

Several New Notions Introduced and Exploited, but not Made Explicit, by Zeno (of Elea)

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ABSTRACT: Some facts are the starting point of this paper. That the paradox of the *Millet Seed* exploits the notion of *to murioston* (“the/a ten thousandth”) is clearly assumed by our main source (Simplicius). *To murioston* is an adjectival noun that, while *murios* as a notion is already at use in the Homeric poems, is totally unattested before; it is therefore unlikely that it had some circulation before Zeno. Moreover, this notion plays a key role in the paradox, to the point that, if left without *to murioston*, it would simply collapse. But consider the *Stadium*: what would remain were the notions of relative motion and that of *onkoi* (‘masses’) not yet clearly available at least to him? To devise a *Stadium* without being able to rely upon these notions would have been extremely difficult!

My paper is meant to account as clearly as I can for the existence of so fantastic a repository of totally unknown notions. It follows that, in my opinion, no professional account of Zeno’s paradoxes is conceivable without focusing one’s attention upon what ostensibly was a total novelty, and a new beginning.

In these pages special attention is paid also to what Gorgias and Plato knew about the Space paradox (sources excluded from the main collections).

KEY-WORDS: Zeno of Elea; Gorgias; Plato; Communication Strategies; Paradoxes; The Stadium Paradox; The Space Paradox.

RIASSUNTO: Il punto di partenza di questo articolo è costituito da alcuni fatti. Che il paradosso del *Seme di miglio* sfrutti la nozione di *to murioston* (“il/un decimillesimo”) è chiaramente presupposto dalla nostra fonte principale (Simplicio). Mentre *murios* è una nozione già in uso nei poemi omerici, questo è un aggettivo sostantivato non attestato in precedenza. È pertanto improbabile che abbia avuto una qualche circolazione prima di Zenone. Inoltre questa nozione ha un ruolo chiave nel paradosso, tanto che, a lasciarlo senza *to murioston*, potrebbe solo dissolversi. Ma si consideri il paradosso dello *Stadio*: cosa rimarrebbe se la nozione di moto relativo e quella di *onkoi* (‘masse’) non fosse stata già chiaramente disponibile almeno per lui? Ideare uno *Stadio* senza poter contare su queste due nozioni sarebbe stato estremamente difficile!

Il mio articolo è pensato per rendere conto dell’esistenza di un così fantastico deposito di nozioni totalmente sconosciute con tutta la chiarezza possibile. Ne consegua che, a mio avviso, non è concepibile nessun resoconto professionale dei paradossi di Zenone che non concentri l’attenzione su ciò che manifestamente costituiscono una novità totale, e un nuovo inizio.

In queste pagine viene riservata una particolare attenzione anche a ciò che Gorgia e Platone seppero del paradosso dello *Spazio*, dato che si tratta di evidenze normalmente escluse dalle principali collezioni.

PAROLE-CHIAVE: Zenone di Elea; Gorgia; Platone; Paradosso; Paradosso dello *Stadio*; Paradosso dello spazio.

Preliminary remarks

That Zeno availed himself of a number of previously unfamiliar (and often unknown) and very sophisticated notions, such as that of relative speed, a ten thousandth, infinite division and so on for a good dozen of mostly innovative notions, is a point one simply cannot deny. Yet, so far as I know, this feature of Zeno's remains has never been highlighted and studied as it probably deserves, with only one notable exception: a seminal paper by Cherubin-Mannucci 2011 (esp. pages 182-193).

Let me first state some facts. That the paradox of the *Millet Seed* exploits the notion of *to murioston* ("the/a ten thousandth") is clearly assumed by our main source, Simplicius. *To murioston* is an adjectival noun that, while *murios* as a notion is already at use in the Homeric poems, is totally unattested before¹; it is therefore unlikely that it had any circulation before Zeno. Moreover, this notion plays a key role; in fact, this paradox, left without *to murioston*, would simply collapse.

And now consider the *Dichotomy* paradox: what would remain, were the notion of infinite division not clearly at work, thus not yet clearly available to Zeno? Or the *Stadium*: what would remain were the notions of relative motion and that of *onkoi* ('masses') not yet clearly available at least to him? To devise the *Dichotomy* paradox without being able to exploit the notion of infinite division would have been simply impossible. But also to devise the *Stadium* paradox without being able to exploit the couple of notions mentioned above would have been equally impossible, and the same happens with a number of other

¹ There are, indeed, two relevant passages in Aristophanes, one in Xenophon, two in Plato, six in Aristotle, four in Galen (and some additional ones), but the discussion between Zeno and Protagoras that Simplicius reports in *Phys.* 1108.14-29 (= 29A29 DK = 38 Lee = 20D12b LM) is so unique in this writer that it needs to be taken in much greater consideration, as a possible quotation or epitome from the original exchange.

paradoxes. Let me presume that on this there is little doubt.

But all these notions were absolutely new, and, as it is easy to imagine, no name was available to label each of them. Aristotle, for example, was able to understand some of them properly, but at least the notion of relative speed remained not really available to him, although he lived more than a whole century after Zeno. It follows that Zeno's creations involved the use of a number of new ideas, and each paradox was devised and mounted with the help of tools that he was able to understand very clearly, but that were totally unknown by his contemporaries as well as by the first readers of his book(let). Conversely, had Zeno been unable to avail himself of some special notions largely unknown to his public, no paradox of his could have been mounted. This in turn means that a unique repository of totally new notions surfaces from the paradoxes. As a consequence, I dare to presume that no professional account of Zeno's paradoxes is conceivable without focusing one's attention upon what ostensibly was a total novelty, and a new beginning.

In the present paper, my main aim will be to account as clearly as I can for *some* elements of so fantastic a repository of hermeneutical tools.

The Stadium

My analysis will begin with the *Stadium*, the last paradox examined in some detail by Aristotle. In his *Physics* we read the following:

The fourth [scil. argument] is the one about bodies of the same dimensions that move at an equal speed in a stadium and pass alongside other bodies of the same dimensions in the opposite direction, the ones starting from the end of the stadium, the others from the middle, in which case, he thinks, one half of a period of time is equal to its double.

The paralogism consists in supposing that a body of the same dimension moving at an equal speed moves during the same time alongside a moving body as alongside a body at rest. But this is false. For example, let the bodies of the same dimensions at rest be AA; let BB be those that start from the middle [scil. of the stadium], which are equal to the former in number and in magnitude, and let CC be those that start from the end [scil. of the stadium], which are equal to these in number and in magnitude, and equal in speed to the B's. It follows that, when they move alongside one another, the first B and the first C are at the end at the same time; and it also follows that the C has crossed all of the B's, and the B's only an half, so that the time is one half, since each one passes beside the other for an equal time. And at the same time it follows that [scil. the first] B has crossed all the C's; for the first C and the first B will arrive at the last [scil. bodies] located at opposite extremities at the same time, as [scil. the first C] is alongside each of the B's and each of the A's for an equal time, as he says, because both of them are besides the A's for an equal time. This then is the argument, and it arises from the falsehood that I have indicated.²

Simplicius, in turn, offers a long discussion of this paradox in *Phys.* 1016.7–1020.6, where he reports some interesting evaluations

² Aristotle, *Phys.* vi 9, 239b–240a17 (= 29A29 DK = 35 Lee = 20D18 + 20R21 LM, transl. G.W. Most): τέταρτος δ' ὁ περὶ τῶν ἐν σταδίῳ κινουμένων ἕξ ἐναντίας ἴσων ὄγκων παρ' ἴσους, τῶν μὲν ἀπὸ τέλους τοῦ σταδίου τῶν δ' ἀπὸ μέσου, ἴσῳ τάχει, ἐν ᾧ συμβαίνει οἶεται ἴσον εἶναι χρόνον τῷ διπλασίῳ τὸν ἡμισυν. ἔστι δ' ὁ παραλογισμὸς ἐν τῷ τὸ μὲν παρὰ κινούμενον τὸ δὲ παρ' ἡρεμοῦν τὸ ἴσον μέγεθος ἀξιῶν τῷ ἴσῳ τάχει τὸν ἴσον φέρεσθαι χρόνον. τοῦτο δ' ἐστὶ ψεῦδος. οἷον ἔστωσαν οἱ ἐστῶτες ἴσοι ὄγκοι ἐφ' ὧν τὰ AA, οἱ δ' ἐφ' ὧν τὰ BB ἀρχόμενοι ἀπὸ τοῦ μέσου τῶν A, ἴσοι τὸν ἀριθμὸν τούτοις ὄντες καὶ τὸ μέγεθος, οἱ δ' ἐφ' ὧν τὰ ΓΓ ἀπὸ τοῦ ἐσχάτου, ἴσοι τὸν ἀριθμὸν ὄντες τούτοις καὶ τὸ μέγεθος, καὶ ἰσοταχεῖς τοῖς B. συμβαίνει δὴ τὸ πρῶτον B ἅμα ἐπὶ τῷ ἐσχάτῳ εἶναι καὶ τὸ πρῶτον Γ, παρ' ἄλληλα κινουμένων. συμβαίνει δὲ καὶ τὸ Γ παρὰ πάντα τὰ B διεξελθῆναι, τὰ δὲ B παρὰ τὰ <A> ἡμίση· ὥστε ἡμισυν εἶναι τὸν χρόνον· τὰ B διεξελθῆναι, τὰ δὲ B παρὰ τὰ <A> ἡμίση· ὥστε ἡμισυν εἶναι τὸν χρόνον· ἴσον γὰρ ἐκάτερόν ἐστι παρ' ἕκαστον. ἅμα δὲ συμβαίνει τὰ B παρὰ πάντα τὰ Γ παρελθῆναι· ἅμα γὰρ ἔσται τὸ πρῶτον Γ καὶ τὸ πρῶτον B ἐπὶ τοῖς ἐναντίοις ἐσχάτοις, ἴσον χρόνον παρ' ἕκαστον γινόμενον τῶν B ὅσον περ τῶν A, ὡς φησι, διὰ τὸ ἀμφοτέρω ἴσον χρόνον παρὰ τὰ A γίγνεσθαι.

made by Eudemus of Rhodes and Alexander of Aphrodisias³. Their evaluations probably are the most interesting portions of the whole commentary by Simplicius.

I'll begin with a detail of Aristotle's report: he is explicit in assuming that the objects called BB start not from an extreme but from the centre of the stadium. Although a minority of scholars (notably Ferber 1981) attached great importance to this detail, it should be clear that it only serves to place the simultaneous meeting place of the AA, BB and CC not at the centre of the stadium but at three quarters of the way across. It is therefore an irrelevant detail (besides, neither Eudemus, nor Alexander, nor Simplicius pay attention to it).

So this is just a detail, to be left aside. Aristotle introduces three sets of *isoi onkoi*, i.e. three successions of generic bodies⁴ with no difference between them. *Onkoi* ('bodies' or 'masses') is a word deemed appropriate to identify some generic objects, whose only feature is that each of them has the same dimensions as each other, and each follows the other in a regular sequence; that is, they are equal, aligned and equidistant. For Aristotle it is understandably difficult to say more, since neither he nor Zeno's audience had, I presume, the least idea of what for us is an old-fashioned freight train with a long succession of exteriorly identical wagons (nor were miniature freight trains available for their babies as toys!).

³ Generally speaking, it is amazing that the long discussion by Simplicius was left completely aside by DK and LM, while Lee reported, at least, a generous portion of the whole (1016.9-1019.9, while the commentary continues until 1020.6). In addition to what is being reported in the next footnote, it is interesting what is said about Alexander of Aphrodisias. According to Simplicius, Alexander examined some manuscripts (*en tisin antiqraphois*: in some copies, but copies of what? of Aristotle's *Physics* or of Zeno's original book?) and, as a consequence, *ēnankasthē legein*, felt himself obliged to mention, not "the first B" (the first element of the 'second' set of *onkoi*), but "the last one" (1017.18-21).

⁴ In *Phys.* 1017.23-25 Simplicius has an interesting notation: ὥστε ἔχειν ἡμῶν ἰσόογκα (ὡς δὲ ὁ Εὐδημῶς φησι, κῦβου). Here he introduces a fine neologism, *isoonka*, masses of the same sort, in order to get a careful identification of the three sets of bodies, then reports that Eudemus called them *kuboi*. It is worth noticing that the notion of *isoi onkoi* or *isoonka* enters in our world an object whose unique properties are functional to simplified mental portrayals of something, just like the simplified picture of the *Achilles* where points are put in the same right line.

I am aware that my last remark could seem out of place, but please consider how great is the difference between trying to speak of old-fashioned freight trains to people who know railways, stations and a variety of trains well, and trying to speak of them to people – such as the ancient Greeks – who had no visual (and physical) experience of all that. Or did ancient Greeks know of other easily understandable sets of masses that were equal, aligned, equidistant, put in a regular spatial sequence and standing or moving? As somebody pointed out to me, ancient Greeks may have known, at least, the phalanges, i.e. some ‘formations’ with rather compact rows of moving hoplites. But two phalanges of hoplite formations ready to collide and three sets of well-characterized *onkoi* finding themselves in three parallel positions have little in common.

From the above I infer that Zeno, and nobody else, was able to devise a very complex situation which is immediately understandable to us, but which is likely to have been very difficult to evoke efficaciously in his time. While we may well find it most natural to see the paradox through the lens of railways and old-fashioned freight trains⁵, Zeno’s contemporaries probably found all that very obscure. Besides, while there was at least one man who devoted himself to understanding in depth Parmenides’ doctrine of being, namely Melissus⁶, no ancient scholar is known for having studied in depth Zeno’s paradoxes, or at least his *Stadium*.

In conclusion, at least for us it is really easy to evoke three sets of masses behaving exactly as three old-fashioned freight trains, named AA, BB and CC respectively, and imagine a small railway station equipped with at least three parallel tracks, with train AA being stationary, while trains BB and CC are moving at the same speed, though in opposite

⁵ The same happens with the paradox known as the *Space*. For us it is extremely simple to imagine a succession of boxes each finding itself inside another which is just a bit larger, as it happens with Russian traditional matryoshkas, but what about for the Greeks of so ancient times? See § 3 below.

⁶ On this point it occurred to me to say something recently (in Rossetti 2020b, 131–135).

directions, and coincidentally cross the station at the same time. A further requirement is that train BB is expected to occupy a track situated between that occupied by train AA, which is not in movement, and the one occupied by the incoming train CC. Furthermore, we have to imagine that somebody finds himself on a carriage of train BB, is awake and carefully looks left and right almost simultaneously.

Only under all these conditions, an observer who is on board a wagon of the BB freight train may have the opportunity to note (or at least to have the impression) that, while each carriage of the train AA seems to pass at a given speed, the carriages of the train CC are passing at a much greater speed. More precisely, while one AA carriage was passing, two CC carriages are passing, much as if the apparent speed of train CC were double in comparison with the apparent speed of train AA. For us a measure of surprise (not of real perplexity) is certainly likely when we realize that the apparent speed is exactly double. But what about for Zeno's audience?

For a contemporary of his, all of that would have seemed very difficult to imagine and understand, although Zeno ought to have a clear idea of the whole situation as well as of the relative speed (otherwise he would have been unable to devise so complex a story). But what he seemingly expected from his audience is that they were able to understand, perhaps confusedly, this situation, so as to discover with a sense of amazement that, under the stated conditions, one speed would actually seem double in comparison with the other although the 'train' AA is stopped (that is has no speed at all).

He probably trusted (rightly) that his audience was unable to reach a full understanding of his argument, for otherwise it would have been quite clear to everybody that, properly speaking, nothing strange happens to the three sets of *isoonkoi*, save a curious appearance. Indeed, had the stated situation been well understood, no serious bewilderment could have occurred. Therefore, Zeno could only hope that even the idea of relative motion failed to be clearly understood, as was almost

surely the case (otherwise Aristotle, while rejecting the paradox, would have evoked the notion of relative speed clearly and acknowledged its importance). With one exception: Zeno himself, who seems to have been in command of such a sophisticated notion and to have exploited it without making the least effort to explain such a fine idea.

Indeed, in order to ensure that the *Stadium* is paradoxical, a well-combined set of synergical assumptions is needed: (1) three collective entities, (2) one of them standing still, (e) the second and third one being in movement, (4) moving in opposite directions, (5) at the same speed, (6) on parallel trajectories, (7) with each set situated in the neighbourhood of the other two, (8) each of them conceived of as a set of *isoonka* objects, (9) each set being rather numerous, (10) each *onkos* placed at the same distance from the others, (11) with an observer (12) who finds himself in one of the BB *onkoi* and is being transported and taken at the speed of the BB masses, (13) who looks left and right almost simultaneously, (14) who pays attention to the frequency with which the other sets of masses AA and CC pass by him, (15) who compares the frequency of what he sees at his left and the frequency of what he sees at his right hand, (16) and is able to realize that, while on the one hand only one mass seems to be passing, on the other side two masses seem to be passing, (17) with the observer being bewildered and finding it amazing that the same moving object has, so it seems, two different speeds because (18) he has no idea of the notion of relative speed. Each point is strictly needed. Remove just one of the conditions (1) to (16), and the concluding events (17) and (18) would not take place. Could somebody have set up such a complicated device without having a definite idea of absolute and relative speed, and without concealing so crucial an idea?

Huggett 2018 asserts quite the contrary: “Zeno was hopelessly confused about relative velocities”. But had Zeno been unable to implement a clear idea of relative motion, how could the *Stadium* paradox have come to be? Indeed, from what Aristotle reports we infer

that Zeno had the unique privilege of having formed a very clear idea of the *isoonka* as well as of the relative motion, in addition to having devised a very sophisticated situation with all its details, to ensure that it will be perceived by his contemporaries as a demanding (and obscure) challenge. The device is too complicated not to presuppose all this.

The Millet Seed

What occurs with the *Stadium* occurs in several other paradoxes. In the *Millet Seed*, for example, since Zeno probably expected to leave his enlightened interlocutor (Protagoras) and, to a greater degree, his audiences a bit confused because of the very strange question, whether an ultra-minimal fragment of reality (a ten thousandth portion of an object whose median weight is 6 milligrams, something which never existed as a separate body, since we still lack tools capable to isolate it⁷) will or will not make noise when falling, say, from a meter high. So fantastic a question was raised towards 450 BCE in a world where only a small minority of learned persons had just begun to pay attention to the question of what it would mean for a thing to be a body, but to be imperceptibly small.

Given this context, the question whether so small a body, when falling, could make a minimal noise or no noise at all, was probably far from being taken, by Zeno's interlocutors and audiences, for a question suitable to have only an obvious answer (a very small noise). But it clearly was for Zeno. From that it follows that he trusted once more in the unpreparedness of his interlocutors.

The Space

1. We know this paradox thanks to a couple of passages found in

⁷ I.e. to get a weight of 0,0000006g. A few additional details are available in Rossetti 2020a, 53-55 (and 2020b, 100 f.)

Aristotle's *Physics*, two from Eudemus (as quoted by Simplicius), another from Simplicius, another from Iohannes Philoponus⁸ and, almost unexpectedly, one from Ps. Aristoteles, *MXG*, one from Sextus Empiricus, and one from Plato. Aristotle wrote:

[S1] Moreover, if it [i.e. place] is one of the things that are, where will it be? For Zeno's aporia requires some argumentation. For if everything that exists is in a place, it is clear that there will also be a place of the place, and this will go on to infinity.⁹

and then:

[S2] Zeno's problem—that if place is something it must be in something—is not difficult to solve. There is nothing to prevent the first place from being in something else—not indeed in that as a place, but as health is in the hot as a state of it or as the hot is in body as an affection. So we escape the infinite regress.¹⁰

Eudemus in turn, as quoted by Simplicius, wrote:

[S3] Eudemus records Zeno's opinion in the following words: "Zeno's difficulty appears to lead to the same conclusion. For it is justifiable to assume that everything that exists is somewhere; but if place exists, where would it be? Presumably in another place, and that in another and so on".

⁸ Other passages by the same Philoponus—and Themistius—fail to add anything relevant.

⁹ Arist. *Phys.* iv 1, 209a23–26 (= 20A24 DK = 13 Lee = 20D13a LM, transl. G.W. Most): ἔτι δὲ καὶ αὐτὸς εἰ ἔστι τι τῶν ὄντων, ποῦ ἔσται. ἢ γὰρ Ζήνωνος ἀπορία ζητεῖ τινὰ λόγον· εἰ γὰρ πᾶν τὸ ἐν τόπῳ, δῆλον ὅτι καὶ τοῦ τόπου τόπος ἔσται, καὶ τοῦτο εἰς ἄπειρον. ἔτι ὡς περ ἅπαν σώμα ἐν τόπῳ, οὕτω καὶ ἐν τόπῳ.

¹⁰ Arist. *Phys.* iv 1, 210b22–27 (= 29A24 DK = 14 Lee = 20R22 LM, transl. J. Barnes): ὁ δὲ Ζήνων ἠπόρει, ὅτι εἰ ὁ τόπος ἐστὶ τι, ἐν τινι ἔσται, λείπει οὐ χαλεπὸν· οὐδὲ γὰρ κωλύει ἐν ἄλλῳ εἶναι τὸν πρῶτον τόπον, μὴ μέντοι ὡς ἐν τόπῳ ἐκείνῳ, ἀλλ' ὡς περ ἡ μὲν ὑγίεια ἐν τοῖς θερμοῖς ὡς ἕξις, τὸ δὲ θερμὸν ἐν σώματι ὡς πάθος. ὥστε οὐκ ἀνάγκη εἰς ἄπειρον ἵέναι.

and then:

[S4] This is clearly stated in the passage where he himself (Eudemus) solves Zeno's argument by writing the following: "Against Zeno we shall say that 'where' is said in multiple senses. If then he thought that the things that are in a place, he is not thinking correctly. For no one would say that health, courage, or a thousand other things are in a place; and certainly not place either, if it is of the sort that has been said. But if 'where' is taken in a different sense, place too could be somewhere; for the limits of a body is a 'where' of the body, for it is an extremity".¹¹

Simplicius elsewhere:

[S5] Zeno's argument seemed to do away with place, putting the question as follows: "if place exists, in what will it be? For every existent is in something, but what is in something is in a place. Place therefore will be in a place, and so ad infinitum. Therefore, place does not exist".¹²

And Philoponus:

[S6] Aristotle solves Zeno's aporia too. "For if everything that exists is somewhere", said Zeno, "and place exists, place also

¹¹ Simpl. *Phys.* 563.17-20 (= 29A24 DK = 15 Lee ≠ LM, transl. H.P.D. Lee): 'Ο Εϋδημος δὲ οὕτως ἱστορεῖ τὴν Ζήνωνος δόξαν λέγων· "ἐπὶ ταῦτο δὲ καὶ ἡ Ζήνωνος ἀπορία φαίνεται ἄγειν. ἄξιον γὰρ πᾶν τὸ ὄν ποῦ εἶναι· εἰ δὲ ὁ τόπος τῶν ὄντων, ποῦ ἂν εἴη; οὐκοῦν ἐν ἄλλῳ τόπῳ, κάκεινος δὴ ἐν ἄλλῳ, καὶ οὕτως εἰς τὸ πρόσω". Then (lines 23-28 = 29A24 DK ≠ Lee = 20R23 LM, transl. G.W. Most): δὴλον γίνεται ἐν οἷς λύει καὶ αὐτὸς [= ὁ Εϋδημος] τὸν τοῦ Ζήνωνος λόγον γράφων οὕτως· "πρὸς δὲ Ζήνωνα φήσομεν πολλαχῶς τὸ ποῦ λέγεσθαι· εἰ μὲν οὖν ἐν τόπῳ ἠξίωκεν εἶναι τὰ ὄντα, οὐ καλῶς ἀξιοῖ· οὔτε γὰρ ὑγειᾶν οὔτε ἀνδριᾶν οὔτε ἄλλα μυρία φαῖη τις ἂν ἐν τόπῳ εἶναι. οὐδὲ δὴ ὁ τόπος τοιοῦτος ὧν οἷος εἴρηται. εἰ δὲ ἄλλως τὸ ποῦ, κἂν ὁ τόπος εἴη ποῦ· τὸ γὰρ τοῦ σώματος πέρας ἐστὶ τοῦ σώματος ποῦ· ἔσχατον γάρ".

¹² Simpl. *Phys.* 562.3-6 (29B5 DK = 15 Lee = 20D13 LM, transl. H.P.D. Lee): 'Ο Ζήνωνος λόγος ἀναρεῖν ἐδόκει τὸ εἶναι τὸν τόπον ἐρωτῶν οὕτως· "εἰ ἔστιν ὁ τόπος, ἐν τινὶ ἔσται· πᾶν γὰρ ὄν ἐν τινι· τὸ δὲ ἐν τινὶ καὶ ἐν τόπῳ. ἔσται ἄρα καὶ ὁ τόπος ἐν τόπῳ καὶ τοῦτο ἐπ' ἀπειρον· οὐκ ἄρα ἔστιν ὁ τόπος."

will be somewhere. And so place will be in a place and so on ad infinitum”.¹³

Let me now quote a couple of additional reports going back to Gorgias' treatise *On Not Being* (*Peri tou mē ontos ē peri physeōs*). This work of his has been lost, but it had the privilege of giving rise to a couple of competent accounts of its contents, so that we can form a definite idea of what Gorgias argued in his *PTMO* (i.e. *Peri tou mē ontos*). One of them surfaces from *MXG*, the short treatise, probably not due to Aristotle, which the *Corpus Aristotelicum* places immediately before the *Metaphysics*. Its full title, *De Melisso, Xenophane et Gorgia*, is somehow artificial, since our sources give a different one, ΠΕΡΙ ΞΕΝΟΦΑΝΟΥΣ, ΠΕΡΙ ΖΗΝΩΝΟΣ, ΠΕΡΙ ΓΟΡΓΙΟΥ, where the reference to Zeno (other than the reference to Xenophanes) is manifestly inappropriate. Its last two chapters account for Gorgias' *PTMO*. The other source is part (§ 65–87) of the admirable 'history of philosophy' we find in Sextus Empiricus, *Adv. Mathematicos* VII 47–261.

I am entering into these details because, so far as I know, both passages, as well a passage from Plato's *Parmenides* ([S10] below), remained outside most collections of primary evidence, such as Lee 1936¹⁴, Diels-Kranz 1952, Kirk-Raven 1957, Mansfeld 1971, Kirk-Raven-Schofield 1983, Gemelli Marciano 2009, Graham 2010, Mansfeld-Primavesi 2012, Laks-Most 2016, Bernabé 2020 and, consequently, outside recent secondary literature (e.g. McKirahan 2010, Fano 2012, Rapp 2013, Goulet 2018, Huggett 2018 and, unfortunately, Rossetti 2020b), although they were considered, at least, by Lee (1936), Cornford (1939) and Caveing (1982). That it deals with the *Space*

¹³ Iohannes Philop. *Phys.* 599.31–33 (≠ DK = 16 Lee ≠ LM, transl. H.P.D. Lee): 'εἰ γὰρ πᾶν τὸ ὄν ποῦ ἐστίν,' ἔλεγεν ἐκεῖνος, 'ἔστι δέ τι καὶ ὀτόπος, καὶ ὀτόπος ἄρα ποῦ ἔσται ὥστε ἔσται τόπος ἐν τόπῳ, καὶ τοῦτο ἐπ' ἄπειρον.' Other passages by the same Philoponus—and Themistius—fail to add anything relevant.

¹⁴ Lee does not enter the relevant texts in his selection; nevertheless, he devotes a whole page to the evidence attributable, in the last resort, to Gorgias' *PTMO*. His opinion will be discussed below.

should be quite evident.

According to the pseudo-Aristotelian source,

[S7] After this argument he says: if [scil. something] is, it is either ungenerated or generated. And if it is ungenerated, he accepts by Melissus' axioms that it is unlimited. But the unlimited could not ever be. For it is neither in itself nor in something else: for in this way they would be two or more [scil. unlimiteds], the one within and the one within which. But nothing is that would be nowhere, *according to Zeno's argument about place*.¹⁵

This source does not go into greater details, but the other does. According to our Sextan source, Gorgias began by claiming that what is «is neither eternal, nor generated, nor both» and therefore «is not» since «if what is is eternal ... it has no beginning» (Sextus, § 68). Indeed, «everything that comes to be has some beginning, while what is eternal, being ungenerated, has not had a beginning. Not having a beginning it is unlimited. And if it is unlimited, it is nowhere» (§ 69). So far, these are Melissan ideas. But our source then continues by arguing:

[S8] For if it is somewhere, then what it is in is different from it, and in this way what is, being enclosed within something, will no longer be unlimited. For what encloses is larger than what is enclosed, while nothing is larger than the unlimited, so that the unlimited is not somewhere. (70) And again: it is not enclosed within itself either. For the 'in which' and the 'in it' will be identical, and what is will become two, place and body (for the 'in which' is a place, and the 'in it' is a body). But this is quite absurd. Therefore what is is not in itself either. So that

¹⁵ Ps. Aristot. MXG 6, 979b20–26 (≠ DK ≠ Lee = 32D26a LM; transl. G.W. Most): εἰ δὲ ἔστιν, ἥτις ἀγένητον ἢ γενόμενον εἶναι. καὶ εἰ μὲν ἀγένητον, ἄπειρον αὐτὸ τοῖς τοῦ Μελίσσου ἀξιώμασι λαμβάνει· τὸ δ' ἄπειρον οὐκ ἂν εἶναι που. οὔτε γὰρ ἐν αὐτῷ οὔτ' ἂν ἐν ἄλλῳ εἶναι· δύο γὰρ ἂν οὕτως ἄπειρω εἶναι, τὸ τε ἐνὸν καὶ τὸ ἐν ᾧ· μηδαμοῦ δὲ ὄν οὐδὲν εἶναι κατὰ τὸν τοῦ Ζήνωνος λόγον περὶ τῆς χώρας.

if what is is eternal, it is unlimited; if it is unlimited, it is nowhere; and if it is nowhere, it is not. Therefore if what is is eternal, it is absolutely not something that is.¹⁶

These statements seem to be vaguely echoed in few lines of Plato's *Parmenides*:

[S9] But neither it is in *some* of the parts: if the whole were in some of the parts, the greater would be contained in the less, which is impossible. (...) Thus as a whole the One is in something else; as all the parts it is in itself, and thus the One must be both in itself and in another.¹⁷

and much more precisely a bit later:

[S10] If it is in itself, it must also encompass itself on the outside; and as a container it will be greater than itself, and as contained, less. In this way the One will be greater and less than itself.¹⁸

That [S9] was left aside in (almost?) every treatment of the *Space* paradox is easily understandable, since this passage has very little to offer as an additional source. On the contrary it is surprising that most editors of the Presocratics and most students of Zeno's paradoxes paid no

¹⁶ Sextus Emp. *Adv. Math.* VII 69–70 (= 82B3 DK ≠ Lee = 32D26b LM; transl. G.W. Most): εἰ γὰρ πού ἐστιν, ἕτερον αὐτοῦ ἐστὶν ἐκεῖνο τὸ ἐν ᾧ ἐστὶν, καὶ οὕτως οὐκέτ' ἄπειρον ἔσται τὸ ὄν ἐμπεριεχόμενον τινι· μείζον γὰρ ἐστὶ τοῦ ἐμπεριεχομένου τὸ ἐμπεριέχον, τοῦ δὲ ἄπειρου οὐδὲν ἐστὶ μείζον, ὥστε (70) οὐκ ἔστι που τὸ ἄπειρον. καὶ μὴν οὐδ' ἐν αὐτῷ περιέχεται. ταῦτόν γὰρ ἔσται τὸ ἐν ᾧ καὶ τὸ ἐν αὐτῷ, καὶ δύο γενήσεται τὸ ὄν, τόπος τε καὶ σῶμα· (τὸ μὲν γὰρ ἐν ᾧ τόπος ἐστίν, τὸ δ' ἐν αὐτῷ σῶμα). τοῦτο δὲ γε ἄποπον· τοῖνυν οὐδὲ ἐν αὐτῷ ἐστὶ τὸ ὄν. ὥστ' εἰ ἀίδιον ἐστὶ τὸ ὄν, ἄπειρόν ἐστιν, εἰ δὲ ἄπειρόν ἐστιν, οὐδαμοῦ ἐστὶν, εἰ δὲ μηδαμοῦ ἐστὶν, οὐκ ἔστιν.

¹⁷ Plato *Parm.* 145d5–6, e3–5 (transl. F.M. Cornford): Οὐδὲ μὴν ἐν τισὶ τῶν μερῶν· εἰ γὰρ ἐν τισὶ τὸ ὅλον εἶη, τὸ πλέον ἂν ἐν τῷ ἐλάττονι εἶη, ὃ ἐστὶν ἀδύνατον. (...) Ἐπι μὲν ἄρα τὸ ἐν ὅλον, ἐν ἄλλῳ ἐστίν· ἢ δὲ τὰ πάντα μέρη ὄντα τυγχάνει, αὐτὸ ἐν ἑαυτῷ· καὶ οὕτω τὸ ἐν ἀνάγκη αὐτὸ τε ἐν ἑαυτῷ εἶναι καὶ ἐν ἑτέρῳ.

¹⁸ Plato *Parm.* 150e5–151a2 (transl. F.M. Cornford): Καὶ μὴν αὐτὸ γὰρ ἐν ἑαυτῷ ὄν καὶ περὶ ἑαυτοῦ ἂν εἶη ἕξωθεν, καὶ περιέχον μὲν μείζον ἂν ἑαυτοῦ εἶη, περιεχόμενον δὲ ἕλαττον, καὶ οὕτω μείζον ἂν καὶ ἕλαττον εἶη αὐτὸ ἑαυτοῦ τὸ ἔν.

attention to the sentence of [S7] despite the clause I put in italics (“according to Zeno’s argument about place”) ¹⁹. True that no pertinent development follows right there, but there is the other account, where an unmistakable reference to the *Space* paradox does in fact occur.

Whatever the editors’ reasons might have been, just please consider what is reported by [S6]: “place also will be somewhere ... in a (second order) place and so on ad infinitum”. Why so? [S8] (and to a certain degree [S10]) offers a convincing explanation: since “if it is somewhere, what it is in is different from it, and in this way what is, being enclosed within something, will no longer be unlimited. For what encloses is larger than what is enclosed”. In other words, space and place (both words translating *ho topos*) are not differentiated here, and are understood in the sense of a sort of physical container. This, in turn, encourages to argue, as we modern would say, that space necessarily finds itself in a meta-space, and this meta-space in a meta-meta-space, and so on, ad infinitum. [S8] makes explicit what previous sources assure but fail to argue in greater detail.

And since Gorgias is, in all likelihood, exploiting an idea of Zeno in order to dismantle a particular tenet of Melissus, since he makes no other use of it, it is likely that these lines do not add to Zeno, but just report something on which other sources go silent. It is therefore surprising that Lee (1936, 39) failed to see a direct connection to what Sextus reports in connection with the *Space* paradox, much as if Zeno were just trying to dismantle the Melissan notion of *apeiron*, which is in fact unlikely. But what Sextus reports in [S8] is, rather, a natural expansion (or, why not, a valuable ingredient) of Zeno’s argument on space, while the exploitation of this ‘ingredient’ as a powerful weapon against Melissus may well have been an idea of Gorgias, foreign to Zeno. After all, Lee’s conclusion, that “Gorgias may be merely adapting

¹⁹ Mansfeld, Gemelli Marciano, and Mansfeld-Primavesi did enter a reference to this *MXG* passage, but much as if no further reference to Zeno’s paradox were available in what we know about Gorgias’ *PTMO*.

for his own purposes an argument of Zeno's", is quite compatible with the interpretation I am presently suggesting.

Lee was impressed by a third Platonic passage, 138ab, which in fact has little to do with Zeno since it considers a sphere and its boundaries, and asks whether the sphere can be taken to 'be in itself' (inside itself), and this connection seems to have contributed to put Lee on the wrong track.

A few years later, Cornford was commenting on another passage from the same Platonic dialogue, [S9], and for him it was clear that "the axiom 'whatever exists must be somewhere' or 'in something' occurs both in a fragment of Zeno and in Gorgias' imitation of Zeno" (1939, 148). Cornford continues by outlining a detailed comparison between Zeno's supposed argument and Gorgias' argument on space, but unfortunately a mistake occurs. For, according to Cornford, the Gorgianic argument is likely to be drawn from Zeno in its entirety, so as to encompass even the argument that that «if things are many, each of them must be somewhere: either (a) in itself or (b) in another» (so Cornford 1939, 149), and both options have to face unsurpassable objections. Now, this is likely to be a wrong assumption since no reference to things 'that are many and find themselves somewhere' is at work in Zeno's *Space*. Aristotle, as well all other sources, begin the *Space* story by asking, rather, 'if it [i.e. place] is one of the things that are, where will it be?' ([S1])²⁰.

2. Having examined the group of four additional sources, each with its problems, it is now time to go back to the substance of Zeno's paradox of *Space*. A preliminary point is that, in all likelihood, in Zeno's time the notion of space with the article (*ho topos*) and as something distinguishable from place, was not yet in common use. Zeno probably wished to stimulate his audience to become familiar with this notion by

²⁰ The same Cornford rightly establishes a connection between [S8] and [S10]. A minor reference to Lee and Cornford surfaces in Caveing 1983, 59 and 198 f.

having recourse, as we read, to provocative questions as these: “if place is something, shouldn’t it be in something?”, “where is *ho topos* as such located?”, “what is *ho topos*?”. In his time, as well as several centuries later, no clear understanding of space was available, essentially because Aristotle circumvented the obstacle and was satisfied with oversimplified answers, such as the distinction between the area occupied by four elements and the area occupied by a fifth element supposedly subjected to radically different physical rules. As usual, for Aristotle it is enough to ‘solve’ the paradox, i.e. to feel himself not disturbed by it or to show how one can neutralize it. From his point of view, this paradox (not unlike others) deserves some attention only insofar as it is or may be perceived as something disturbing, as a source of perplexity. For us, not for Aristotle, this is quite a good reason to study how the paradox came to be mounted.

There is little doubt that Zeno’s stratagem consisted in combining an unfamiliar notion, that of space, with the notion of infinite regress: “there should be a place of the place” and also, we are entitled to presume, “a place of the place of the place”, “a place of the place of the place of the place”. To mount so complicated scenario was certainly enough in order to bewilder any audience of his time, was it not? But once more we see that Zeno had a clear idea, if not of *ho topos*, at least (A) of the mental obstacle raised by the question “where is *ho topos*?”, (B) of the possibility of iterating the question so as to amplify the impression of bewilderment, (C) of the disorienting conclusion “therefore space does not exist”—otherwise he would have been unable to mount this intellectual provocation. As usual, he avails himself of the stratagem, but in no way does he make it explicit, nor does he spend a word to comment the argumentative and rhetorical tools he has clearly contrived.

An interesting feature of the story is the lack of models. For people living in the twenty-first century CE it is all too easy to have a clear idea of matryoshkas and cardboard boxes, each suitable to fit into a

larger one almost ad infinitum but, I repeat, in ancient Greece it was not so easy to find any term of comparison in everyday experience. At the most, Greeks knew small objects suitable to be put into a small bag which was suitable, in turn, to be inserted into a larger one to be preserved somewhere at home. If so, it may have been possible to argue, at least, that every (little) object is somewhere, for example in a bag which is preserved in a room, while the room is in (= is part of) a house, the house in a village, the village finds itself on an island, the island in the sea, the sea on earth, so that one can finally suggest that the earth is situated in space, then ask where that space is likely to be situated and finally suggest: “perhaps in a meta-space? But if so, the meta-space would be located, in turn, in a meta-meta-space, would it not?”

That Zeno evoked a serial succession is clearly attested by the clause *eis apeiron* or *ep' apeiron* ('endlessly'), that occur in [S1], [S2], [S5], [S6], as well as by the clause *eis to prosō* (another way of saying 'endlessly'), that occurs in [S3]. This is, in fact, a building block of the Space paradox. Another building block surfaces from [S8] and [S10], “what encloses is larger than what is enclosed” and Zeno probably launched the idea that this is universal, that every container is larger than its contents, so how can space be an exception? The third block, “Therefore, place does not exist”, is the conclusion reported by Simplicius in [S5].

Zeno's audience, real or virtual, would have experienced the impression to find themselves blocked in a *cul de sac*, an aporia not easy to dismantle. It is true that for Aristotle and Eudemus to dismantle this particular aporia is simple, but what they offer as a key to its dissolution – a sort of *pollachōs legetai ho topos* ('place/time is said in several ways') – is in no way a promising exit strategy, because the 'in' clause ('in a sort of container') is quite explicit and is not affected by equivocation. In order to dismantle the *Space* paradox one should point out, rather, that, since space is not a physical object and we could not touch (nor view) it, it is not a box like any other. This is enough in order to understand

that the rules valid for physical objects are hardly applicable to it²¹.

If so, we come to identify the mental obstacle raised and exploited by Zeno: it consists in suggesting that the rules are the same, and then leading his audience into temptation by asking what, according to the established rules, space may or should be and, once the audience runs out of answers, by suggesting: “unless space does not exist”. What he consciously and carefully conceals is the question of whether space is a container of the same type as every other container known to us. Now, if he conceals, he knows what is being concealed²². Therefore, Zeno is likely to have had a definite (albeit undeclared) interest in assuring that his audience feels disoriented, and in avoiding making any statements to them that would be able to dissolve their perplexity (or at least so his interest seems to have been).

*Concluding remarks. Why Zeno was more
than just a master of communication*

Clearly, the sort of investigation I have just outlined could continue with a number of other well-known paradoxes, the *Achilles* included²³. A fantastic repository of very sophisticated notions that are at work in one or the other paradox, surfaces, and we are discovering a largely unknown feature of Zeno: his unique familiarity with an impressive number of abstract notions (other than with ad hoc argumentative strategies) which, in all likelihood, were not only totally unknown to his contemporaries, but more than once remained so even to his posterity. Zeno is likely to have evoked these notions (an

²¹ Besides, for a room to be part of a house is not the same as, for a house, to be found in a village, nor for a village to find itself on an island, nor for an island to find itself in the sea, nor for the sea to find itself on earth. The succession is, indeed, a succession of *unequals*.

²² Not a theory about the nature of space, just a definite idea of the difference between space and physical containers.

²³ In Rossetti 2020a a comparable examination of the *Achilles* (40–44 and 57 f.), the *Arrow* (50–52), and the *Dichotomy* (60–64) is available.

incomplete list will be supplied in a moment) without spending words on them, without offering a tentative label for each of them, without drawing the attention of his audience to them, without insisting in all these new ideas in order to assure that each of them becomes part of a shared patrimony of mental tools²⁴. Indeed, only on the infinitely small he seems to have turned the spotlight efficaciously, either before or after the *homoiomereiai* (similar parts) of Anaxagoras and the atoms of Leucippus-Democritus. On the contrary, relative motion, *to murioston* ('the ten thousandth'), *onkoi* ('masses') and *isoonkoi* ('equal masses'), *ho topos* ('the space'), *eis apeiron* or *ep' apeiron* ('endlessly'), *dichotomia* ('division in two parts'), *peras tou sōmatos* ('limit of body') and other notions, plus the definition (!) of 'thing' or 'object' formulated in negative ("something that does not possess any magnitude, or thickness, or volume": so Simplicius when introducing 29B2 DK²⁵)—form an impressive set of new notions or tools that were at work in his paradoxes and were somehow evoked, but not explicitly identified or commented upon. As a consequence, given Zeno's reticence, they remained foreign to those who were in the better conditions for paying them a much greater attention, philosophers. An epoch-making loss, one would say, since familiarity with so sophisticated a set would have made people considerably more skilled and sagacious.

That said, it may be appropriate to offer some further ruminations (just some) on another immensely new idea of Zeno, his communication strategy²⁶. His book was entitled *Peri phuseōs*, as usual among learned people of his time, but what he offered was a set of

²⁴ Indeed, Zeno could have wanted to attain this goal, but did nothing in view of that.

²⁵ It is worth noticing that the Sextan source ([S8] above), in § 73, happens to argue that, if something is one, it necessarily is (= has) a quantity (*poson*), or a continuity (*suneches*), or a magnitude (*megethos*) or a body (*sōma*) and, if it has a body, it has three dimensions, *mēkos*, *platos* and *bathos*. Could this be another borrowing from Zeno? Not impossible, I would say.

²⁶ I've already dealt with these topics in Rossetti 2010, 2017, and even more recently, but Zeno's communication strategy is so meaningful that there is ample room for further explorations.

paradoxes where each one was apparently left without introductions and/or commentaries, i.e. without meta-texts, much as if the person in charge of reading them was alerted orally to pause whenever the portrayal of an intriguing situation and the implementation of a given perplexity (e.g., “really Achilles would be unable to reach and surpass a tortoise?”) occurred. I mean: to pause in order to ensure that the audience had some time to imagine the situation, to live the perplexity, and perhaps to say something (e.g. “Impossible! Achilles would certainly reach and outmatch”, or just “Why? Sorry, something escaped me”). Indeed, it should have been completely out of place to finish reading, say, the *Achilles* section and pass immediately on to read the *Stadium*, for the intelligibility of the whole would have been too seriously compromised if one passed to a new story without interruption. Therefore, also when other owners of copies of his books would read (or order a third person to read) them aloud to their friends, the same policy would have been desirable in order to help the audience in their efforts to understand and enjoy the most anomalous of treatises (entitled *Peri phuseōs*) ever circulated in the Greek speaking area.

Thanks to this feature of Zeno’s book, we come to discover much more than an additional detail. Instead of encouraging people to share a given opinion, Zeno’s communication units were meant to disrupt a given opinion (e.g. that the quick foot Achilles will easily reach the slow turtle). Moreover, he was hardly willing to give explanations or to draw conclusions once a reading with many scheduled interruptions was finished. This means that his book is likely to have been (and have been perceived as) extremely unconventional, even in the event of an individual reading. Whichever the context, it ended by having raised several bizarre perplexities, without suggesting the least way out, and this probably was, to everyone’s surprise, his not less bizarre pride: to have avoided giving the least positive teaching.

Indeed, in Zeno’s time every audience was expected to listen in silence to the rhapsode singing Homer, to the actors playing on stage, to

the orator delivering his epideictic or forensic speech, to the great doctor reading a book of his (devoted to this or that disease), to the historian telling an episode of the great struggle with Persians, to Antiphon performing his *Tetralogies*, eventually to a former pupil of Socrates telling his dialogue (and so on) *until its end*. So, his book was different from every other reading session precisely because more than pauses were expected: pauses meant to grant some room to the impressions and the opinions of a confused audience trying in vain to capture the meaning of each short story.

It is probably appropriate to ask, for how many centuries did this exception remain unparalleled. Because, starting with Aristotle, the treatise form imposed itself on a very large scale, and every learned text consisted of rather long units.

Before continuing with these ruminations, let me insist that the conclusion reached a moment ago seems void of alternatives, since to decode, explain or teach something about this or that paradox would have destroyed its paradoxicality, that is precisely what made them unique and valuable. Indeed, we can presume that Zeno encouraged his audience (his interlocutors) to ruminate, to raise tentative objections, and enjoyed continuing with this awkward play for a while. And if somebody was hasty to solve (*lucien*, as Aristotle would say) his paradoxes, he would probably have done his best to resist those attempts, while he may possibly have been prepared to give positive answers when (and if) somebody asked for the meaning of one or more new notions.

As it is easy to guess, starting from several scheduled pauses, we are now coming near Zeno's legacy and the essence of his effort in devising new and new paradoxical stories. However, a question is likely to remain unanswered: 'What was this all for?'

Let me suggest that Zeno wasn't just a great master in communication. What I said so far in this paragraph was, in fact, a way of trying to tell in which sense he was a creative on matters of communication strategies, but this in no way is the end of the story, I

would surmise. Because his short stories had—and still have—a very special power to wake minds up. The only pre-condition is that one accepts to feel bewildered and becomes curious, for his stories give access to a number of new possibilities, ideas, notions, so that you can see the world from another, and then another, and then another point of view. This way, a number of new ‘sensors’ come to be activated and we begin to note things never noticed before. And our universe becomes wider, richer and more varied than one could expect.

This is indeed a very considerable additional merit. One would add: a merit of philosophical import. For this reason too, in my opinion, Zeno’s paradoxes lie in a large cave, or a big mine, which still has to be explored in greater detail.

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