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VICTOR BROCHARD ON ZENO'S ARGUMENTS AGAINST MOTION

"In 1885", says Florian Cajori, 'discussion of Zeno's arguments against motion was opened up in France, which lasted over a decade and in which a large number of writers participated". Cajori continues, "At no other decade and in no other country was the discussion of the topic so persistent and general". ("The History of Zeno's Arguments on Motion", *American Mathematical Monthly*, XXII, 1915, p. 255.) This historian, one feels, should also have said that in no other decade was so much achieved in understanding these ancient arguments or in finding solutions to the difficulties pin–pointed by those arguments.

One of the earliest of these studies was Victor Brochard's paper, "Les arguments de Zenon d' Élée contre le mouvement" (The Arguments of Zeno Against Motion). This had followed three very important studies, namely, those of Paul Tannery, Christian Renouvier, and Francois Evellin. Paul Tannery was perhaps the first to hold that the arguments of Zeno were directed against a certain view of the composition of space and time, namely, the view that spatio–temporal intervals are constituted of an infinitude of magnitudeless points and moments, and that the arguments were valid against that view. Christian Renouvier was perhaps the first to take the four arguments reported by Aristotle — popularly called "Zeno's Paradoxes of Motion" — as constituting a dilemma. Taking it for granted that space and time must either be infinitely divisible or divisible into a finitude

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of indivisible, 'extended' and isometric 'elements', Renouvier endeavoured to show that the first two arguments constituted one horn of the dilemma (space and time cannot be divisible *ad infinitum*) and the last two constituted the other horn (space and time cannot be divisible into a finitude of elements). François Evellin was perhaps the first to hold that Zeno's arguments show that motion is impossible on the hypothesis of infinite divisibility of space and time and that motion was possible only on the suposition of discrete, elemental, character of space and time.

Victor Brochard not only followed Renouvier in taking the four arguments as the two horns of a dilemma but he found in them a curious symmetry : these arguments formed two pairs with regard to a number of alternatives. For example, the first and third consider only a single mobile, and, as such, absolute motion, whereas the second and fourth consider mobiles in the plural, and, as such, relative motion, and, similarly, the first and fourth consider motion and space between prescribed limits whereas the other two consider them without prescribing any limits to them.

Many writers, including Zeller and Renouvier, have held that the Aristotelian enunciation of the *Arrow* requires emendments, in particular that ' or in motion, (**ee kaineitai**) in the statement ' A thing is at rest or in motion when it is in a space equal to itself' should be deleted. Brochard holds that no emendment is required and that the clause ' or in motion ' although it has the appearance of a naivete in actuality it conceals a snare : once the unemended proposition is granted the adversaries' hypothesis (that space and time are consitituted of elements) stands disproved. That is, according to Brochard, from the premises that at any moment (as a temporal element) a body must be in a proper place and that a temporal interval

is but a collection of a certain (finite) number of moments, the conclusion that the body is at rest during a given interval only follows from the further premiss that at any moment a body must be in motion or at rest. Thus, this proposition is required if the Arrow is to show that motion is impossible. Moreover, an adversary of Zeno may hold, as Evellin had held, that at a moment a body is not necessarily at rest; if so, to oblige him to hold that the body, although in a proper place at a given moment, is in motion and to demolish his hypothesis (the hypothesis of elemental character of space and time) by resort to the argument of the Stadium (which, according to Brochard, shows that if a body is in motion at a moment, then the moment must be divisible), it is obviously necessary that the adversary must first grant that at any moment at which a body is in a proper place it is either at rest or in motion. But, according to Brochard, once this proposition is granted, the Arrow shows that a body is either always at rest, or it is in motion at a moment, and the Stadium shows that if it is in motion at a moment then the moment is, contra hypothesis, divisible. Thus, in the opinion of Brochard, the two arguments of the Arrow and the Stadium show that motion is impossible on the hypothesis that space and time are constituted of indivisible elements.

Victor Brochard was perhaps the first to give to the Stadium the intepretation now generally accepted, viz., as showing that the moment of time must be divisible in order that the element of one mobile set may 'encounter' each element of another mobile set moving with the same speed in an opposite direction. Thus, the last two arguments are seen to be a coherent set of arguments against the view that space and time are constituted of (indivisible) elements. The Arrow argument lays down the general principle that a body is in motion or at rest at a moment (since a body which occupies a proper place during a period of time is admittedly at rest, and a body in motion must

occupy a proper place at any moment) and shows that the flying arrow is at rest during the period of its supposed motion if it is taken to be at rest at a moment at which it occupies a proper place, and, the Stadium shows that if it is in motion at a moment then the moment is divisible.

Cajori (op. cit., p. 255) says that Brochard took Zeno to be a sceptic and held that Zeno had really meant to deny motion. But, Brochard clearly says that Zeno's arguments were not directed against the existence of the continuum but only against the view that the continuum was something composite, was a whole. According to Brochard, the Eleatics seem to have nevertheless regarded the One or the continuum as continuous and hence, possibly, as extended. In this connection, Brochard quotes Spinoza as maintaining that if the quantity is considered *qua* substance with the aid of understanding then it would be judged to be infinite, one and indivisible, whereas the quantity is represented by the imagination as finite, divisible and compounded of parts, and holds that this view is closely similar to that of the Eleatics. Brochard further holds that Spinoza did not borrow this view from the Eleatics which shows that such a view can be held, and, hence that Zeno may well have held such a view.

In what follows, we present a translation of Brochard's historically important article, " Les arguments de Zéno d' Élée contre le mouvement "- *Mémoires de l' Académie des sciences morales et politiques*, New Series, vol. XXIX (1885), pp. 555–568.

TRANSLATION

[555] The arguments of Zeno of Elea against motion have been discussed very many times. If this were any reason for not discussing it afresh, what important problem would not

merit to be abandoned ? But, it is not so much the metaphysical question—although very serious in itself and in its consequences—as the historical question which we propose to discuss. Since ancient times, whence these so-called sophisms have come to trouble and irritate human thought, there is perhaps no philosopher of any consequence who may have resisted being attracted by the problem presented by Eleatic subtilty and who may not have had his say at least on the *Achilles*. But, for the greater part, until our century, they have been more inclined to refute Zeno than to understand him. The task which we have undertaken is to determine as exactly as possible the actual import of these famous arguments in the thought of their creator, and without forestalling ourselves from appreciating their worth to point out with precision the target at which they aim.

(I)

Zeno, they say, shared the idea of Parmenides on the unity of Being ; he wished to avenge his master against mockeries directed against him, and to reduce to absurdity the theses with which people opposed him. For that purpose, he made use of two series of arguments, [556] the one against multiplicity, the other against motion ; it is only the latter which will concern us here.

While distinguishing between these two series of arguments, it should be recognized that there is a close relationship between the two. Zeno denied motion only because he denies plurality. In fact, motion implies space and time, which are continuous; motion is impossible in these continua because they are not composite, or, as Zeno puts it, are not multiples. Motion, if it is real, divides the place and time in which it is realized ; it cannot therefore be produced in a continuum without parts.

If space and time have parts -- if the continuum is composite — then either those parts are infinitely divisible or they are indivisible elements. Zeno refutes the first of these suppositions

by the arguments known as the *Dichotomy* and *Achilles;* the second by the *Arrow* and the *Stadium.* The four arguments thus form a dilemma. This is what M. Renouvier was the first to show in the chapter of *Essais de critique générale*[1] devoted to Zeno of Elea. However, he leaves aside the fourth argument, the Stadium. We shall show on the contrary that this argument which has so greatly embarrassed and scandalised the historian, is intimately connected with the preceding arguments and completes the demonstration.

The four arguments form a system of curious symmetry. The first and the fourth consider the continuum and motion between given limits, the second and the third envisage them without any prescribed limits and as having any magnitudes whatsoever. In the first and the third, a single body is set to realize motion, and it is found that even the commencement of motion is impossible. The second and the fourth, by comparing two [557] bodies in motion and in a way making the absurdity of hypothesis even more palpable, prove that motion connot continue even though begun, and demonstrate the impossibility of relative motion as well as that of absolute motion. The first two establish the impossibility of motion from the nature of space, supposed continuous, without however its being the case that time ceases to be considered as composed in the same manner as space; in the last two, it is the nature of time which serves to prove the impossibility of motion, without however its being the case that space ceases to be considered as also formed of indivisible points. Lastly, the second is but another form of the first, and the fourth rests on the same principle as the third. The first pair of arguments is meant to combat the idea which naturally enough first presents itself to the mind, that of indefinite divisibility of the continuum; the second is directed against the conception which offers itself only when the mind has recognized the diffi-

culties in the former. The logical order of these arguments entirely conforms to the historical order in which Aristotle has transmitted tnem to us and which must certainly have been the order adopted by Zeno

Let us briefly summarise these four arguments.

I. It is assumed that space and time are infinitely divisible. Admittedly, the texts do not expressly mention this supposition; but it is clearly implied in language of the first two arguments.

1· The Dichotomy.[2] "There is no motion, for, it is necessary that the mobile should arrive in the middle of its course [558] before reaching the end. And it will have to traverse a half of the half before reaching the middle, and so forth *ad infinitum.*

2. The Achilles. " The slower will never be overtaken by the faster, for it is necessary that the pursuer should first attain the point from which the pursued has departed so that the slower will necessarily remain ever ahead." The swift–footed Achilles will never overtake the tortoise. And if it be impossible to reach a goal, then there is no motion at all.

II. The continuum is assumed as formed of indivisible elements. Aristotle expressly tells us, at least about the third argument, that time is supposed as formed of instants (**Ton chronon psucheistai**)

3. The Arrow. Here a problem of interpretation arises. Edward Zeller and M. Renouvier deem it necessary to emend the text of Aristotle; we, on the contrary, think that the text should be left unaltered. We first translate and explain the text of Aristotle.

" A thing is at rest, or *in motion,* at the time when it is in a space equal to itself. The arrow which flies is always **(ev to neen)** in the instant. It is therefore always motionless. "

This is how we interpret this text. It is absolutely impossible that the arrow should move in an instant (supposed indivisible), for, if it changes its position, the instant would immediately be divided. Now, the body, in an instant, is either at rest or in motion; as it is not in motion, it is at rest, and as time *ex hypothesi,* is made up only of instants, the body is always at rest.

This enunciation, " a body is always at rest or in motion at the time when it is in a space equal to itself ", has appeared incorrect to E. Zeller and to M. Renouvier who propose to delete **ee chineitai.** The proposition that a body is at rest [559] when it is in a space equal to itself, is the very definition of rest according to Mr. Renouvier. This definition of rest is for him, as for Zeller, the essential element of the argument. On the contrary, we think that the nerve of the proof lies in the proposition, 'the arrow is always in the instant'. This means, we saw, that at each division of time, it is not in motion. Does it follow that it is at rest ? Yes, it is said, for, it is in a space equal to itself, and this is the definition of rest. It is quite true that a body in motion must occupy several positions in a given period; but in a given instant ? That it may be conceived that in an instant the body is not at rest, is exemplified by the case of M. Evellin, who, taking up again the thesis which Zeno attacks, maintains [3] that the arrow is in motion in an instant while occupying a space equal to itself. There is then a subterfuge by which the adversary may escape. It is to shut this that Zeno has begun by laying down the principle that a body is either at rest or in motion at the time when it occupies a place equal to itself. These words, " **ee chineitai** " which M. Renouvier attributes to an unintelligent copyist, have the appearance of a naivete but they conceal a snare. *

It is also useless to add **Chata to eeson,** as Zeller does, after **to pheromenon en to nun.** The argument drawn from the instant [560] suffices, without adding any consideration of space (although one may urge the same reasoning on the basis of the point just as on the basis of the instant).

4. The Stadium. "The fourth argument is in relation to two equal series of points which move in opposite directions in the Stadium, passing in front of a third and equal series of points, the one departing from the middle of the Stadium and the other from the extremity, with equal speeds; whence Zeno con cludes that the time taken will be equal to the double of itself."

This argument is made clearer by a figure drawn by Zeller to Aristotle's specifications. Let there be a line of points A^1, A^2, $A,^3$ $A,^4$ supposed to be stationary; in addition, let there be two other series, B^4, B^3, B^2, B^1, and, C^1, C^2, C^3, C^4, disposed as in figure 1. (It would be necessary to add, in our view, that all the points are conceived as contiguous without being confounded.)

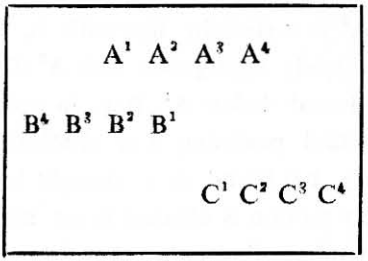

Fig. 1

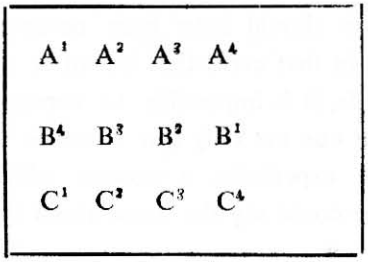

Fig. 2

Let us now postulate that the two series of B and C move in opposite directions with the same speed. B^1 and C^1 will arrive at the same time at the opposite extremities of series A (fig.2). In the same time, says Zeno, B^1 will have passed before all the Cs and C^1 before all the Bs, but, on the contrary, B^1 and C^1 will have passed before only the half of As. Now, series A is equal to each of the other two; times are proportional to spaces; the time taken by the Bs and the Cs to trave$_{rse,}$ the whole length of the A

(to traverse) the half of this length, is therefore double of itself[b]. (Brochard means to say that if t′ be the time taken by series B to traverse scries C, and if t″ be the time taken by series B to traverse a half of seriesA, then since series A and B are equal, it follows that t″ is a half of t′, and since series B traverses the whole of C in the ame time it traverses a half of A, it follows that t′ and t″ are equal; hence, t′ is both equal to t″ and double of t″; hence, t′ is double of itself.)

Nothing more sophistical than this argument if, as [561] Zeller puts it, it consists in supposing that the space traversed by one body equals the lengths of the bodies before which it passes whether or no these bodies be at rest. But this interpretation does not seem to us to be correct.

If, as we have assumed, Zeno argues on the hypothesis of indivisibles, we have to admit that the points A, B and C are in themselves the absolute elements of space, and move in the instant, absolute elment of time in itself. After the first instant, B^1 which was, I suppose, below A^2 in a straight line with it, is found below A^3, supposed immediately contiguous with A^2; C^1 which was at first below A^3 is found below A^2. But, in order that B^1 and C^1 occupy their actual positions, it is absolutely necessary that at one moment they be found in a straight line with one another. However, their motion is effected in an indivisible instant. It is necessary, therefore, that either they should not get across (and in that event there is no motion) or that in an indivisible instant two positions should have been occupied by each of the two mobiles (but in that event the instant is no longer indivisible). In other words, it is impossible to conceive of such an indivisible instant that one not only can conceive of but actualise by a very simple experience, a motion which divides this instatant. (And one could say the same about the

unit of space, supposed indivisible : a given element would have to enlarge itself to the point of containing at the same instant two elements of the same dimension.) To say that the instant is divided into two equal parts, is, on the present hypothesis, to say that it is the double of itself.

II

[562] What is the value of the four arguments thus interpreted ? Audacious enough to make such an assertion, we do not hesitate to say that they all are irreproachable.

Without inordinately violating the limits of this work, we cannot examine all the refutations and solutions of the difficulty which philosophers and mathematicians have had pleasure to devise. It would suffice to recall to mind, as pointed out by many others, that most criticisms evade the real question, or, at least, do not state it in those terms in which Zeno had stated. For example, when Aristotle, who later retracted this objection, remarks against the Dichotomy and the Achilles that time like space is divisible ad infinitum, and that it is quite possible to pass through an infinitude in an infinite time, and, when Leibnitz declares that an infinitely divisible space is exhausted in an infinitely divisible time, they both are menifestly beside the point. Zeno knew very well, and his very demonstration necessitates, that space and time comport themselves in the same fashion, that they both should be, always and in a paralled manner, infinitely divisible. The question is to know how, in both space and time, this series of divisions, which is inexhaustible by definition, may be exhausted, and [let it be noted], it has to be exhausted in order that motion may occur. It is no answer to say that they are exhausted simultaneously.[6]

The mode of refutation adopted by mathematicians, from Descartes to M. Tannery, in a way excellent, has an analogous

defect : it resolves another problem than that which was presented. To show that the sum of $1+{}^{1}/_{2}+{}^{1}/_{4}\ldots$ is equal to 2 in the case of the Dichotomy, and to calculate in the case of [563] the Achilles the precise moment at which Achilles will have overtaken the tortoise, as has been very well shown by M. Evellin, is to reply to the question, ' when ? ' whereas the question to be answered is ' *how ?* '. If one adopts the hypothesis of infinite divisibility, one will never encounter the limit in the Dichotomy as is admitted by everybody, and in the other argument, the distance which separates Achilles from the tortoise, ever so decreasing, will never become null. And if one introduces the limit and the discrete, magnitude with the Calculus, then Zeno was aware that these arguments were no longer of any avail. In that case, one is in the presence of another thesis about the composition of the continuum, and this one comes under the mischief of the third and fourth arguments.

The critic who has most recently studied the arguments of Zeno, M. Dunan, contrary to the opinion generally held, deems it necessary to separate the Dichotomy and the Achilles. The former seems to him to be beyond the pale of any objection: the second is a sophistry. The reason he advances is that, if, as the Dichotomy shows it, the fact of movement is impossible in actuality, then the moment one accords movement to Achilles and to the tortoise, "nothing hinders one from supposing that Achilles possesses a speed sufficiently fast to be able, in one attempt, to traverse first the distance which separated him from the tortoise, and then the distance which the tortoise traversed, nay, even a much greater distance, so that, while on his way, he will put his hand on it". (p.22)

But to arrive at this conclusion, M. Dunan has assumed that space, as the argument manifestly implies, is infinitely divisible but time is composed of indivisible instants finite in number.

Now, nothing in the text authorises this supposition. Everything supports the belief that here, as in the Dichotomy, time is divisible the way space is. To affirm that this conception [viz. that of Dunan] is necessitated as soon as one admits the reality of the movement of Achilles, would be, it seems, to take the supposition of Zeno too seriously, to abuse a concession granted provisionally, and to argue if not too harshly [564] at least too strictly. Since Zeno has begun by supposing Achilles and the tortoise in motion, it is quite clear that, in a sense, he debars himself from arriving at a conclusion which denies the possibility of motion. But, he avails himself here of proceeding, or if you like, of an expedient, which is quite permissible. Motion is impossible; the Dichotomy has proved it. Nevertheless we suppose, for a moment, by grace, that it is possible; if so, one arrives at other absurdities. The same arguments which prevent motion from beginning, prevent it from continuing once begun. The second argument completes the first; it is the same idea presented in a more concrete, more piercing. more tragic form, as Aristotle said.

The last two arguments have been less often discussed than the Achilles. They are refuted chiefly with disdain : the people have been only too quick in calling them sophisms. However, if the Arrow is taken in its true sense, it is not easy to see what one could object to. Manifestly, it is not any the easier to explain motion on the hypothesis of indivisibles than to compose a line with points or a duration with instants. Still, there is this difference, wholly to the advantage of Zeno, that the point is not the negation of the line, nor the instant of the duration, as obviously as is rest the negation of motion. Is it possible to refute Zeno ? We would not wish to deny the possibility since M. Evellin has attempted it. This is not the place to discuss his ingenious theory, but the subtle philosopher would not take

exception to us if we say that this ingenious theory is not without presenting some difficulty. In any case, if Zeno merits the name of a sophist for having invoked the argument of the Arrow, it would be necessary to give the same name to many other philosophers, including Pascal.

The Stadium remains, which no one has dared to defend except Bayle, who only did so with timidity. If the interpretation we have given to it be correct, it [565] justifies itself. It notifies that with the aid of motion, one can always divide an instant supposed indivisible. At bottom, it is the same argument by which Leibnitz demonstrated that the concept of the fastest possible motion was a controdictory concept. Understood this way, the Stadium is to the Arrow what Achilles is to the Dichotomy : it presents the same idea in a more concrete and tragic form, or, if one so desires, in a more pleasant form. It is this innocent pleasantry, pressed into the service of a profound idea, which has not been comprehended, and which has brought to the argument and its propounder their ill repute. Perhaps, it would never do to joke in metaphysics.

Zeno of Elea had perhaps seen beforehand that his irony would be fatal to him; this can be conjectured from the very appropriate passage in Plato which shows us to what extent Zeno merits the title of a sophist. "You have not perceived", Zeno says to Socrates, "That my work is not pretentious, that it was not composed with the intention that you ascribe, and that I do not make an ado of what it comprises as if that were something extraordinary. But you have rightly remarked that it is a defence of Parmenides against those who attacked him with jeers, claiming that if the Being is one, many ridiculous and contradictory consequences result from it. My book replies to the partisans of multiplicity; it gives to them tit for tat, with interest, and tries to show that it leads to still more ridiculous consequences on

the hypothesis of multiplicity than that of unity, if one examines it attentively. It was for waging this dispute that I had written it in my youth. Someone stole it from me, and I could not deliberate whether or not it should be published. You are wrong then, Socrates, in believing that I did not write this work in my youth for the sake of dispute, but in ambition at an advanced age. "

III

[566] It remains to settle a last point. At what did Zeno wish to arrive through all these subtleties? How would his argument come to the support of the thesis of Parmenides?

Historians and critics, who do not regard Zeno as a sophist, are not agreed on this point. As one may expect it, they are inclined to recognize in Zeno their own ideas.

We take up only the most recent works. M. Dunan is inclined to interpret the argumentation of Zeno in an idealistic sense. He declares, as a matter of fact, that " the problem posed by Zeno could not be profitably treated and definitively resolved before the appearance of the *Critique* of Kant (p. 42)". As for Zeno himself, M. Dunan esteemed " that he had a very imperfect notion of the true sense and bearing of his arguments, that he took pretty little account of his own thought." This is being very severe. But the question is not answered : if Zeno did not khow full well what he was saying, how would he come to the aid of Parmenides ?

M. Evellin seems to hold that in proving the impossibility of motion in the infinitely divisible continuum, Zeno had wished to prove the necessity of another conception, that of the discrete and that Zeno used to believe in the reality of motion. This is a realistic interpretation : the continuum would be an appearance;

the real would be the discrete. But this opinion would not be sustainable. The texts actually say that Zeno denied motion without qualification. We have, moreover, shown that the thesis of M. Evellin is precisely the one which Zeno combated in the second half of his argumentation.

According to M. Renouvier, if we have correctly comprehended his thought for Zeno also, the continuum [567] would only be a phenomenon, an illusion; but Zeno did not believe in the reality of the discrete, the indivisible points and instants, either; he opposed each of the two possible conceptions of the continuum and destroyed them both without drawing a line between the two; it is this fact which enables one to link his arguments to the antinomies of Kant. This interpretation by M. Renouvier is an idealistic interpretation, with this exception that according to M. Renouvier Zeno affirms the absolute reality of the One.

However, nothing in the text proves by itself that such was the thought of Zeno. On the contrary, we see that Parmenides declared the Being continuous, and often used to put these two terms together : **en chai xuneches** (Mullach, 62,76–77,81.) Moreover, it seems to us very difficult not to interpret the thesis of the Eleatics in a realistic sense.

To tell the truth, it is not against the existence of the continuum, it is against the composition of the continuum, that the arguments of Zeno are directed. The Being is continuous, but undivided and indivisible. It must not be said that it is a whole, for, it does not have parts : it is essentially One. But this absolute unity does not appear to have prevented the Eleatics from considering the Being as continuous, and, consequently, may be, as extended.

But, may one conceive of the continuum as indivisible, and have we the right to attribute such a conception to a dialectician like Zeno of Elea ? It would have been advisable to hesitate, had we not found an exactly similar thesis in another mighty logician, who, most certainly did not borrow it from Zeno, but whose chance agreement with the Eleatics in this regard is indeed very significant and very instructive. This is how Spinoza expresses himself. (*Ethics.* part I, pr. 15, Schol.) : " If we consider quantity as our imaginations represent it to us, which is the easiest and the most customary proceeding, we shall judge that it is finite, divisible and compounded of parts; but, if we conceive of it with the aid of understanding, if we consider it *qua* substance, something very difficult to do [568] in sooth, it [i.e., quantity] would appear to us, as we have well proved, as infinite, one and indivisible. This will be evident to anyone who is capable of distinguishing between imagination and understanding, especially if one will also note that matter is everywhere the same, and that there is no distinction of parts in it except insofar as one conceives of it [i.e., of matter] as modified in diverse ways, whence it follows that there exists between these parts only a modal and not a real distinction. "

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NOTES

1. *Logique*, vol. I, p. 67.

2. We present these argumeuts as given by Aristotle, *Physics*, VI, 9.239B. Cf. Simplicius, *Phys.* 236.B; Themistius, *Phys.* 55.B. Monsieur Renouvier has shown very rightly that it is not required to attach too great an importance to the expression en peperasmeno chrono which figures in the text of Aristotle [*Physica*, 233a23] and that of Themistius (*Esquisse d'une classification systematique*, vol. I, p. 38).

   [In the original, foot-notes have been numbered page-wise; we have re-numbered them serially, independently of the pages on which they appear in the original or the translation.—Tr.]

3. *Infinie et quantite*, p. 93.

4. This interprestation has the advantage of being in accord with the text of Simplicius (*Phys.*, 236, B) which also carries, pan otan ee chata to eeson ean to ee chineitai ee eerremee as well as with the whole interpretation of this commentator, quite superior, in our view, to that of Themistius. It is true, as Zeller observes, that Simplicius develops the thought of Zeno but nothing warrants the supposition that he did not understand him. And notwithstanding the remarks of Schleiermacher (Zeller, vol. II, p. 79, trans. Boutroux), the fact that Simplicius had with him the work of Zeno does not diminish his authority. M. Dunan has very well elucidated the question of text in what concerns this argument in his study on *Les arguments de Zenon d'Elee contre le mouvement*, Paris : Allcan, 1884, p. 10.

6. One ordinarily translates ogchoi by *masses*, and it is certainly legitimate. However, it seems to us that the idea conveyed by this word is less that of masses than that of *indivisible*, if you like, indivisible and contiguous, masses. That is why we prefer to render it by *points*, although this word may not be altogether satisfactory. The word ogchoi is employed as a synonym for 'atom' by Epicurus (apud Diogenes Laertius, X, 54) and later by Asclepiades, of Bithynie (Sext. Empiricus, *Adversus Mathematicos*, VIII, 220)

6. On this point, see the brilliant chapter of M. Renouvier, already cited [in Foot-note no. 1]. Cf. *Esquisse d'une systematique des doctrines Philosophique*, vol. I, p. 38.

7. Parmenides, 128. C.