

Chapter 2

On Extent

as the first general property of material bodies.

9. The first general property of material bodies is their extent, so that anything that has no extent cannot be regarded as a material body.

We are not only convinced by our experience that all material bodies that we know possess extent, but our concept of bodies incorporates extent in such a way, that we can exclude all things without extent from the category of material bodies. Not only has Natural Science never doubted this, but Descartes¹ has gone so far as to regard extent as the essence of material bodies. However, as we shall see below, this cannot be justified, for, although all material bodies have without doubt extent, it does not follow that all things having extent are also material bodies. Empty space may or may not be possible, but so much is certain, the concept of empty space, which undoubtedly is possible, is distinct from the concept of material bodies. It follows from this that our concept of material bodies involves something in addition to extent. The additional properties that, together with extent, are involved in the concept of a material body, will be indicated below, after we have examined all additional properties that are of necessity associated with extent. Here we note that every main property includes within itself several associated properties that must be ascribed to material bodies just as the main property itself.

10. Whatever can be said of extent per se, can without exception also be said of material bodies.

Since extent is of necessity associated with material bodies, everything that is connected with extent is likewise associated with material bodies; it follows that all properties of extent are at the same time also properties of material bodies. For as soon as extent is ascribed to bodies, everything that is of necessity connected with extent must also be ascribed to bodies, otherwise they would not have extent, and therefore not be material bodies. Since the essence of material bodies lies not merely in their extent, things are possible, that have extent but are not bodies, and the concept of an extended thing contains in itself the concept of a material body. Therefore the properties of an extended thing quite generally must be regarded as also the property of material bodies. In some quarters an objection against this conclusion is raised by asserting that since extent is only an abstract concept, it should not be ascribed to material bodies as real things. This can be countered by pointing out that all general concepts are abstract concepts, and nobody has so far maintained that the concept of the sexes should not be regarded as abstract. But irrespective of this we have the well founded rule that all properties of the sexes are also the property of each genus and of each individual within it; in fact on this rule rests the totality of our knowledge. Just as everything that can be said of material

¹ René Descartes (1596 – 1650), *Principia Philosophiae*, Amstelodami 1644.

bodies in general, regarded as an abstract concept, can also be said of all particular kinds of bodies, and even of individual bodies, so must also be ascribed to bodies both in general and in particular all that can be said of extent, which is a more all embracing concept. Whoever dares to deny this conclusion contravenes the most firmly secured rules of logic. Therefore whoever denies material bodies the properties of necessity connected with extent, denies them extent itself and thus excludes them from the genus "material body".

11. Everything that has extent is divisible, and divisibility can be continued ad infinitum; therefore all material bodies are infinitely divisible.

The objection to this statement, based on the abstract concept of extent, is refuted by simply saying that infinite divisibility is a property of extent, so far as it is extent. The proof of this stems from geometry. Here it is shown in the most concise possible way, that everything that has extent must be divisible without limit, and if we enquire further why infinite divisibility must be ascribed to extent, we find quite explicitly that this follows of necessity from the nature of extent. Thus wherever there is extent, there is infinite divisibility. Since all material bodies have extent, they must be infinitely divisible. We even know from experience that the actual subdivision of many material bodies can be carried out to an astonishing degree, and that our tools and senses are too blunt to permit this subdivision to be carried even further. However here we are not discussing what can actually be done, but rather the merely the possibility of taking the subdivision even further. Let us assume a body is already in actual fact divided into 100 parts. Each part will then still have a certain size, and it is certain that each part is still capable of further subdivision. Since, irrespective of how far in thought we have proceeded with the subdivision, the parts still have a certain size and extent, further continuation of the process of subdivision remains as possible as it was in the beginning. Our senses seem to balk at this, however truth must be judged not according to our senses, but solely according to logic. If after a certain hypothetical subdivision one were to encounter parts that could not be subdivided any further, then these parts would have to be bereft of all size. This however contains a contradiction, since it is untenable that half or a third of a body should no longer have a size, and it is equally contradictory if one wanted to maintain this of the thousandth or the millionth, or even much smaller parts, since before arriving at these last parts one would have encountered such parts which could be subdivided, and which consequently had extent, although half of them were bereft of all size. It is maintained by some that the possibility of infinite divisibility has been disproved by irresistible arguments, however the weakness of these arguments will be shown in the following statements.

12. Although material bodies are infinitely divisible, the statement that every body consists of infinitely many parts is simply wrong, and is even in contradiction with infinite divisibility.

One generally regards the two sentences:

Every body is infinitely divisible

and

Every body consists of infinitely many parts

as equivalent, and proves on irrefutable grounds that it is impossible for the latter sentence to be true. Far from wishing to refute these grounds, I in fact ascribe to them the this sentence contains an obvious contradiction within itself and is directly in opposition force of a complete proof and totally reject the latter sentence. I shall however show that to the first sentence. Therefore all objections against the latter do not in any way affect either the former sentence ,or the infinite divisibility of material bodies in the slightest. If one says that a body consists of infinitely many parts, one imagines the body divided into parts, and says that the number of these parts is infinite. I now ask what type of part is it, the number of which is infinite? There are many types of part, such as halves, thirds, tenths hundredth and so forth. But nobody will say that the number of halve parts, or thirds, or hundredth or thousandths parts are infinite. Instead one states that what is meant is the last parts into which a body has been subdivided at the end of an infinite sequence of subdivisions. Consequently the sentence must be interpreted to mean that the number of these last parts of a body is infinite. But the first sentence expressly denies that there are last parts, since it maintains that however far the subdivision has been taken, it can be continued with equal ease without end, thus excluding totally the possibility of last parts. Accordingly, anybody who claims that a body is infinitely divisible and that at the same time it consists on an infinite number of parts, contradicts himself, and it is little wonder that such an untenable opinion can be overthrown by the most convincing proofs.

13. Although, in view of its divisibility, a body must be regarded as a composite thing, it is nevertheless not composed of simple things; for if it were composed of simple things, it would not be infinitely divisible and would also have no extent.

The extent itself excludes in principle all simple particles, because extent does not admit last particles. For in however many parts one may divide a body, these parts always maintain extent, because of which they can always be subdivided further. Therefore the statement: *where there are composite things, there must also be simple ones* is by no means true, bearing in mind that all parts that one can imagine in a body have extent, and in consequence must be composite. The proponents of simple things argue that the simple things, that constitute a body, are at a distance from each other, and because of this distance have extent. However if all these simple things were at a distance from each other, with nothing between them, there would be nothing to prevent them from being driven together so closely that no distance between them remained. In that case, since all parts have no extent, it should be possible to bring them together in a point, which contradicts experience and logic. One readily admits that in any body there can be a large number of such small spaces, that contain no matter associated with the body itself. Apart from the fact that we make here no distinction between the proper matter of a body and foreign matter, since in the name of a body everything is included that is contained within its extent, even if the distinction is made, the proper matter must occupy a certain part of the total extent, and it is true also for this part, that it must be infinitely divisible. If one does not wish to transform bodies completely into nothing, i.e. into empty space, one

cannot deny them infinite divisibility. But apart from all this, since in the case of a body we mainly think of its extent, there can be no doubt that this extent should be infinitely divisible.

14. From the above, if one refers to the parts of a material body, then this expression is ill-defined unless it is stated after how many subdivisions the parts in question have been obtained.

It has already been shown that one cannot understand the last parts, of which there are none; but if one adds which parts one means, the second, or third or tenth or hundreds, then there is no difficulty, and no objection can be raised against the infinite divisibility of a body. It is often objected that, if material bodies did not consist of a definite number of simple parts, God himself could not completely understand them, which would be most absurd. This argument seems rather weak, since it maintains that God could not understand extended, and therefore composite things other than by their last parts; however who would deny that God could understand completely all actual parts, such as halves, thirds and so on? But an understanding of parts that do not exist, such as the last, can not even be sought with God. But these objections against the infinite divisibility carry little weight, and since we have refuted all those made against the infinite number of parts, the infinite divisibility remains beyond all doubt.

15. Every material body has not only one extent, but is always extended in the so called three dimensions of length, breadth and depth, and it must consequently have a definite shape in all directions.

Whatever has extent in only one direction is called a line, and what has extent in two directions is called a surface; both have extent, but nevertheless they are not bodies, and we have here an example showing that not all things with extent can be considered to be bodies. A body must have threefold extent, in length, in breadth and in depth. There are no further kinds of extent, and consequently a body must possess all possible kinds of extent, that is to say it must have extent in all directions. A body is also bounded all round, and the outer circumference of its extent is called its shape, of which there are infinitely many types, as is shown in geometry. In each individual body this shape is fully determined in all its parts. But when we speak of a body in general, we can ascribe to it no more than the property of adopting a shape, and one must regard this property as indeterminate. But of the parts of a body one cannot say that they have a definite shape, not even if one states the result of how many subdivisions the part is. This is so because one can in infinitely many ways cut from a given body a piece that represents half of the whole, and this piece can therefore have infinitely many shapes. The question as to the shape of the parts of a body is ill-put, and can only be raised by those who maintain that bodies have ultimate parts. But since these parts have no size, the concept of shape becomes inapplicable. This appears sufficient to give us a complete understanding of extent and its properties, so that we will now proceed to the examination of other general properties of material bodies.