I will discuss Aristotle's conception of the extension or matter of bodies (Section 6.4). In this sense, Chapters 5 and 6 together will yield a systematic and detailed theory of bodies.

Chapter 7. In this chapter I introduce the important distinction between continuity and contact. This is an addition to the previous chapters because it enables us to make a topological distinction between the way in which several objects are connected and the way in which the parts of a single object are connected. In this sense, I shift from a description of the topological features of a single body to an analysis of the interrelations between bodies (Section 7.2).

Moreover, I will argue that the topological difference between continuity and contact—the number of boundaries involved—is grounded in the ontological difference between ontologically independent objects and parts of a single object that are not ontologically separate. Continuity is thus connected to the unity of an object. The spatial wholeness and continuity of a body is explained through considerations about the metaphysical status of the body (Section 7.3).

Finally, in Section 7.4, I turn to a more detailed examination of the connection between continuity and unity. The continuity of an object is, I will argue, explained by its form. In this sense, the continuity of an object is grounded in a causal account of its unity. Although no complete account of the ontology of physical substances and their forms will be offered, the section will provide an account of how the study of bodies relates to an overarching analysis of physical substances.

5

Body in *Categories* 6

5.1. Introduction and Framework

Aristotle begins his discussion of the category of quantity in *Categories* 6 by introducing the following classificatory scheme.

> Of quantities [1] some are discrete, others continuous; and [2] some are composed of parts which have position in relation to one another, others are not composed of parts which have position.[1] (*Cat.*6 4b20–23)

Aristotle presents two ways of classifying quantities. On the one hand [1] quantities divide into the continuous and the discrete and on the other [2] into those whose parts have a position and those that do not. Aristotle does not tell us how the two classifications are connected. Rather he discusses both classifications one after the other without explicitly connecting the two.[2] But since Aristotle later claims that 'only these we have mentioned are called quantities strictly, all the others derivatively'[3] (*Cat.*6 5a38–39), we might at least be confident that Aristotle believes that his discussion of quantities is complete and that he has mentioned all of them. That is to say, the discussion which begins at 4b20 and ends at 5a37 contains an exhaustive list of all quantities, and each quantity can be brought under one of the classificatory schemes. The main task in the next sections is to understand the classificatory schemes and to place body within them.

Aristotle proceeds as follows: *given* a list of quantities, some of these are continuous and others discrete, some are composed of parts with position, and others of parts without position. Of course, this leads to the question why Aristotle seems confident that he has in fact covered all quantities. Aristotle has not given sufficient grounds for believing this.[4] However, since for our purposes the classificatory schemes and the classification of body and the basic magnitudes are relevant, the question whether the

[1] *Τοῦ δὲ ποσοῦ τὸ μέν ἐστι διωρισμένον, τὸ δὲ συνεχές· καὶ τὸ μὲν ἐκ θέσιν ἐχόντων πρὸς ἄλληλα τῶν ἐν αὐτοῖς μορίων συνέστηκε, τὸ δὲ οὐκ ἐξ ἐχόντων θέσιν.*

[2] [1] is discussed in *Cat.*6 4b24–5a15 and [2] in *Cat.*6 5a15–37.

[3] *Κυρίως δὲ ποσὰ ταῦτα μόνα λέγεται τὰ εἰρημένα, τὰ δὲ ἄλλα πάντα κατὰ συμβεβηκός.*

[4] An example of a quantity that might be missing is motion. In *Metaph.* V.13 motion appears together with time and place as a derivative quantity. Since time and place are listed as proper quantities in *Categories* 6 one could reasonably argue that in the *Categories* motion should be treated on a par with time and place and hence as a per se quantity. For an interpretation of *Metaph.* V.13 see Appendix A.

list of quantities is complete should not be the focus. What should be our focus instead is the question why Aristotle classifies quantities in the way he does. Classificatory schemes [1] and [2] are not mutually exclusive. A quantity can fall, and in fact every quantity does fall, under both schemes.[5] What is the point of mentioning these ways of classifying quantities at all? Do they give us reason to believe that they are a guide to all the quantities that exist? Or is it rather that they spell out crucial features of quantities that allow a good classification of them as quantities?

I think that the latter is the case. The classificatory schemes spell out a crucial feature of quantities, namely the presence or absence of a topological structure. Body understood as a quantity is an extended spatial item with a certain structure.

Having said this, there is a caveat. The caveat pertains to the status of the *Categories*.[6] Stephen Menn, for example, has argued that the *Categories* as well as the *Topics* do not belong to philosophy, but to dialectic.[7] Menn believes that the scholarly debate on how to understand the difference between the account of substance in the *Categories* and the account of substance in the *Metaphysics* is misguided because the aims of the two treatises are quite different. Accordingly, one might believe that an analysis of quantities in the context of *Categories* 6 is useless because Aristotle never intended to give an analysis there.

However, even if Menn is correct and the *Categories* remains neutral on many controversial questions, I think it should not be denied that the *Categories* mentions and discusses these questions. After all, it should not be impossible for the *Categories* to contradict the physical and metaphysical treatises.[8] Therefore, I am inclined to see the discussion of the *Categories* as presenting a characterization of quantities for the purposes of dialectic. But it does not follow that because the characterization of quantities is made in the context of dialectic, the characterization itself is not to be taken seriously. I think that it should be taken seriously, even though one cannot and should not expect of it a full and detailed analysis of all the issues raised in the *Categories*. But the *Categories* gives—at least in the case of quantities, though I would argue that the same holds for the discussion of substance—an important frame for a deeper discussion. That is, even though dialectic can be done without taking into account a full analysis of the subject matter, it does not follow that the distinctions we find in the *Categories* or the *Topics* are not endorsed by Aristotle. This is especially true if we consider that what Aristotle says about the predicables clearly provides the background for his most mature philosophical thoughts.

Indeed, as Wolfgang Mann remarks, even if we rarely find philosophical explanations in the *Categories*, the distinctions in the *Categories* allow for further

[5] Of course, [1] and [2] taken on their own are mutually exclusive. So no item is both continuous and discrete or such that its parts do and do not have position. But, as shall later become clear, a body is both continuous and has parts that have a position.

[6] Regarding the authenticity of the *Categories* I follow Heidegger: 'Ich halte sie für echt, so etwas macht kein Schüler' (Heidegger 1992, 118). For a comprehensive discussion see Frede 1983; Oehler 1984.

[7] Cf. Menn 1995.

[8] As Menn himself acknowledges. Cf. Menn 1995, 333 fn. 35.

explanations. There is a '*potential availability* of explanations, even if none are provided' (Mann 2000, 4 fn. 4). Therefore, I think that the discussion of the *Categories* can be helpful in precisely these two respects: first, it can be read as a neutral, but nonetheless truthful, characterisation of quantities; second, the presentation we find allows for further explanation and clarification of the doctrine involved. This is indeed, as I will argue, how the presentation of body proceeds.[9]

5.2. The Continuous and the Discrete

Aristotle begins the chapter by dividing quantities in two broad classes. Quantities can be divided into those that are continuous and those that are discrete.

Of quantities some are discrete, others continuous.[10] (*Cat.*6 4b20)

Next, Aristotle systematizes each kind of quantity according to the criterion whether it is continuous or discrete.

Discrete are number and speech; continuous are lines, surfaces, bodies, and also, besides these, time and place.[11] (*Cat.*6 4b22–25)

As I have already said, Aristotle claims in the *Categories* that the items in the list are the only *per se* quantities.[12] If this is the case, we obtain the following complete classification of quantities (see Fig. 5.1.):

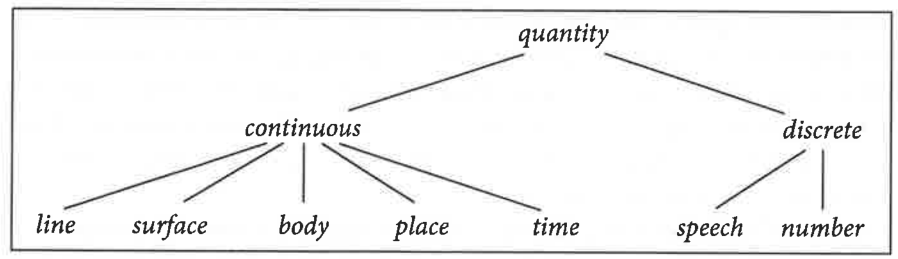


Fig. 5.1.

[9] I do not claim, however, that this is universally true. There might very well be—in fact I am sure that there are—important changes in doctrine between the *Categories* and the *Physics* or *Metaphysics*. As a (controversial) example one might provide Aristotle's account of place. Several commentators have argued that the accounts of place in the *Categories* and in the *Physics* are not compatible with each other (cf. Mendell 1987; Algra 1995). The reason is that the *Categories* suggests an account of place where place figures as something like a container, whereas the *Physics* portrays place as the two-dimensional boundary of the surrounder (cf. *Physics* IV.1–4.). I think, however, a similar move is open here, too. In the *Categories* Aristotle does not provide a full treatment of the ontological constitution of places. Even in the *Physics* Aristotle does not deny that there is a *diastema*, an extension of a place. He only denies that this extension is ontologically independent from the thing in the place.

[10] *Τοῦ δὲ ποσοῦ τὸ μέν ἐστι διωρισμένον, τὸ δὲ συνεχές.*

[11] *ἔστι δὲ διωρισμένον μὲν οἷον ἀριθμὸς καὶ λόγος, συνεχὲς δὲ γραμμή, ἐπιφάνεια, σῶμα, ἔτι δὲ παρὰ ταῦτα χρόνος καὶ τόπος.*

[12] Cf. *Cat.*6 5a38–39.

Body is placed among continuous quantity. The items are classified in a tree-like structure. The top node is quantity, which is divided into the continuous and the discrete, which are subdivided in turn.[13] With regard to the *Categories* the obvious hypothesis is that this represents a genus–species relationship. The continuous and the discrete are genera within the category of quantity. Body is a species within the genus of the continuous. I think that this is the most plausible hypothesis, but for our purposes nothing depends on the question whether these really are genus–species relations or not.

More important is a proper explication of the continuous and the discrete themselves. What are the defining features of the continuous and the discrete?

5.2.1. *The definition of the continuous and the discrete*

Immediately after the last quote Aristotle justifies the claim that number is discrete with the following train of thought:

> For [1] the parts of a number have no common boundary at which they join together. [1a] For example, if five is a part of ten the two fives do not join together at any common boundary but are separate; nor do the three and the seven join together at any common boundary. [1b] Nor could you ever in the case of a number find a common boundary of its parts, but they are always separate. Hence [2] number is one of the discrete quantities.[14] (*Cat.*6 4b25–31)

The word '*γάρ*' signals that [1] is a justification of the claim that number is discrete. A number is discrete because the parts of the number do not join at a common boundary. The general claim [1] is first substantiated by appeal to examples [=1a]. The number ten is discrete because its parts, for instance the two fives, do not share a common boundary. Neither do the seven and the three. The second example indicates that no way of dividing the ten yields two parts that share a common boundary. It has nothing to do with the fives that they do not join. None of the parts of the ten will join another part at a common boundary.

It is noteworthy that in both examples Aristotle does not choose arbitrary parts.[15] Rather, in both instances the parts are adjacent or next to each other.[16] The two fives are next to each other. Moreover, the two fives or the three and the seven are disjoint, that is, they do not share a part. I think the picture Aristotle has in mind is roughly this:

•1 •2 •3 •4 •5 •6 •7 •8 •9 •10

[13] The classification of 'speech' as a quantity might seem odd. But what Aristotle probably has in mind are long and short syllables of spoken language, and not propositions. The former, of course, can be measured.

[14] *τῶν μὲν γὰρ τοῦ ἀριθμοῦ μορίων οὐδείς ἐστι κοινὸς ὅρος, πρὸς ὃν συνάπτει τὰ μόρια αὐτοῦ· οἷον τὰ πέντε εἰ ἔστι τῶν δέκα μόριον, πρὸς οὐδένα κοινὸν ὅρον συνάπτει τὰ πέντε καὶ τὰ πέντε, ἀλλὰ διώρισται· καὶ τὰ τρία γε καὶ τὰ ἑπτὰ πρὸς οὐδένα κοινὸν ὅρον συνάπτει· οὐδ' ὅλως ἂν ἔχοις ἐπ' ἀριθμοῦ λαβεῖν κοινὸν ὅρον τῶν μορίων, ἀλλ' ἀεὶ διώρισται· ὥστε ὁ μὲν ἀριθμὸς τῶν διωρισμένων ἐστίν.*

[15] However, in the *Categories* Aristotle never explains what counts as a part of a quantity.

[16] I use the words 'adjacent to' and 'next to' interchangeably here.

The seven and the three refers probably to the units with the numbering 1 through 7 and 8 through 10.[17] The collection {1, . . . ,7} is next to the collection {8, . . . ,10}. And there is no unit which is part of both collections. I think that we have a pretty good pre-philosophical grasp of what it means to say that one item is next to another. In our example for instance, it seems clear that {1,2} is next to {3,4}, but not next to {5, . . . ,10}. This intuitive notion of 'next to' has an Aristotelian background. In the *Physics* Aristotle defines 'in succession (*ἐφεξῆς*)' as follows:

> A thing is in succession when it is after the beginning in position or in form[18] or in some other respect which has been determined, and when further there is nothing of the same kind as itself between it and that to which it is in succession, e.g. a line or lines if it is a line, a unit or units if it is a unit.[19] (*Ph.* V.3 226b34–227a3)

Aristotle describes an ordering relation which is based on the notions of after (*μετά*) or prior (*πρότερον*) and posterior (*ὕστερον*)[20] and the notion of between (*μεταξύ*).[21] Without going into details I think the main idea behind these concepts can be understood straightforwardly. First, one determines a beginning or first member and arranges the other members according to some definite respect. An entity is posterior to another if it is further away from the beginning (and everything is posterior to the beginning). For example, if one arranges people by height, the shortest person marks the beginning and shorter people are closer to the beginning, whereas taller people are further away. Second, we say that two members of our ordering relation are next to each other if no other member is between them. In other words, I assume that to say 'a thing is in succession when it is after the beginning' does not mean that the thing in question comes right after the beginning. The clause ensures that the thing in question is part of the series and can be ordered according to a certain characteristic.

[17] I am inclined to take these cases merely as examples. It seems foreign to the text to interpret this passage in the light of Pythagorean or Platonic numerology, as Cattanei 2011, 140 does.

[18] The manuscripts FI and Themistius read '*φύσει*' which probably should be preferred. Cf. Waschkies 1977, 175 fn. 32. This is also suggested by a parallel passage in *Metaph.* V.11 1018b10–12. For our present purposes, however, nothing hangs on this. For further discussion of this passage see Section 7.2.

[19] *ἐφεξῆς δὲ οὗ μετὰ τὴν ἀρχὴν ὄντος ἢ θέσει ἢ εἴδει ἢ ἄλλῳ τινὶ οὕτως ἀφορισθέντος μηδὲν μεταξύ ἐστι τῶν ἐν ταὐτῷ γένει καὶ οὗ ἐφεξῆς ἐστιν (λέγω δ' οἷον γραμμὴ γραμμῆς ἢ γραμμαί, ἢ μονάδος μονὰς ἢ μονάδες, ...)*

[20] These notions are the topic of *Metaph.* V.11: 'We call things prior and posterior (1) in some cases (on the assumption that there is a first, i.e. a beginning, in each class) because they are nearer some beginning determined either absolutely and by nature, or by reference to something or in some place or by certain people, e.g. things are prior in place because they are nearer either to some place determined by nature, e.g. the middle or the last place, or to some chance object; and that which is further is posterior' (*Metaph.* V.11 1018b9–14).

[21] Aristotle defines this notion in the following way: 'What is between involves three things at least; for the contrary is a last point in change, and that which a changing thing, changing continuously and naturally, naturally reaches before it reaches that to which it changes last, is between' (*Ph.* V.3 226b23–27). This definition is problematic, since it relies on the concept of a change between contraries. For the purposes of this section I treat 'between' as a primitive notion. It is, however, not too difficult to apply the notion of between in a context where there is, strictly speaking, no change. Consider numbers: if you were to count the numbers from one to ten, you would naturally arrive at the seven before arriving at the ten.

If we apply this to our initial example above the following picture emerges: the one is the beginning, and all the other units are ordered according to their numerical value. The seven is closer to the one than the nine because its numerical value is less. The seven is next to the six because there is no other unit between these.[22]

I think that it is no coincidence that Aristotle's examples satisfy that definition. The claim cannot and should not be that there are some parts which are not connected by a boundary, for example, parts {1,2} and {7,8}. The reason why something is discrete is that its *adjacent* parts are not connected. This becomes even more obvious when we consider continuous objects. For example, my body is a continuous whole, that is, all its parts are connected. However, my arms are not connected with my legs. Does this make my body discontinuous? The answer is no, because my arms and legs are not next to each other (assuming that there is a definite ordering relation according to being a body part).[23] Thus, the question whether something is continuous is the question whether the parts which are next to each other join at a common boundary.

In [1b] the claim that number is discrete is generalized further.[24] No parts of the ten join at a common boundary. This is true of every number. Hence, we can conclude that [2] numbers are discrete quantities.

The argument that lines, surfaces, and bodies are continuous runs similarly.

> [3] A line, on the other hand, is continuous. [4a] For it is possible to find a common boundary at which its parts join together, a point. [4b] And for a surface, a line; for the parts of a plane join together at some common boundary. [4c] Similarly in the case of a body one could find a common boundary—a line or a surface—at which the parts of the body join together.[25]
>
> (*Cat.*6 5a1–6)

Aristotle opens his discussion of the continuous entities with the line (=[3]). In his justification of the claim (=[4a–c]) he includes surfaces and bodies too. The parts of lines, surfaces, and bodies differ from numbers because they have a common boundary. To have a common boundary is to join *at* something. The parts of a line join *at* a point, the parts of a plane *at* a line, and the parts of a body join *at* a surface. In using the phrases to join at or to be connected at something Aristotle is obviously thinking of an object with parts, and those parts as possessing boundaries at which

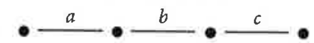
[22] It is obvious that Aristotle's definition presupposes the possibility of an unambiguous order. Numbers, e.g. can be ordered in an unambiguous way since it is easy to specify which numbers are next to each other. But how should one order objects in a three-dimensional space? Aristotle says in *Ph.* V.3 227a3 that two houses are next if there is no house between them. But what if the two houses have the same distance from a third house? Obviously, these cases are hard to explain on the basis of Aristotle's explicit remarks.

[23] cf. *Ph.* V.3 227a17–23. Here, being in succession is presented as prior to and a prerequisite for continuity. I discuss this in Chapter 7.

[24] Notice the word 'ὅλως'.

[25] *ἡ δὲ γραμμὴ συνεχές ἐστιν· ἔστι γὰρ λαβεῖν κοινὸν ὅρον πρὸς ὃν τὰ μόρια αὐτῆς συνάπτει, στιγμήν· καὶ τῆς ἐπιφανείας γραμμήν, – τὰ γὰρ τοῦ ἐπιπέδου μόρια πρός τινα κοινὸν ὅρον συνάπτει. – ὡσαύτως δὲ καὶ ἐπὶ τοῦ σώματος ἔχοις ἂν λαβεῖν κοινὸν ὅρον, γραμμὴν ἢ ἐπιφάνειαν, πρὸς ἣν τὰ τοῦ σώματος μόρια συνάπτει.*

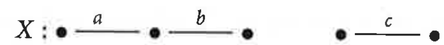
they are connected.[26] The boundary is at least one dimension less than the thing whose boundary it is.[27] As stated above, it is reasonable to assume that the adjacent parts of a line or a body must be connected by a boundary.[28]



Clearly, this line is continuous, though part *a* and part *c* do not join at a common boundary. It is not a counterexample because *a* and *c* are not next to each other.

5.2.2. *Getting the quantifiers right*

Whether an object is discrete or continuous is determined by the absence or presence of a common boundary for the adjacent parts. If X is discrete, its adjacent parts lack a common boundary. If X is continuous, its adjacent parts join at a common boundary. Let us ask ourselves whether *all* the adjacent parts of a continuous object should be connected, or only some? It seems to me that *all* the adjacent parts must be connected. Consider the following example:



Does this represent a continuous line? It seems not to, because parts *b* and *c* are not connected. There are two lines, namely the line consisting of parts *a* and *b* and another line *c*. Therefore, in the case of continuity we should say, it seems, that *all* the adjacent parts must be connected. It is not sufficient for continuity that only some adjacent parts are connected. In our example it is not sufficient that *a* and *b* are connected because the further connection to *c* fails. This, however, makes it difficult to classify X at all, because Aristotle seemingly also holds that no adjacent parts of an object are connected when he says that:

> nor could you ever in the case of a number find a common boundary of its parts, but they are always separate.

This is the only instance where Aristotle makes the quantifier explicit, so one should not take it lightly. However, if we follow Aristotle's assertion that the parts of something discrete *never* have a common boundary, line X is not discrete. Since it is also not continuous, it is neither continuous nor discrete. Of course, one could conclude that division into the continuous and the discrete is not exhaustive. But in my opinion,

[26] Though I leave it to the next chapter to explain precisely what *object* means. For the time being it is sufficient to think of an individual item such as a triangle rather than the property triangularity.

[27] Though it will be discussed later, I wish to say that boundaries are not fictional items. A body is bounded by a surface. The surface is a dependent individual, not a fiat object. The equator is a fiat object. The surface of a cube has for Aristotle a different ontological status. For more on boundaries see Section 6.3. For a modern discussion see Varzi 2008, 1997; Casati and Varzi 1999; Smith 1997a.

[28] Setting aside several topological relations where an object may (intuitively) be said to have two parts which are connected by *two* boundaries. A torus could be an example: its two halves are connected by two boundaries.

this assumption goes against the spirit of these classifications. I believe that Aristotle wants to classify every quantity as either continuous or discrete.[29] So, what shall we say about X? I suggest that X is discrete. I have two reasons for this assumption. The first is simply that it seems to me that X cannot be classified as continuous. I do not think that Aristotle would be willing to classify X as continuous. Hence, it must be discrete. This leads to my second reason. When Aristotle says that discrete objects have no boundaries at which their parts join, he is speaking about numbers. With respect to numbers it is true that *all* the parts are unconnected. The problem is that our object X is in no straightforward sense a number. A number is, roughly, an aggregate of things which are treated as indivisible units.[30] In the case of X, I think, we should say that it represents the number 2. If we think that X represents the number 2, there are two entities $a+b$ and c (rather than one single continuous entity). In this case, the question whether there is a boundary at which part a and part b are connected simply does not arise. It is not the case that X has two continuous parts $a+b$ and another part c that is discrete from $a+b$. Rather there are only two parts $a+b$ as an indivisible unit and c as another indivisible unit.

In general, an object should be regarded as discrete if the connection between its parts fails once. If my analysis of objects such as X is correct, an object is discrete if at least some of its adjacent parts are not connected.[31]

5.2.3. *Defining the continuous and the discrete*

The criterion determining whether something is continuous or not is the connection of its parts. A body, for example, is continuous because it is connected. How should we understand this 'because'? Though Aristotle does not say so explicitly I think we might reasonably interpret it as a definition of the continuous. To be continuous is defined by having parts that join at a boundary, and to be discrete is defined by the lack of such a connection. I think that Aristotle not only mentions a necessary condition for continuity,[32] but in fact spells out what it is to be continuous. To be connected in the right way is necessary *and* sufficient for being continuous.

Proposition 2. *X is continuous (CONT)* $=_{def}$ *All the adjacent parts of x are connected by a boundary.*

Proposition 3. *X is discrete (DISC)* $=_{def}$ *Some adjacent parts of x are not connected by a boundary.*

[29] Notice that this is also the case if these distinctions are drawn for dialectical purposes. For it seems plausible that winning the dialectical 'quantity-game' gets difficult if the classifications of quantities are not exhaustive.

[30] Cf. *Metaph.* XIII.3 1077b30.

[31] I am not saying that Aristotle explicitly considered such an example. My suggestion is that examples like this are not foreign to Aristotelian texts and all the tools we need for an answer can be extracted from the texts.

[32] In logical terms: X is continuous only if the parts of X are connected.

5.2.4. *Some limitations of the theory*

Aristotle's discussion in the *Categories*, however, has certain limitations that should not escape attention. These limitations are, I believe, mostly due to the status of the *Categories* and the resulting caveat I discussed in Section 5.1. In the context of the present discussion the most important limitation concerns the absence of the distinction between continuity and contact. This distinction is crucial in his discussion in *Physics* V.3.[33] In the *Categories* Aristotle even uses the word 'being in contact (συνάπτειν)' in his elucidation of continuity. This can be misleading because in other contexts 'contact (ἅφη)' is explicitly contrasted with 'continuity (συνέχεια)'.[34] The absence of this distinction means that on the basis of the theory of the *Categories* one cannot distinguish between the case of several *things* that touch each other and several *parts* of one thing that join. Take Fig. 5.2 as an example:

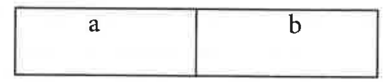


Fig. 5.2.

In the *Categories* Aristotle gives us no guidelines to decide the question whether the picture shows *two* objects a and b that touch each other or *one* object that has a and b as parts. Or consider the following two objects in Fig. 5.3:[35]

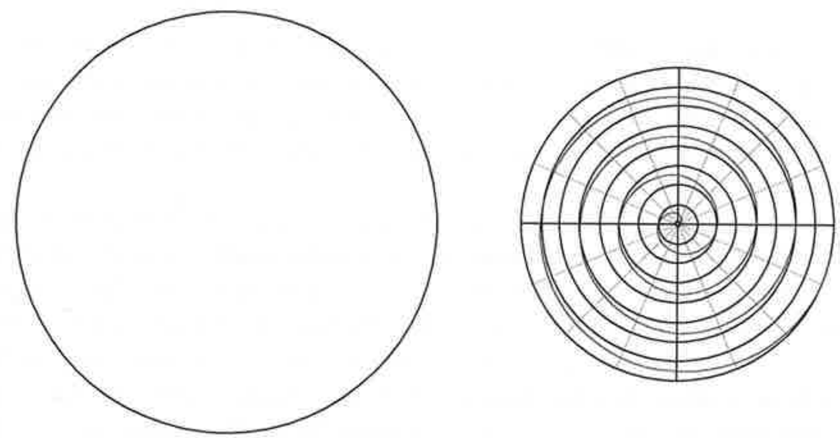


Fig. 5.3.

Do they have the same topological arrangement? Both are continuous objects and both look like discs. In both cases there are no 'holes' in the object. Yet there seems

[33] See Chapter 7 for a detailed discussion.

[34] Cf. *Ph.* V.3 and *Metaph.* III.5 1002a34–b5.

[35] Except the spiral which is from wikipedia (http://en.wikipedia.org/wiki/Archimedean_spiral) all other graphics in this work were kindly provided by Mareike Witt.

to be a difference between those objects.[36] If one thinks of the second object as a snake, one can see the difference. The spiral line can be seen as the skin of the snake at which the parts are not continuous, but merely in contact. The difference between continuity and contact, however, is not explicitly drawn in the *Categories*. We learn that something is continuous if and only if all its adjacent parts join at a common boundary. But whether and in what respect 'joining at a common boundary' is different from 'being in contact' is not stated in the *Categories*.[37] As a consequence, in the *Categories* CONT and DISC are not fully explained because the notion of being connected by a boundary is not fully explained. In other words, Aristotle states both in the *Categories* and in *Physics* V.3 that the parts of something continuous join at a 'common boundary'.[38] I believe that it is plausible to think that he means the same. But from the *Categories* we cannot tell whether this is so. And the reason is that only in the *Physics* Aristotle explicitly contrasts 'being continuous' with 'being in contact'. The theory from the *Categories* is in this respect not specific enough.

A similar limitation might hold of the notion of part that is employed in the *Categories*. Aristotle does not explicitly define what counts as a part, but I think it is plausible that the notion of part employed here corresponds to the first sense of part distinguished in *Metaphysics* V.25:

> We call a part that into which a quantity can in any way be divided; for that which is taken from a quantity qua quantity is always called a part of it, e.g. two is called in a sense a part of three.[39]
>
> (*Metaph.* V.25 1023b12–15)

The parts into which a quantity, insofar as it is a quantity, can be divided are themselves quantities. The parts into which a surface can be divided are themselves surfaces, as opposed to the colour of the surface which is a part in another sense. This, however, does not yet tell us whether, for example, points are parts of the line. In chapter six of the *Categories* Aristotle does not inform us.[40]

However, I think that these limitations should not be seen as a serious shortcoming. As I said earlier, in the *Categories* Aristotle is not concerned with laying out a complete theory. This is not the purpose of the *Categories*. However, I think Mann is right in emphasizing the '*potential availability* of explanations, even if none are provided' (Mann 2000, 4 fn. 4). The account of the *Categories* can be consistently extended by accounts of quantities from the *Metaphysics* or *Physics*. The necessary distinctions can be drawn using the *Categories*' account as a basis which is then further augmented. Although, admittedly, many questions are left open, the question can be answered by taking in more material and not by revising or rejecting the account of the *Categories*.

[36] Or to be more precise: given the expressive power of Aristotle's theory we can draw a distinction between those objects.

[37] I address this question in Chapter 7.

[38] *Contra* Cattanei 2011, 137 who thinks that the *Categories* and the *Physics* disagree on this point.

[39] *Μέρος λέγεται ἕνα μὲν τρόπον εἰς ὃ διαιρεθείη ἂν τὸ ποσὸν ὁπωσοῦν (ἀεὶ γὰρ τὸ ἀφαιρούμενον τοῦ ποσοῦ ᾗ ποσὸν μέρος λέγεται ἐκείνου, οἷον τῶν τριῶν τὰ δύο μέρος λέγεταί πως).*

[40] For a discussion see Sections 6.3 and 6.4.

Nevertheless, there are two questions pertaining to Aristotle's conception of continuity and discreteness that need to be addressed at this stage. First, is this the correct explication of continuity? Second, is the division of quantities into continuous and discrete successful? These questions need to be addressed here because a failure to answer them threatens the usefulness of the *Categories* for a general account of bodies and magnitudes.

5.2.5. *Is it really the definition of continuity?*

I presented CONT and DISC as definitions. I think that they indeed capture the essence of the continuous and the discrete. In particular, I think that this is the same definition that Aristotle uses in other works as well. My argument comes from looking at non-technical as well as technical uses of the word '*τὸ συνεχές*'.

5.2.5.1. CONTINUITY AND CONNECTION

In a non-technical sense *τὸ συνεχές* translates best as 'that which holds together', which captures the composition of the word from *σύν* and *ἔχω*.[41] Moreover, Aristotle himself uses that derivation to explain the meaning of the word. In his entry on '*ἔχειν*' in *Metaphysics Delta* he remarks:

> That which hinders a thing from moving or acting according to its own impulse is said to have it, as pillars have the incumbent weights, and as the poets make Atlas have the heavens, implying that otherwise they would collapse on the earth, as some of the natural philosophers also say. In this way that which holds things together is said to have the things it holds together, since they would otherwise separate, each according to its own impulse.[42]
>
> (*Metaph.* V.23 1023a17–24)

Aristotle emphasizes the active role which something that holds together exerts. Of course, it is going too far to assume that continuous things are generally held together by active forces. Nonetheless this passage makes an important point. Continuous objects are connected and hold together. They are 'ones', as Aristotle says in *Metaphysics* V.6.[43]

Correspondingly, Aristotle defines the continuous explicitly as a kind of connection.

> Now if the terms 'continuous', 'in contact', and 'in succession' are understood as defined above—things being continuous if their extremities are one, in contact if their extremities are together, and in succession if there is nothing of their own kind between them, ...[44]
>
> (*Ph.* VI.1 231a21–23)

[41] Cf. Liddell et al. 1996, *ad loc.*

[42] *ἔτι τὸ κωλῦον κατὰ τὴν αὑτοῦ ὁρμήν τι κινεῖσθαι ἢ πράττειν ἔχειν λέγεται τοῦτο αὐτό, οἷον καὶ οἱ κίονες τὰ ἐπικείμενα βάρη, καὶ ὡς οἱ ποιηταὶ τὸν Ἄτλαντα ποιοῦσι τὸν οὐρανὸν ἔχειν ὡς συμπεσόντ' ἂν ἐπὶ τὴν γῆν, ὥσπερ καὶ τῶν φυσιολόγων τινές φασιν· τοῦτον δὲ τὸν τρόπον καὶ τὸ συνέχον λέγεται ἃ συνέχει ἔχειν, ὡς διαχωρισθέντα ἂν κατὰ τὴν αὑτοῦ ὁρμὴν ἕκαστον.*

[43] *Metaph.* V.6 1015b35–16a1.

[44] *Εἰ δ' ἐστὶ συνεχὲς καὶ ἁπτόμενον καὶ ἐφεξῆς, ὡς διώρισται πρότερον, συνεχῆ μὲν ὧν τὰ ἔσχατα ἕν, ἁπτόμενα δ' ὧν ἅμα, ἐφεξῆς δ' ὧν μηδὲν μεταξὺ συγγενές, ...*

The reference goes back to *Physics* V.3, where we find the same definition:

> The continuous is a certain kind of the contiguous: I call things 'continuous' when the limits of each at which they are in contact become one and the same and, as the word implies, hold together.[45] (*Ph.* V.3 227a10–12)

I think that this definition of the continuous is a further elucidation of the definition we find in the *Categories*.[46] But regardless of the question how the connection should be precisely spelled out it seems clear to me that the continuous is in Aristotle's writings defined as a kind of connected entity.

5.2.5.2. CONTINUITY AND DIVISIBILITY

The reader may suspect that my account contradicts the position that continuity is defined by infinite divisibility. In this vein Wieland thinks that the definition of the continuous as a connected entity is preliminary and is later replaced by the proper definition of the continuous as something that is infinitely divisible.[47] Of course, I do not wish to deny that according to Aristotle continuous things are infinitely divisible. But I believe that this is a theorem or inference about the continuous, rather than a matter of definition. I think that Aristotle argues in *Physics* VI.1 that because a continuous entity is defined by having parts that are connected by a boundary, it cannot consist of indivisible parts, nor can it be divided into indivisibles.[48] It is admittedly hard to tell whether the argument begins with an intuitive understanding of continuity and leads to a proper definition, as Wieland believes, or whether the argument begins with the definition of the continuous and deduces what follows from it, as I claim. But I think that the following passage might tip the scales in favour of my reading:

> All magnitudes, then, which are divisible are also continuous. Whether whatever is continuous is also divisible is not yet, on our present grounds, clear.[49] (*Cael.* I.1 268a28–30)

This question would obviously be senseless if the continuous were defined outright as being infinitely divisible. This passage suggests therefore that Aristotle kept the notion of divisibility and the notion of continuity apart. Continuity is not defined in terms of divisibility. Rather, infinite divisibility is a consequence of the account of continuity. Moreover, it seems plausible to assume that the question Aristotle raises in *De Caelo*

[45] *τὸ δὲ συνεχὲς ἔστι μὲν ὅπερ ἐχόμενόν τι, λέγω δ' εἶναι συνεχὲς ὅταν ταὐτὸ γένηται καὶ ἓν τὸ ἑκατέρου πέρας οἷς ἅπτονται, καὶ ὥσπερ σημαίνει τοὔνομα, συνέχηται.*

[46] I discuss the definition from the *Physics* at length in Chapter 7.

[47] Cf. Wieland 1975, 257–8.

[48] Cf. *Ph.* VI.1 231a21–b18. For an analysis see Section 6.4.5 and the literature mentioned there.

[49] *Ὅσα μὲν οὖν διαιρετὰ τῶν μεγεθῶν, καὶ συνεχῆ ταῦτα· εἰ δὲ καὶ τὰ συνεχῆ πάντα διαιρετά, οὔπω δῆλον ἐκ τῶν νῦν.*

is in fact answered in *Physics* VI.1.[50] Accordingly, I believe that the logic of Aristotle's argument in *Physics* VI.1 has to be understood thus:

> Moreover, it is plain that [1] everything continuous is divisible into divisibles that are always divisible; for [2] if it were divisible into indivisibles, we should have an indivisible in contact with an indivisible, since [2a] the extremities of things that are continuous with one another are one and are in contact.[51] (*Ph.* VI.1 231b15–18)

Aristotle shows that something continuous cannot be made up by indivisibles *because* they cannot touch each other in the way that is requisite for continuous entities. Aristotle states in [1] that something continuous is divisible ad infinitum. This is a theorem about the continuous. But it is not built into the definition of the continuous. It is not the case that someone who supposes that the continuous is composed of indivisibles has failed to understand what continuity means. Therefore, Aristotle supports his claim in [2] by a *reductio* argument. If it were the case that the continuous is composed of indivisibles, those indivisibles should be in contact. It is in [2a] that Aristotle relies on the definition of the continuous. Since the extremities of the parts of the continuous are in contact and one, or, as we might also put it, have a common boundary, and since indivisibles cannot be in contact with each other,[52] it is impossible that the continuous is composed of indivisibles. But if it cannot be composed of indivisibles, it must be composed of divisibles. Thus, we see that Aristotle provides a full-blown argument to the effect that everything continuous is divisible ad infinitum.[53]

All these passages point towards the fact that the notion of continuity that is employed in the *Categories* is not deviant, but compatible with other central texts on continuity.

5.3. Having Parts with Position versus Having Parts without Position

Besides the division into the continuous and the discrete Aristotle offers another classification as well.

[50] Commentators of *De Caelo* agree with me that this is the place where the question is addressed. Cf. Leggatt 1995; Jori 2009, *ad loc.*

[51] *φανερὸν δὲ καὶ ὅτι πᾶν συνεχὲς διαιρετὸν εἰς αἰεὶ διαιρετά· εἰ γὰρ εἰς ἀδιαίρετα, ἔσται ἀδιαίρετον ἀδιαιρέτου ἁπτόμενον· ἓν γὰρ τὸ ἔσχατον καὶ ἅπτεται τῶν συνεχῶν.*

[52] As was argued before by Aristotle. Cf. *Ph.* VI.1 231a18–b10.

[53] As I said, these arguments will be reviewed in greater detail in Section 6.4.5. Of course, it is an intricate question what a defining feature is in contrast to something that follows from this feature. Aristotle clearly believes that it is metaphysically (in our sense of the word) impossible that the continuous is composed out of indivisibles. Neither it is an empirical question. Hence one might question on what grounds one can distinguish between the defining properties of the continuous and those properties it has as a consequence of that definition. Yet, I think that the test I offered points in the right direction. To argue about the continuous at all one has to grasp what it is. That it is ever-divisible is not part of what it is to be continuous. Otherwise Aristotle would hardly feel the need for an elaborate argument.

Further, some quantities are composed of parts which have position in relation to one another, others are not composed of parts which have position.[54] (*Cat.* 6 5a15–16)

Aristotle does not say how he thinks that this classification corresponds to classification into the continuous and the discrete. Yet his discussion makes it clear that the quantities are arranged thus (see Fig. 5.4):[55]

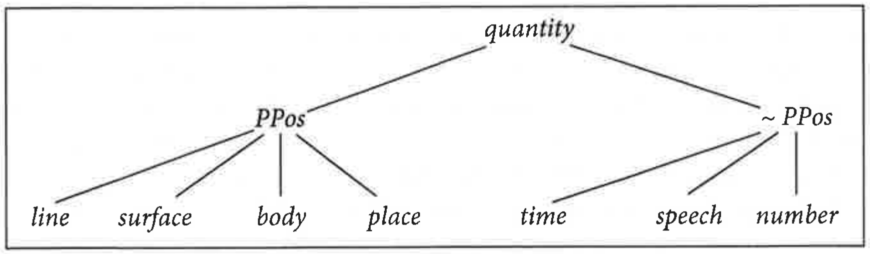


Fig. 5.4.

The classification suggests that the extension of *having parts with position* is a subclass of *being continuous*, because everything that has parts with position is continuous, but not vice versa. In logical terms we may say that *having parts with position* implies *being continuous*. The difference between the two classifications is that time does not have parts with position, but is nonetheless continuous.

Besides the extensional difference regarding the classification of time, we should ask in what way the notions of *continuity* and *having parts with position* differ intensionally. Is there a definitional nexus between the two or are they definitionally independent from each other?

For example, the parts of a line have position in relation to one another. [PPos] For each of them is situated somewhere, and you could distinguish them and say where each is situated in the plane and [CONT] which one of the other parts it joins on to. Similarly, the parts of a plane have some position. For one could say [PPos] where each is situated and [CONT] which join on to one another. So, too, with the parts of a solid and the parts of a place.[56] (*Cat.* 6 5a17–23)

Aristotle apparently justifies (note the *γάρ*) his claim that the parts of a line have position in relation to one another by invoking two criteria. First, the parts are situated somewhere, and more precisely they are distinguishable such that one could name their position. Second, all the parts join to one another. The second condition is, of course, what defined *being continuous*. The occurrence of CONT is probably due to the aforementioned example of the line. For, if one considers the positional relations

[54] *Ἔτι τὰ μὲν ἐκ θέσιν ἐχόντων πρὸς ἄλληλα τῶν ἐν αὐτοῖς μορίων συνέστηκεν, τὰ δὲ οὐκ ἐξ ἐχόντων θέσιν.*

[55] Cf. *Cat.* 6 5a15–37; Studtmann 2002, 2004.

[56] *οἷον τὰ μὲν τῆς γραμμῆς μόρια θέσιν ἔχει πρὸς ἄλληλα, – ἕκαστον γὰρ αὐτῶν κεῖταί που, καὶ ἔχοις ἂν διαλαβεῖν καὶ ἀποδοῦναι οὗ ἕκαστον κεῖται ἐν τῷ ἐπιπέδῳ καὶ πρὸς ποῖον μόριον τῶν λοιπῶν συνάπτει· – ὡσαύτως δὲ καὶ τὰ τοῦ ἐπιπέδου μόρια θέσιν ἔχει τινά, – ὁμοίως γὰρ ἂν ἀποδοθείη ἕκαστον οὗ κεῖται, καὶ ποῖα συνάπτει πρὸς ἄλληλα. – καὶ τὰ τοῦ στερεοῦ δὲ ὡσαύτως καὶ τὰ τοῦ τόπου.*

between the parts of a line it is natural to assume that it is possible to say where the line parts join to each other. But this is true in virtue of the line being continuous, not in virtue of its parts having a certain position. Therefore, one should not assume that *θέσις* is necessarily tied to continuity.[57] It is, of course, perfectly conceivable for two *non-continuous* objects to stand in a positional relation. Aristotle uses in the *Categories* the example of the density of an aggregate. An aggregate is dense if and only if its parts are close to each other.[58] This is, as Aristotle himself says, a positional relation. Moreover, as we will learn later, the exclusion of time is due to the fact that the parts of time do not exist at the same time.[59]

If my analysis is correct so far, the definition of *having parts with position* (PPos) should be stated like this:

Proposition 4. *x has parts with position (PPos)* $=_{def}$ *x has parts which [1] are (definitely) spatially situated and [2] exist at the same time.*

In what follows I shall first spell out what I understand by the two conditions and then present some more evidence on the notion of position by drawing on other related texts.

5.3.1. PPos considered

For an object to have parts with position, it must satisfy two criteria. Its parts must be [1] definitely situated and [2] exist at the same time. To be sure, the two conditions are not independent of each other. The parts of an object cannot be definitely situated (=[1]), if they do not exist at the same time (=[2]). Yet, for expository reasons, it is useful to discuss the two conditions separately.

At some points, Aristotle seems to suggest that *being situated somewhere* (*κεῖσθαί που*) and *having a position* (*θέσις ἔχειν*) are roughly equivalent.

With a number, on the other hand, one could not observe that the parts have some position in relation to one another or are situated somewhere.[60] (*Cat.* 6 5a24–25)

This quotation may suggest that *being situated somewhere* is a mere stylistic variant of *having parts with position*. Though it surely is difficult to keep these two apart, I am inclined to take *being situated somewhere* as an explication of *having a position*.

First, this is suggested by what seems to me the more authoritative passage that I quote above and which reads:

For example, the parts of a line have position in relation to one another. [PPos] For each of them is situated somewhere, and you could distinguish them and say where each is situated in the plane. (*Cat.* 6 5a17–19)

[57] *Contra* Cattanei 2011, 148. She thinks that being continuous is part of the definition of PPos.

[58] *Cat.* 8 10a19–21. This is obviously close to a definition of density as mass per volume.

[59] *Cat.* 6 5a26–28.

[60] *ἐπὶ δέ γε τοῦ ἀριθμοῦ οὐκ ἂν ἔχοι τις ἐπιβλέψαι ὡς τὰ μόρια θέσιν τινὰ ἔχει πρὸς ἄλληλα ἢ κεῖταί που.*

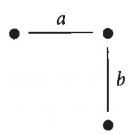
The notion of being situated somewhere is here used as an explication of the notion of position, as is signalled by the word 'for (γάρ)'.

Second, 'being situated somewhere' is, in terms of the concepts employed, richer. Its very words make the idea of some sort of spatiality (πoυ) explicit.[61] Therefore, I assume that 'being situated somewhere' is more basic and an explanation of 'having a position'.

As Aristotle makes clear, the first criterion [1] not only requires that the parts are somewhere in an indefinite sense, but that they have a precise position.

For each of them [i.e. parts of a line] is situated somewhere, and you could distinguish them and say where each is situated in the plane. (*Cat.* 6 5a18–19)

I do not think that Aristotle has some sort of epistemological argument in mind here. He does not mean to say that a mathematician or anyone else has a certain ability to distinguish the parts of a line. Rather, he says that the parts of a line not only lie *somewhere* on a plane, but have a specific and determinate position. They are, as we will say, definitely situated. Consider the following line, which is composed of two parts.



Part *a* and part *b* not only have a common boundary, but stand in a positional relation to each other. They are connected in a 90 degree angle, and one part is below the other. Having a position thus implies that the parts have a certain kind of spatial orientation towards each other.[62] Therefore, the division of quantities into those whose parts have position and those whose parts do not is a division into what we might call spatial entities and non-spatial entities. By 'spatial entity' I mean any object that has these positional properties. In this sense, position (θέσις) is a relation between the parts of an object.[63] In the *Categories* it is a relation between the parts of an object which assigns a certain position to them. The key concept for assigning a position to the parts is the notion of *being somewhere*. This notion is central to the notion of spatiality I wish to describe. Moreover, things that have parts with position are coextensive with things that have extension.[64] In this sense, only extended things have parts with position which suggests the appropriateness of the term 'spatiality'.

[61] Note that the term 'spatiality' is used as a translation of what it means to be πoυ. It is distinct from the related notions of 'space' and 'place'.

[62] Cf. *Ph.* IV.1 208b12–25. I discuss the passage below. [63] Cf. *Cat.* 7 6b12.

[64] Cf. the reference to extension in the definition of quantities in *Metaph.* V.13: 'In magnitude, that which is continuous in one dimension is length, in two breadth, in three depth. Of these, limited plurality is number, limited length is a line, breadth a surface, depth a body' (*Metaph.* V.13 1020a11–14).

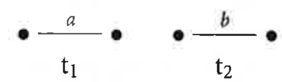
We may further clarify this by turning to the existence condition (=[2]). Thus, the grounds on which Aristotle denies position to the parts of time is that they do not endure (ὑπομένει).

Nor with the parts of a time either; for none of the parts of a time endures, and how could what is not enduring have any position? Rather might you say that they have a certain order in that one part of a time is before and another after.[65] (*Cat.* 6 5a26–30)

The parts of something have position only if they endure (ὑπομένει). The parts of time are continuous, they join at a common boundary. They have a certain order insofar as the parts of time imply an ordering by priority.[66] Perhaps we can even say that the parts of time exist insofar as the past has existed, the present exists now, and the future will exist. But the parts do not stand in a positional relation in a stricter sense, because for Aristotle things which have position must exist *at the same time*.

This, I submit, is another reason for thinking that θέσις is a *spatial* relation. It seems generally true that things standing in spatial relations have to exist at the same time. Let us return to the example of the line.

The line-part *a* is to the left of part *b* and the line-part *b* is to the right of part *a*. But now let us imagine that the parts do not exist simultaneously:



At t_2 line-part *a* has no position with respect to part *b*. It is neither left nor right of *b*. Part *a* does not exist at all. It seems nonsensical to say that part *a* is left of part *b*. This sets spatial objects apart from other entities. Only spatial objects have parts with position, which presupposes the simultaneous existence of the parts. Aristotle's rhetorical question: 'how could what is not enduring have any position?' (*Cat.* 6 5a27–28), is thus certainly not superfluous, as Ackrill maintains.[67] Quite to the contrary: it is (among other things) what distinguishes a spatial order from other types of order, which is precisely what Aristotle does when he says that the parts of time and number have order (τάξις), but not position (θέσις). The kernel of truth that lies in Ackrill's remark is that θέσις indeed brings in the idea of spatiality.

5.3.2. Position, place, and space

It is important, though, that one keeps the notions of position and spatiality distinct from the notion of space or the notion of place. To begin with, one cannot equate the former with space. Θέσις is a spatial or topological relation between the parts of an

[65] οὐδὲ τὰ τοῦ χρόνου· ὑπομένει γὰρ οὐδὲν τῶν τοῦ χρόνου μορίων, ὃ δὲ μή ἐστιν ὑπομένον, πῶς ἂν τοῦτο θέσιν τινὰ ἔχοι; ἀλλὰ μᾶλλον τάξιν τινὰ εἴποις ἂν ἔχειν τῷ τὸ μὲν πρότερον εἶναι τοῦ χρόνου τὸ δ' ὕστερον.

[66] Cf. *Metaph.* V.11 1018b14–19. [67] Cf. Ackrill 1963, 94.

object, and Aristotle explicitly says that the parts are situated *somewhere* (*κεῖταί που*) which seems to presuppose some kind of space. However, one should not presuppose that it involves a reference to an *independently existing* space. Speaking of spatial relations does not commit us to the view that Aristotle believed in a space that is independent from those objects. More likely, it is an abstract way of describing the spatial configuration of an object. It describes the spatial arrangements of the parts, an arrangement which presupposes the existence of the parts and which brings in the idea of spatiality. This, to repeat, does not require the actual existence of a space, but only the applicability of concepts like extension, being apart from and being close to, above, below, etc. We might freely speak of one part being above the other or a line being extended in one dimension without implying an ontological correlate.

On the other hand, the notion of position clearly is connected to the six spatial directions.[68] If the parts of a body have a certain position, one can apply notions such as up, down, left, and right. Moreover, all the things that have parts with position are extended in one, two, or three dimensions. This warrants the title of 'spatial entities'.

Second, the notion of spatiality is independent from the concept of place (*τόπος*) as we find it in the *Physics*.[69] *Having a position* or, as we might say, *being somewhere* is distinct from *being in a place*. Two examples may show this. First, only movable bodies have a place, but mathematical items which are unmoved and have no place nevertheless have position.[70] Second, the parts of an extended object are positionally related, but they do not have a place. Thus, being in a place and having a position are distinct.[71]

Moreover, it even seems that the notion of position is more basic than the notion of place because in the explication of the concept of place Aristotle makes use of positional relation, for example the coincidence of the boundaries of the surrounded and the surrounder. The notion of surrounding is a positional relation.[72]

All of the above shows, it seems to me, that Aristotle has a notion of position in mind which differs both from having a place and an (abstract) space.

5.3.3. *Further evidence on* thesis

I have argued that the notion of position is a topological or spatial relation between the parts of an object. Though not identical to having a place, it clearly is the case that only spatially extended objects have parts with position. That the idea of a determinate

[68] Cf. *Ph.* IV.1 208b12–25 and my discussion in Section 5.3.4.
[69] For a comprehensive interpretation of Aristotle's account of place in the *Physics* see Morison 2002.
[70] *Ph.* IV.1 208b22–25. [71] *Ph.* IV.1 211a29–31.
[72] I am, of course, referring to the notion of place as it is expounded in the *Physics*. It is still debated how the notion of place in the *Categories* relates to the notion of place in the *Physics*. Cf. Morison 2002; Mendell 1987, 2005. But whatever the precise relation it seems that the *Categories* account of place also makes place explanatorily posterior to the concept of position. The reason is that in the *Categories* place is a species of things that have parts with position. In this sense, explaining what place is relies on an elucidation of what position is.

spatial position is important is implicit in the way in which Aristotle distinguishes between points and units.

> That which is in no way divisible in quantity is a point or a unit—that which has no position is a unit, that which has a position is a point.[73] (*Metaph.* V.6 1016b29–31)

Both a unit and a point are indivisible. But they are distinct types of entities. A unit is a measure of numbers and it belongs to discrete quantity and lacks a position. The point, on the other hand, belongs to continuous quantity, though it is not itself a quantity.[74] A point is, to pick up our characterization, definitely situated on a line; each point has a precise position in relation to all the other points that are on the line.[75]

The second passage comes from *On Generation and Corruption*.

> Nevertheless contact in the strict sense belongs only to things which have position. And position belongs only to those things which also have a place; for in so far as we attribute contact to the mathematical things, we must also attribute place to them, whether they exist in separation or in some other fashion.[76] (*GC* I.6 322b32–323a3)

Aristotle defines the notion of contact in this passage and maintains that the proper sense of contact applies only to things which have a position.[77] He then draws the further inference that things that have position have place too. Again, the importance of this passage comes from the explicit connection between *having a position* and *having a place*. *Having a position* is a spatial property which is closely connected to, but still conceptually distinct from, having a place. In *On Generation and Corruption* Aristotle restricts contact in the proper sense to physical bodies which are the per se occupants of places. In the same vein he restricts *having a position* to things that are in a place. This seemingly contradicts the account of the *Categories* as well as the

[73] *τὸ δὲ μηδαμῇ διαιρετὸν κατὰ τὸ ποσὸν στιγμὴ καὶ μονάς, ἡ μὲν ἄθετος μονὰς ἡ δὲ θετὸς στιγμή.*
[74] Because a point has no parts that can be connected nor is a point measurable as quantities. Cf. *Metaph.* V.13.
[75] The example with points and units is problematic for two reasons. First, according to the *Categories* points are not quantities. In the *Categories* points are not mentioned as quantities and they do not satisfy either classification since they are neither continuous nor do they have *parts* with position. Hence, I use the weaker expression that points *belong* to continuous quantity (since they are the boundary of lines) and units to discrete quantity (since they are the measure by which numbers are counted). Second and related, position is a relation between the parts of an object, but, strictly speaking, points are not parts, but boundaries of a line (see Section 6.3). Thus, it may seem that points cannot have a position at all. However, it should be remembered that in *Categories* 6 Aristotle glosses over this distinction, or does not explain what criteria are set on parthood. Moreover, if we allow for a slightly weaker notion of part which includes items that *belong* to the magnitude in question, as limits surely do, the notion of position is applicable to points. This also makes intuitive sense because, if, e.g. we take two points A and B on a line, A could be said to be positioned to the right of B. In this respect, there seems to be no difference to parts. What is important for our purposes is that position marks a distinction between entities with spatial properties and other objects. A point belongs to spatial entities because it has a certain position whereas units do not.
[76] *Ὅμως δὲ τὸ κυρίως λεγόμενον ὑπάρχει τοῖς ἔχουσι θέσιν, θέσις δ' οἷσπερ καὶ τόπος· καὶ γὰρ τοῖς μαθηματικοῖς ὁμοίως ἀποδοτέον ἁφὴν καὶ τόπον, εἴτ' ἐστὶ κεχωρισμένον ἕκαστον αὐτῶν εἴτ' ἄλλον τρόπον.*
[77] For a detailed interpretation of *GC* I.6 see Natali 2004; Williams 1982; Joachim 1926; Buchheim 2010. Buchheim, however, constructs the logic of the sentence quite differently.

Physics, where mathematical entities have a position but no place. I am inclined to explain the discrepancy by distinguishing between a narrow sense of *θέσις* and a broad sense. In *On Generation and Corruption* Aristotle maintains that the things which have a position in the primary sense are only physical bodies. Mathematical entities have position only in a secondary sense. The reason for this is, I believe, the different ways in which *θέσις* involves the six spatial directions. If spatial directions are understood objectively, then things having a position must have a place, that is, the relation of *θέσις* enables the applicability of the six spatial directions, up, down, left, right, etc. In *On Generation and Corruption* Aristotle understands these as objectively given. *Thesis* implies the six spatial directions which in turn imply place, *if one understands the directions objectively.*

5.3.4. Thesis *and the six spatial directions*

This brings us to the interesting question of the precise way in which position relates to the six spatial directions. In the *Categories* position is a relation between the parts of an object. Or perhaps more generally, it is a relation between objects. Since it is a spatial relation it seemed appropriate to say that one part lies to the left of another part. Yet, the assignment of left and right is in many cases not objectively determined, as Aristotle points out in the *Physics*, where he contrasts having a position with having a place by demarcating a difference in the way things relate to the six spatial directions.

> Now these are parts and kinds of place—up and down and the rest of the six dimensions. Nor do these (up and down and right and left) hold only in relation to us. Relative to us they are not always the same but depend on the position in which we are turned: that is why the same thing is often both right and left, up and down, before and behind. But in nature each is distinct and separate. Above is not anything you like, but where fire and what is light are carried; similarly, too, down is not anything you like but where what has weight and what is made of earth are carried—the implication being that they do not differ merely in position, but also in power. This is made plain also by mathematical objects. Though they have no place, they nevertheless, in respect of their position relatively to us, have a right and left as these are spoken of merely in respect of position, not having by nature these various characteristics.[78]
>
> (*Ph.* IV.1 208b12–25)

Aristotle points out that 'up' and 'down' are objectively determined in the natural world. Up is where fire is or naturally tends to. Mathematical items do not have a place, and yet it is possible to ascribe the six spatial directions to them. One can characterize

[78] *ταῦτα δ' ἐστὶ τόπου μέρη καὶ εἴδη, τό τε ἄνω καὶ τὸ κάτω καὶ αἱ λοιπαὶ τῶν ἓξ διαστάσεων. ἔστι δὲ τὰ τοιαῦτα οὐ μόνον πρὸς ἡμᾶς, τὸ ἄνω καὶ κάτω καὶ δεξιὸν καὶ ἀριστερόν· ἡμῖν μὲν γὰρ οὐκ ἀεὶ τὸ αὐτό, ἀλλὰ κατὰ τὴν θέσιν, ὅπως ἂν στραφῶμεν, γίγνεται (διὸ καὶ ταὐτὸ πολλάκις δεξιὸν καὶ ἀριστερὸν καὶ ἄνω καὶ κάτω καὶ πρόσθεν καὶ ὄπισθεν), ἐν δὲ τῇ φύσει διώρισται χωρὶς ἕκαστον. οὐ γὰρ ὅ τι ἔτυχέν ἐστι τὸ ἄνω, ἀλλ' ὅπου φέρεται τὸ πῦρ καὶ τὸ κοῦφον· ὁμοίως δὲ καὶ τὸ κάτω οὐχ ὅ τι ἔτυχεν, ἀλλ' ὅπου τὰ ἔχοντα βάρος καὶ τὰ γεηρά, ὡς οὐ τῇ θέσει διαφέροντα μόνον ἀλλὰ καὶ τῇ δυνάμει. δηλοῖ δὲ καὶ τὰ μαθηματικά· οὐκ ὄντα γὰρ ἐν τόπῳ ὅμως κατὰ τὴν θέσιν τὴν πρὸς ἡμᾶς ἔχει δεξιὰ καὶ ἀριστερὰ ὡς τὰ μόνον λεγόμενα διὰ θέσιν, οὐκ ἔχοντα φύσει τούτων ἕκαστον.*

their position as *being to the left* or *being to the right*, which are also the differentia of place.[79] It is, however, not an objective position, but rather a position that holds in relation to us. This is why mathematical objects have no place, since place implies absolute positioning.

In his explanation Aristotle seemingly relies on the idea that in the case of mathematics position is a relation between *us* and the objects. They have 'a position relative to us', as he says. This is evidently a slightly different sense of *θέσις* than the one in the *Categories*. Still, I think that these two senses—position as a relation between parts of an object and position as a relation between us and mathematical objects—do not contradict each other. Consider again the two parts of the following (mathematical) line:

The two parts have a positional relation to each other. This relation, the configuration of the line, is not dependent on us. What is, however, dependent on us is which part is said to be on the left and which to the right. It depends on us that *a* is to the left of *b*. And this, I believe, is what Aristotle points out in the *Physics* passage. Of course, it is not up to us that the two parts of a line have a positional relation. It is, for example, not up to us that the parts are side by side. Nor is Aristotle committed to the view that the positional relations between the parts of an object change in relation to us. What Aristotle is committed to is the view that the application of the six spatial directions, left, right, up, down, and so on, is not objectively determined in the case of mathematical objects. We do not change the configuration by first saying that *a* is on the left and then saying that *b* is on the left. We merely state that in relation to *us* the configuration has changed (by having turned the book, for instance). And there is no fact of the matter which of the two ascriptions is correct. Thus it remains true that the notion of position involves the six spatial directions in *all* cases, be it mathematical or physical objects. But in the case of mathematical objects the way in which the six directions are applied depends on us.

The reason why there is a different emphasis in these passages can again be explained by the different projects pursued by the treatises. In the *Categories* the project is classificatory. The classification of quantities into those whose parts have position and those whose parts do not is a neat division. It is, we argued, what distinguishes spatial entities from others. In the *Physics* and *On Generation and Corruption* Aristotle ultimately wants to establish a contrast between spatial directions and places that are by nature and those that are not by nature, but depend on us. Therefore, it is important whether the position applies to the whole object in relation to us or in relation to nature. We want to say that fire moves upwards not in relation to us, but in accordance with nature. Given the different types of project Aristotle pursues in the *Categories* and in the *Physics* such differences are only to be expected.

[79] *Ph.* IV.2 208b12–13.

However, the underlying thought is the same in all of the texts that I discussed: θέσις is a relational spatial property.

5.3.5. *A classification of bodies*

We have now arrived at an interpretation of the two classificatory schemes according to which quantities are categorized (see Fig. 5.5):

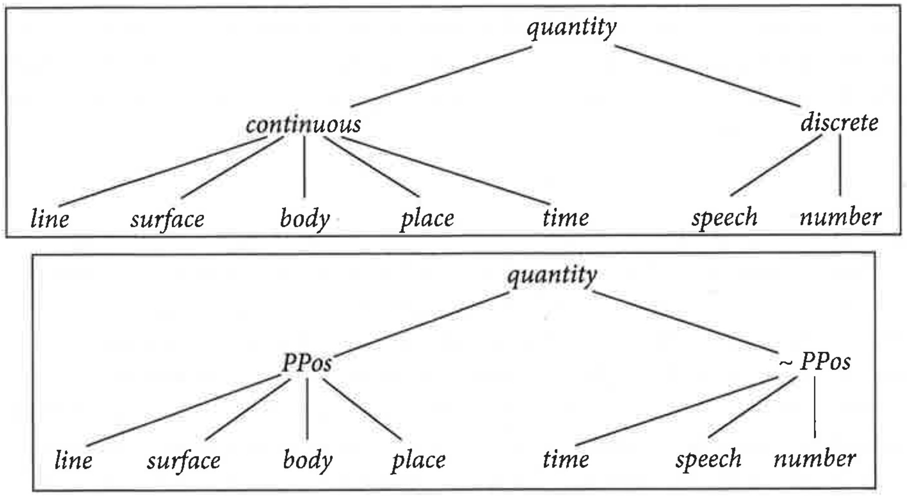


Fig. 5.5.

Bodies are continuous (CONT) and have parts with position (PPOS).[80] A body is thus a spatial entity characterized by its topological properties. All its parts are spatially related and have a position with respect to each other; for instance some parts are above, others below, and so on. Moreover, all of the adjacent parts of a body are connected with each other. Body as presented in the category of quantity is a connected, three-dimensional spatial entity whose parts are definitely situated.[81] We can put it as follows:

Proposition 5. *x is a body in the category of quantity ('quantitative body')* $=_{def}$ *[1] x is extended in three dimensions and [2] all adjacent parts of x are connected by a boundary and [3] the parts of x have position.*

This is a formal description of how body is presented in *the Categories*. The content of Proposition 5 will guide us through pretty much the whole remaining treatise. This guidance is to be understood as a framework. For example, in the next chapter I will review Aristotle's argument that bodies are prior to other magnitudes in virtue of having three dimensions (Section 6.2). Following this, I will analyse in what way

[80] For the exact formulation see Proposition 2 in Section 5.2.3 and Proposition 4 in Section 5.3.
[81] This is not explicitly stated in *Categories* 6. It is made explicit in *Metaphysics* V.13. See Appendix A.

quantitative bodies can be seen as composites of form and matter. The form of the body will be identified with its limit (Section 6.3) and the matter with its extension (Section 6.4). In Chapter 7, I will discuss the crucial distinction between continuity and contact and the implication this has for the ontology of bodies. In this sense, we will investigate the metaphysical underpinnings as well as many other questions that are left open, such as for example the relation of bodies to their limits. Nonetheless, the *Categories* can be seen as providing the background for the later discussion as well as being a guide for deciding what questions need to be addressed.