritus there is an infinite number of atomic shapes, according to Epicurus that number is finite.

Acknowledging the originality to Epicurus on the second point the author denies the originality on the first point claiming that the doctrine of the minimum can be found already in the old atomists, either explicitly or implicitly.

This sort of a claim, however, can only be made by someone who is not clear on the concept of a spatial continuum. For Democritus, the extended atom is physically indivisible because it represents a spatial continuum in which there are no *separated* parts, a continuum which is mathematically (divisible but) *undivided*. However, for Epicurus, the atom is (just like for Democritus) physically indivisible, but mathematically (not only divisible but also) *divided*, i.e., composed of indivisible mathematical points (minima). Because they are mathematically undivided, Democritus' extended atoms can have infinitely many shapes; while Epicurus' extended atoms have a limited number of shapes precisely because they are mathematically divided and composed of a limited number of minima. Lacking the understanding of the concept of the undivided continuum, the author was not capable of noticing this logical connection, which is why she arrived at the thought of separating doctrines which logically cannot be separated. Therefore, it is not surprising that for her mistaken thesis the author could not find any historical proof. (Petronijević, 1928; emphasis in the original, translation by Pavle Stojanović)

Petronijević begins by focusing on what he believes is the main difference in the respective doctrines of Democritus and Epicurus: the first one being that for the former the atom is not divided, while for the latter it is divided into minima; and the second, that for the former atoms can have an infinite number of different shapes, while for the latter this number is limited. Petronijević then proceeds to explain why he thinks that

Atanasijević's interpretation that Epicurus' theory of the minima is borrowed from Democritus is mistaken. Namely, Democritus conceived of the atom as a spatial continuum that has no separate parts, which is to say that it is mathematically divisible but not divided. On the other hand, for Epicurus the atom is divided since it is composed of indivisible mathematical points, i.e., the minima. Petronijević's point seems to be that Atanasijević's interpretation is wrong because she misunderstands the difference in the way Democritus and Epicurus conceived of the nature of the spatial continuum of the atom. In other words, she fails to see that Democritus' view that the number of atomic shapes is infinite is logically implied by his conception of the atom as actually undivided, while Epicurus' claim that the number of atomic shapes is finite is logically implied by his conception of the atom as actually divided into a finite number of minimal parts. Thus, there can be no continuity between these two positions.

How good is Petronijević's objection? The first thing to note is that it relies heavily on his distinction between the concepts of a *divisible* and a *divided* continuum. The dichotomy seems to correspond to the difference between something being divided actually and being divided only potentially.³ Accordingly, Petronijević's point apparently is that, speaking of 'mathematical' (which I take to mean theoretical) divisibility, for Democritus the atom can be *potentially* divided although it is not *actually* divided; while for Epicurus the atom is not only *potentially* divided but also *actually* divided, and for this reason, atoms for Democritus can have an infinite number of shapes, while for Epicurus that number is limited. But, if this is correct, then Petronijević misses his mark, and doubly so. First, the objection leaves Atanasijević completely unscathed if she intended the Weak Interpretation of the thesis as we have described it above, according to which Democritus implicitly or explicitly held that atoms can be divided theoretically into smaller constituent parts. There seems to be no tension between this claim and Petronijević's contention that for Democritus atoms are mathematically divisible but not actually divided. Second, Petronijević's objection is not effective against the Strong Interpretation of Atanasijević's thesis either. Namely, Democritus' view that there is an unlimited number of atomic shapes and sizes is in fact compatible with the claim that atoms are composed of minimal magnitudes, because while the idea of the minimum precludes the infinite divisibility of the atom into ever smaller parts, it does not on its own prevent the existence

3 This language is oddly similar to Aristotle's approach to infinite divisibility in his *Physics*, and it is questionable whether it is generally useful for trying to understand the views of the atomists, regardless of other specific concerns regarding Petronijević's objection.

of an atom consisting of an infinite number of minimal magnitudes (i.e., it does not set an upper limit in size of the atom).⁴ Therefore, Petronijević's criticism of Atanasijević appears to fail entirely, and even seems needlessly *ad hominem* in tone.

Nevertheless, this does not mean that Atanasijević ultimately has a conclusive case. We have already seen above that there is some ambiguity regarding the precise content of her main thesis, and the difference between its Strong and Weak versions is not insignificant. An even more serious problem for Atanasijević, however, is that she offers little textual evidence in support of her thesis, relying mostly on contextual and speculative arguments. While she does refer to several passages in various sources to bolster her case, a more detailed and comprehensive analysis of primary texts would have done a much better service to her overall argument.

Still, Atanasijević does deserve some credit for being possibly the first, or at least among the pioneering historians of philosophy, to propose the thesis that Epicurus' theory of the minima had its origins in earlier atomism. Although disputed and even somewhat neglected by the scholarship of the day,⁵ her contribution was eventually vindicated at least to a degree by the fact that the same or similar thesis was later endorsed and defended by a number of prominent scholars, such as Luria (1932), Heath (1949), Mau (1957), Vlastos (1965), Furley (1967, Study I, Ch. 6), Guthrie (1969), and Stokes (1971).

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4 Thus, Epicurus' setting the upper limit to the size of the atom below the threshold of perception is not logically entailed by the existence of the minima, and should be viewed as an independent tenant of his doctrine probably motivated by his view that no atom has ever been directly perceived (see, for example *Her.*, DL 10.55–6 = LS 12 A).

5 A very useful overview of the immediate impact of Atanasijević's book on the scholarship is provided by Марић 2022, pp. 117–121.

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