Alteration and Persistence: Form and Matter in the *Physics* and *De Generatione et Corruptione*[1]

I. *Physics*

Aristotle's *Physics* is a study of nature (*phusis*) and of natural objects (*ta phusei*). These objects, he says (*Physics* i.2, 185a12-13)—either all of them or at least some of them—are in motion. That is, they are *kinoumena*, things that are subject to change. He does not argue in support of this proposition; he simply lays it down without argument (*hupokeisthô*), for it is not the job of a philosophical study of nature to prove that there are things that can undergo change.

Parmenides had argued that change was altogether impossible, and Aristotle quite correctly notes that this position rules out the possibility of an account of nature. But even if Parmenides is wrong (and in *Physics* i.3 Aristotle exposes what he takes to be the fallacies in Parmenides' arguments), it is still incumbent upon a study of nature to provide an account of how change is possible. The first book of the *Physics* is largely devoted to this task.

Aristotle characterizes his project somewhat differently, however. First, his description of the phenomenon he wishes to explicate is not *change* but rather *coming-to-be* or *becoming* (*genesis*). And second, he says that he is attempting to provide the *first principles* (*archai*) of becoming. Nevertheless, our characterization seems appropriate. For (1) the becoming or coming-to-be that Aristotle is discussing is what happens when something grows (becomes larger), or changes temperature (becomes hotter), or moves (comes to be in a different place), or comes into existence (comes to be, *simpliciter*). Coming-to-be, that is to say, is just changing in one way or another. And (2) the first principles of a given phenomenon are just the more basic concepts to which we must appeal in stating how that phenomenon occurs. So if we wish to understand what change is and how it occurs we must provide its first principles.

In reviewing the history of his subject (as he so often does in introducing a topic for discussion) Aristotle points out that all his predecessors who recognize the reality of change "identify the contraries with the principles" (188a27). That is, the Presocratic philosophers who (unlike Parmenides and Melissus) thought that change really occurs think that the notion of contrariety must be appealed to in accounting for change. Aristotle readily concurs, but he is not content merely to signal agreement. For, he insists, "we must see how this can be arrived at as a reasoned result" (188a32).

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[1] To appear in the *Oxford Handbook of Aristotle* (Oxford University Press, forthcoming).

Suppose we have a case in which "white comes to be[2]" (188a35) and we try to account for it without the notion of contrariety. Perhaps a musician returns well tanned from a Caribbean vacation and stays indoors for a month at his piano, thereby losing his tan and becoming pale. What has happened? Well, he has acquired a new attribute—being pale. And what was he before being pale? To say "he was musical" would be true, but irrelevant (188a35-b2):

> For how could white come from musical, unless musical happened to be an attribute of the not-white or of the black? No, white comes from not-white … Similarly, musical comes to be from non-musical.

So "becomes white from being musical" is not the correct way to describe this case of becoming (even if it was the musician's devotion to his craft that led him to stay out of the sun and sit all day at his piano). The correct description brings out that there are not just a pair of attributes involved, but a pair of *contrary* attributes.[3]

One might well complain that there is no need to make explicit an attribute that antedates the change—to say "becomes white *from being black*"—since "becomes white" by itself entails that there was a change. After all, a thing that was already white cannot *become* white. But this misses the point of Aristotle's analysis. For he is trying to provide the first principles of becoming, and so cannot allow any of the implications of the term "becomes" to creep into his account without explicit acknowledgement.

An easy way to do this (although it is not Aristotle's way) is to leave "becomes" out of the account altogether and make do with attributes and tenses of the verb "to be." Instead of saying "from being musical it becomes white" we would have to say "first (at t_1) it was musical, and later (at t_2) it was white." And the inadequacy of this formulation is immediately apparent, for it is does not entail that there was any coming-to-be at all. Even if our musician was pale all along it would still be true that at t_1 he was musical and at t_2 he was white. What is missing, of course, is anything that entails that he *became* white, viz., that at t_1 he was not-white. So we need more than time and attributes in our account, but time and *contrary* attributes.

Aristotle thus concludes, at the end of *Physics* i.5, that the principles will be at least two—a *pair* of contraries for each case of coming-to-be. But that will not be enough, as he argues in the next chapter (189a22-26):

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[2] The Greek for "white comes to be" (*leukon gignetai*) could equally well be translated "comes to be white." Since it is clear that Aristotle does not mean to be discussing the coming into existence of the attribute of whiteness, the second translation might seem preferable. But there is still an ambiguity in his account that the first translation preserves, between a thing's becoming white and a white thing's coming into existence.

[3] Notice that, technically speaking, Aristotle does not restrict himself to contraries (e.g., white/black) as principles of coming-to-be but also includes contradictories (e.g., white/not-white, musical/non-musical). At this stage the distinction is unimportant, but it comes into play in *Physics* v, where he wishes to distinguish change in the broadest sense (*metabolê*) from the more specific kind of change (*kinêsis*) that involves the passage from one contrary to another (or to or from an intermediate between a pair of contraries).

> For it is difficult to see how either density should be of such a nature as to act in any way on rarity or rarity on density. The same is true of any other pair of contraries … both act on a third thing different from both.

This third principle Aristotle dubs the *underlying thing* (*hupokeimenon*), a term often translated as *subject* or *substratum*. In most cases the underlying thing is what persists through the change. For example, in Aristotle's case of the pale musician, the subject is the man who once was dark and became pale. And in general, in any change there is something, x, such that x was F at t_1 and x was G at t_2, where t_1 and t_2 are different times and F and G are contraries[4]. This is a rough, preliminary, characterization of the tripartite analysis of becoming that Aristotle settles on in *Physics* i.7.

But when he takes up the topic of change again in *Physics* v,[5] Aristotle uses slightly different terminology for the ingredients of his analysis. He points out that "every change is *from* something and *to* something" (225a1), and these two "somethings" are traditionally called the *termini* of change: (1) the *terminus a quo* (the "from which"—an attribute[6] possessed by the subject at the start of the change that is no longer present after the change) and (2) the *terminus ad quem* (the "to which"—an opposed attribute possessed by the subject at the completion of the change but not present at the start). Curiously, however, Aristotle goes on to describe these *termini* as "subject" (*hupokeimenon*) and "non-subject" (*mê hupokeimenon*), according as the terms used are positive (e.g., "musical") or negative ("non-musical"). It is possible that he is using *hupokeimenon* here in an entirely different sense, but it is more likely that he thinks that there is more than one thing that can correctly be considered the *hupokeimenon* of change.

This suspicion is borne out by an examination of Aristotle's discussion of the example with which he begins *Physics* i.7: the case of the man who becomes musical. Aristotle focuses on "that which becomes" (*to gignomenon*) and "what it becomes" (*ho gignetai*)—clearly the termini of the change—and he says (190a15) that the *gignomenon* is what "underlies" (*hupokeisthai*), i.e., is the subject of the change. And at 190a2-5, Aristotle applies the terms *gignomenon* and *ho gignetai* to any of the following: the man, the musical, the not-musical, the musical man, and the not-musical man. Only one of these items (the man) persists through the change, so it is clear that the subject (*hupokeimenon*) of change is not always the persisting item, but may be one of the *termini*.

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[4] Again, to capture Aristotle's idea adequately this schema should be a bit more complicated. F and G need not be contraries, but might be contradictories (musical/non-musical) or intermediates between a pair of contraries (light gray/dark gray).

[5] Here Aristotle is discussing change in the broadest sense (*metabolê*), not just the passage between contraries (*kinêsis*).

[6] It is sometimes more appropriate to take a *terminus* to be an individual *as characterized by* an attribute (e.g., the musical thing), rather than as an attribute (e.g., musicality) of that individual. The issue is complicated by the fact that Aristotle often picks out the *terminus* with an expression, such as *to mousikon* (literally, "the musical"), which is ambiguous between these two possibilities.

I have claimed that either of the *termini* might be considered the subject of the change, but it might be objected that Aristotle has made room only for the *terminus a quo*. For 190a15 explicitly recognizes *to gignomenon* as a *hupokeimenon*, but says nothing about *ho gignetai*, which we have taken to be the *terminus ad quem*. But in fact he uses the term *gignomenon* more loosely, sometimes applying it to the *terminus ad quem*. For example, at 190b11, he says:

> … there is, on the one hand, something which comes to be (*ti gignomenon*), and, on the other, the thing which comes to be that (*ho touto gignetai*).

Here the *gignomenon* must be the *terminus ad quem*—the object that results at the end of the change—since it is being contrasted with *ho touto gignetai* ("the thing which comes to be that"), which is either the *terminus a quo* or the persisting element. The importance of keeping the *terminus ad quem* in the running as a possible subject of change will emerge as we proceed.

Still, it is not immediately apparent why Aristotle should say that a non-persisting *terminus* may be the subject of the change, since in the example that he discusses at such length in *Physics* i.7 it seems so clear that it is the man—i.e., the persisting item—that is the subject. It is the man, after all, who is first unmusical and later becomes musical. In what sort of case might the subject be a non-persisting item?

We get our answer at 190a31-33, where Aristotle distinguishes between simple and qualified coming-to-be:

> Things are said to come to be in many ways, and some things are said, not to come to be, but to come to be something, while only substances are said to come to be without qualification (*haplôs*[7]).

Qualified coming-to-be, or becoming *something*, is expressed by the use of a complement with the verb 'becomes' (*gignetai*)—'becomes pale' or 'becomes musical'. The use of the complement indicates that the becoming is not the coming into existence of a new subject, but the alteration of an already existing one. In qualified coming-to-be, the man does not come to be, full-stop, but comes to be pale or musical. A case of coming-to-be without qualification, by contrast, occurs when the subject comes into, or goes out of, existence. In such a case, of course, the subject of the change cannot be the persisting item. For the persisting item in a given change does not come into or go out of existence in that change.

One might well complain that it is entirely arbitrary whether one characterizes a becoming as qualified or unqualified. Take the case of the man who becomes musical. If one takes the subject of the change to be the man, we have qualified coming-to-be, for the man does not come into existence; rather, he comes to be *something*, that is, he becomes musical. But suppose we take the *terminus ad quem*—the musical—to be the subject; then we would seem to have a case of unqualified coming-to-be. For something new has come into existence; after the change there was one more musician in the world than there had

[7] *Haplôs*, "simply," or "without qualification," is often translated by the Latin *simpliciter*, as I will do occasionally in the remainder of this chapter.

been before. So one and the same case of becoming can be described either as qualified becoming (a man's becoming musical) or as unqualified becoming (a musician's coming into being).

Aristotle, however, resists this temptation. At 190a33 he tells us that "only substances are said to come to be without qualification." (Hence unqualified coming-to-be is sometimes called "substantial change"—change that involves the generation or destruction of a substance.) And at *GC* i.4 (319b25-31) he discusses this very example, pointing out that the reason we do not have here a case of unqualified coming-to-be is that the persisting subject of the change is a man, a substance.

The coming-to-be of a musician is therefore *not* an unqualified coming-to-be, but merely an alteration in the "underlying" man who becomes musical. This result fits in well with Aristotle's theory of categories, according to which *musician* (as opposed to *man* or *tiger*) would not be considered a term for a substance, but rather a term for a compound of a substance and a quality. And the coming-to-be of such a compound is not an unqualified coming-to-be, but merely an alteration of its underlying substance. (Hence qualified coming-to-be is sometimes called "accidental change"—a change through which a substance[8] persists as its subject.)

The change in the case of the musical man, that is to say, is a change in *quality*—what Aristotle elsewhere describes as alteration, *alloiôsis*. In alteration, the persisting subject of the change is a substance (e.g., a man) and the contraries are a pair of incompatible qualities. Similarly, there are changes in which the persisting subject is a substance and the two *termini* are drawn from other categories. In *Physics* v.1, Aristotle adds quantity and place as categories in which substances can undergo *kinêsis*, for clearly substances grow and move about.

Most of the examples Aristotle discusses in *Physics* i are of accidental change. But it is clear that he thinks that his tripartite analysis of coming-to-be in *Physics* i.7 accommodates substantial change, as well. As we will see, however, such an accommodation introduces some new complexities.

Aristotle raises the issue at 190b1-10:

> But that substances too … come to be from some underlying thing, will appear on examination. For we find in every case something that underlies from which proceeds that which comes to be; for instance, animals and plants from seed. Things which come to be without qualification, come to be in different ways: by change of shape, as a statue; by addition, as things which grow; by taking away, as the Hermes from the stone; by putting together, as a house; by alteration, as things which turn in

[8] Typically, the persisting item in an accidental change will be a substance. But in some cases the same matter that can underlie a substantial change (e.g., bronze) can be altered in ways that do not involve the generation or destruction of a substance. For example, a quantity of bronze may be moved or heated; or a heap of bricks and boards may be rearranged into a slightly differently shaped heap. In neither case do we have substantial change, since no new substance has been created. Aristotle can mark such cases off from substantial changes by appealing to the fact that their *termini* are accidental characteristics rather than the forms that embody the essential characteristics of a substance.

> respect of their matter. It is plain that these are all cases of coming to be from some underlying thing.

We have been presented with a variety of cases in which a substance comes to be "from some underlying thing" (*ex hupokeimenou tinos*), but it is clear that not all of these underlying things are on the same footing. In the first case, we get the result we would expect. An animal or plant is generated out of a seed (*sperma*). The seed is the *terminus a quo* of the change, and so does not persist in the result. But of course we view the change as the generation of a plant or animal, not the destruction of a seed, so from that perspective the subject of the change is the *terminus ad quem*—the plant or animal that comes into existence.[9]

But the situation is different in the other cases Aristotle cites. In the case of the statue, the underlying thing would appear to be the bronze from which (and of which) the statue is made. Once the bronze has been appropriately shaped, we no longer simply have some bronze, but a statue made of bronze. The bronze, however, was present both before and after the change, so if this is to a case of substantial change, the bronze cannot be its *hupokeimenon* in the sense required for a substantial change. The case of a statue made of stone ("Hermes from the stone") is different in one respect—we have *taking away*, not *change of shape*, as the relevant operation—but it is the same in other respects. For the stone, like the bronze, is a persisting item—the stone is still there in the resulting statue. Similarly, the generation of a house occurs when the bricks, boards, nails, etc., of which it is to be constructed get put together in the appropriate way (i.e., in accordance with the plans drawn up by the architect). Once again, the *hupokeimenon* that Aristotle has identified seems to be something that persists in the *terminus ad quem*, which would disqualify the example as a case of substantial change.

It seems clear that Aristotle has been using *hupokeimenon* in two different ways in this passage, sometimes to pick out the persisting element and sometimes to pick out one of the *termini*. I surmise that at this stage in his discussion of the topic of becoming, he has not yet fully disentangled these two different senses of *hupokeimenon*. It is apparent that he needs a special term for the persisting element in a change, which will be the subject, in that sense, of substantial as well as accidental changes. And a brief survey of his examples in 190b1-10 makes it clear what we should expect that to be. For in all the examples in which the *hupokeimenon* is a persisting item (bricks and boards in case of a house, bronze in the case of a statue, stone in the case of Hermes) the persisting *hupokeimenon* is what Aristotle would describe as matter (*hulê*). The one example of a non-persisting *hupokeimenon* is the seed, which clearly is not the matter of the resulting plant or animal.

That the persisting item—whatever it might be—can be called the matter of the change is immediately suggested at 190b25, where Aristotle lists *man* alongside *gold* as an example of matter. From the point of view of an ontological classification, of course, *man* is not matter, but substance. But when a man is the persisting element in a change

[9] In *GC* i.3 (318a24-25), Aristotle explicitly claims that the generation of one thing is the destruction of another. See below, p. 9.

(e.g., when he becomes musical), the man is the matter of the change. The point is finally stated explicitly in *Physics* i.9 (192a32-33):

> For my definition of matter is just this—the primary *hupokeimenon* of each thing, from which it comes to be, and *which persists in the result* ….

Aristotle now has the ingredients in place provide a single analysis that covers all cases of coming-to-be and still permits a distinction between accidental and substantial change. Just as a substance is the persisting element (the "matter") that is present in both of the *termini* of accidental change, so too there is matter that persists (and so, in a sense "underlies") in cases of substantial change, where the substance that is generated or destroyed is not available to be the persisting item.

Incorporating substantial change into his tripartite analysis, however, requires Aristotle to modify it. For although he will insist that every change has a persisting element, he can no longer maintain that the *termini* will always be a pair of contraries or even a pair of intermediates on a scale whose end points are contraries. The reason is simple: substances do not have contraries (*Categories* 3b24). So the generation of a horse or a statue cannot have as its *terminus a quo* the contrary of a horse or of a statue, for there are no such things.

Aristotle addresses the issue at 190b11:

> Thus, from what has been said, whatever comes to be is always complex. There is, on the one hand, something which comes to be [the *terminus ad quem*], and, on the other, the thing which comes to be that—the latter in two senses, either the subject [*hupokeimenon*] or the opposite [*terminus a quo*]. By the opposite I mean the unmusical, by the subject, man; and similarly I call the *absence of shape or form or order* the opposite, and the bronze or stone or gold the subject.

Notice that 'contrary' (*enantion*) has now been replaced by 'opposite' (*antikeimenon*), a more generic term (see *Categories* 10 and *Metaphysics* V.10) covering more cases of opposition than strict contrariety. In the case of the generation of a substance, the *terminus a quo* is simply the lack or privation (*sterêsis*) of the form of that substance in the matter underlying the change. A statue comes to be when bronze or stone acquires a certain form or shape. In general, the generation of a substance consists of the appropriate matter taking on the appropriate form. Whereas the three ingredients of accidental change are a substance and a pair of contraries, the three ingredients of substantial change are matter, form, and privation.

At this stage, it would appear that the underlying matter in a given substantial change is some specific kind of stuff, the kind in question dependent on the type of substance being generated. Thus, statues are made of bronze or stone, houses of bricks and boards, animals of flesh, etc. Each kind of change has some specific kind of matter as its persisting ingredient. But what Aristotle says at 190a9-12 is often taken to suggest quite a different idea:

> The *hupokeimenon* can be known by analogy. For as the bronze is to the statue, the wood to the bed, or the matter and the formless before receiving form to any thing which has form, so is the *hupokeimenon* to substance, i.e., the 'this' or existent.

Bronze and wood seem to be presented here not as examples of the persisting element in substantial change so much as analogues of it: what persists in a substantial change stands to the substance that is generated as bronze stands to the statue that is made of it. After all, bronze and wood can be known by perception, and so can be known more directly than merely by analogy. But if bronze cannot serve as the persisting element in substantial change, one might well wonder what kind of matter Aristotle has in mind. A common answer is *prime* matter—a kind of matter that (unlike bronze or stone) has no form or nature of its own, and so can serve as a subject for more determinate kinds of matter such as bronze and stone and hence as the ultimate subject of the substances composed of those kinds of matter. Such matter is not perceptible, and hence its existence must be hypothesized; it is known only by analogy to the more determinate kinds of matter that we can perceive.

Whether in this passage Aristotle is alluding to prime matter, and even whether he endorses the concept of prime matter anywhere in his works, are issues that have long been in dispute. We will defer discussion of the second issue until section II. As for the first, we can safely note that the account that he gives in the *Physics* of the generation and destruction of substances does not explicitly endorse or by itself logically commit him to the employment of such a concept. First, the claim that the *hupokeimenon* can be known by analogy does not entail that the stuff that serves as the persisting element is not perceptible. What we know by analogy is not the nature of the persisting element in a given substantial change but the role that it plays in the generation of a substance—a role analogous to that of bronze in the generation of a statue, or wood in the generation of a bed. Any such analogue of bronze or stone may, for all this passage requires, be determinate and perceptible. Second, although Aristotle's tripartite analysis of becoming maintains that for every change there is a persisting element, it does not require that there be a single element so basic that it persists through every change. The account of substantial change in the *Physics* is devoid of any commitment to prime matter.[10]

II. *De Generatione et Corruptione*

Aristotle takes up the topics of alteration and coming-to-be again in *GC*, announcing near the beginning of the work (314a5-7) that we must inquire:

> whether we are to suppose that the nature of alteration and generation is the same or different, as they are certainly distinguished in name.

The inquiry begins in *GC* i.3. The conclusions Aristotle would like to reach are that there is a viable distinction between generation and alteration, that both occur, and that neither can be reduced to the other. We recall that his position in the *Physics* is that the

[10] Note, however, that in *Physics* i.7 Aristotle does not consider cases of elemental transformation (e.g., water into fire). A case can be made that the account in *Physics* i.7 together with *GC*'s doctrine of elemental transformation does commit Aristotle to prime matter. Cf. Bostock (2006: 19) and Waterlow (1982: 46). We will discuss this in section II below.

difference between alteration and generation is that the former is qualified coming-to-be (coming to be *something*) whose persisting element is a substance, while the latter is unqualified coming-to-be (coming-to-be *simpliciter*) in which a substance is generated or destroyed. Not surprisingly, Aristotle refers (317b14) to his solution in the *Physics*, but also announces—with uncommon candor—that even granted the distinctions on which that solution is based:

> there remains a question of remarkable difficulty, which we must take up once again, namely, how is coming to be *simpliciter* possible …. (317b17-19)

The reason for his continued puzzlement is not hard to discern. The solution he offered in the *Physics* treated generation (which is one kind of substantial change) as a change whose *terminus ad quem* is a substance that is the subject of the change, but it still allowed there to be a *hupokeimenon* in another sense—the matter that persists through the change. But given that even in generation we have something that persists, it would seem reasonable to insist that here too we have a case in which the subject (the matter) becomes *something* (i.e., takes on a form that it lacked before the change). Viewed in this way, our alleged case of generation seems to be a kind of alteration (or qualified coming-to-be) after all. From this perspective, the (alleged) coming-to-be of a substance turns out to be merely an alteration of its underlying matter.[11] So how, after all, is coming-to-be *simpliciter* possible?

It might be tempting to suppose that we could distinguish coming-to-be *simpliciter* from alteration by claiming that in the former there is nothing that persists through the change. For there can be no alteration if there is no subject that persists through it. But, not surprisingly, Aristotle resists this temptation, for it would involve abandoning what he takes to be his distinctive and novel contribution to the solution of the problem of change. An alternative that he does consider is that in coming-to-be *simpliciter* the *terminus a quo* is "not being *simpliciter*" (317b11). But he quickly abandons this alternative, for it threatens to reintroduce the Parmenidean puzzles that he was trying to solve in the first place (317b29-31):

> the principal and perpetual fear of the early philosophers will be realized, namely, the coming to be of something from nothing previously existing.

Aristotle begins his assault on this problem by addressing a seemingly different question, but one that he thinks will help point the way to a solution to the main problem: how is it that generation and destruction continue to occur, again and again (318a16-20)?

> If some one of the things which exist is always disappearing, why has not the universe been entirely spent and taken its departure long ago, if, that is, there was only a limited quantity of matter for the generation of each of the things coming into being? For it is certainly not because the matter of generation is infinite that it does not give out. That is impossible ….

His solution is to adopt a kind of conservation principle (318a24-25): "the corruption of one thing is the generation of another, and vice versa." Notice that this principle is

[11] Cf. Charlton (1970:75-76).

stronger than what is needed merely to avoid the result that it would take only a finite series of corruptions to culminate in the disappearance of all material objects. The problem of disappearance could be solved by a weaker principle: that the corruption of one thing is always accompanied by the generation of another.[12] But the weaker principle does not foreclose the familiar Parmenidean worry, for it leaves open the possibility that the corruption of any object *x* (*in nihil*) is always accompanied by the generation of some other object *y* (*ex nihilo*). The stronger principle, however, denies that the generation and corruption in question are two distinct changes. It does not claim merely that the corruption of *x* is simultaneous with the generation of *y*, but that the corruption of *x* and the generation of *y* are one and the same event. So *x* is not corrupted into nothingness, but into *y*, and *y* is not generated *ex nihilo*, but *ex x*.

But the conservation principle raises questions of its own. Aristotle puts it this way (318a28-30):

> Why are some things said to come to be and to cease to be *simpliciter* and others not *simpliciter*, … if one and the same thing is both the generation of *A* and the perishing of *B*, and vice versa? (*Dia ti de pote ta men haplôs ginesthai legesthai kai phtheiresthat to d' oukh haplôs, … eiper to auto esti genesis men toudi phthora de toudi, kai phthora men toudi genesis de toudi*).

This appears to be a question about the distinction (D_1) between substantial and accidental change, and it is not immediately apparent why the conservation principle should raise this question. The conservation principle seems to entail that no substantial change is exclusively a generation, rather than a corruption, or vice versa; it does not seem on its face to threaten D_1. It is rather the distinction (D_2) between generation and corruption that seems threatened: if every generation is also a corruption, and vice versa, why are some substantial changes considered simply[13] generations (rather than corruptions), and others simply corruptions (rather than generations)?

Aristotle's answer makes it clear that, at least initially, it is D_2 that he has in mind. At 318b19 he gives the view of "most people" (*tois pollois*) concerning the distinction he is discussing:

> … when the change is to perceptible matter, they say that generation occurs, when to matter that is not apparent, corruption. They distinguish what is and what is not by their perceiving or not perceiving it ….

Clearly, this is a theory about D_2, the distinction between generation and corruption: where the *terminus ad quem* is perceptible (and the *terminus a quo* is not), people call the change a generation; where the *terminus a quo* is is perceptible (and the *terminus ad quem* is not), they call the change a corruption. Presumably, if this theory about D_2 were to be extended to D_1, it would hold that whereas substantial change involves imperceptible matter as one of the *termini*, alteration would be a change from perceptible

[12] Cf. Williams (1982: 88).

[13] Williams (1982: 89) thinks that Aristotle here uses *haplôs* in a new way that he does not clearly distinguish from the old one. Algra (2004: 98) disagrees.

matter to perceptible matter.[14] Yet Aristotle never puts forward any such view as one that the many might hold about D_1.

At any rate, they are wrong about D_2, Aristotle says (318b27-32), for on their account something's turning into wind or air would be a corruption, and something's turning into earth would be a generation, whereas "in truth wind and air are more *some this* and form (*tode ti kai eidos*) than earth is." So the view of the many doesn't get the distinction between generation and corruption right in all cases. The correct view, Aristotle thinks (318b1ff), is that it depends on which of the *termini* is an individual substance (*tode ti*), for it is only substances that can be said to be *simpliciter*. So, presumably, when a tree is burned into ashes—a change that the conservation principle counts as both the corruption of the tree and the generation of the ashes—we have a case of corruption *simpliciter*, since the *terminus a quo* is a substance. On the other hand, when a seed grows into a tree, the *terminus ad quem* is a substance, and so we have a case of generation *simpliciter*. So much for D_2.

By 319a5, Aristotle has finally made the distinction between D_1 and D_2 explicit, and points out that although he has dealt adequately with D_2, he has not yet addressed D_1:

> … all that has so far been determined is why, when every instance of corruption is the generation of something else, we do not attribute 'coming to be' and 'ceasing to be' impartially to the things which change into one another; but the problem that was mentioned later was not this, but why that which learns is not said to come to be *simpliciter* but to come to be knowledgeable, whereas that which is born *is* said to come to be.

But the conservation principle still seems to pose a threat even to D_1. Take the case of the generation of a statue. It comes to be not *ex nihilo* but out of an unformed piece of bronze —out of matter and privation, as the account in the *Physics* puts it. The generation of the statue, according to the conservation principle, is the destruction of something, but of what? The only plausible candidate[15] seems to be the privation of form in the bronze, for that is what is "destroyed" when the bronze is formed into a statue. But once put that way it becomes obvious that there still seems to be alteration, or qualified coming-to-be, here: the bronze was unformed, and comes to be something (*gignetai ti*), viz., a statue. Even if the coming-to-be of the statue is the corruption of the unformed state of the bronze, it still turns out to be an alteration in the piece of bronze that persists through the change.

Aristotle's solution is that "this distinction (i.e., D_1) is made in terms of the categories" (319a12-13):

[14] A change from imperceptible matter to imperceptible matter would presumably not be noticed, and so the possibility of such a change would not be taken into account by the view of the many.

[15] *Pace* Jones (1974), who thinks that the matter is the material individual that is the *terminus a quo* of the change, which is "used up" and hence no longer exists after the change. Jones's interpretation is adequately rebutted by Code (1976).

> For some things signify an individual (*tode ti*), some a quality, some a quantity. So those which do not signify substance (*ousia*) are not said to come to be *simpliciter* but to come to be something.

"That which learns" (*to manthanon*) is not a substance, and so does not come to be *simpliciter*. The coming to be of that which learns is in fact an alteration of an underlying substance—a man comes to be knowledgeable. The coming to be of the statue (a case which Aristotle does not actually discuss here) would presumably be regarded as a generation, since the statue that comes to be is a substance[16]. If this were an alteration, its persisting subject would be the piece of bronze. But since that does not count as a substance,[17] the subject of this change is not the matter that persists through it but its *terminus ad quem*.

Although the defense of D_1 might seem to be complete, Aristotle takes up the topic once again and devotes all of the brief chapter 4 to it. It is important to understand why he believes that D_1 is still in need of examination. In the cases of substantial change that he has discussed so far (e.g., the ones catalogued at *Physics* 190b1-10), it is clear that even when a substance is generated or destroyed, there is some matter that persists through the change—bronze in the case of a statue, or wood in the case of a house. But in *GC* he is going to move on to cases of elemental transformation (e.g., air into water), and in these it is less obvious what, if anything, persists. So the problem will be to show that a tripartite account of change in general (along the lines of *Physics* i.7) that applies to both generation and alteration still allows for a viable distinction between them. To put the point another way: if there are substantial changes through which nothing persists, how can any change through which something does persist, such as the non-elemental ones catalogued in the *Physics*, be considered genuine coming-to-be *simpliciter*?

Any account of Aristotle's treatment of this topic is bound to be controversial, for it hinges (as noted in section I) on the much-disputed issue of his commitment to prime matter. On the traditional account, Aristotle posits (although perhaps only implicitly) an imperceptible prime matter as the thing that persists in cases of elemental transformation; according to many recent commentators, however, his account of such transformations does not include or require prime matter.[18] The interpretation presented here falls into the

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[16] I assume that the statue would count as a substance. Aristotle is not consistent on this point.

[17] The argument that the matter of which an individual is composed is not its substance is long and complex, and is not given in the physical works but in the *Metaphysics*—see esp. Z.3. How matter fits into the categorial scheme to which Aristotle appeals is also obscure.

[18] The dispute is far too complex for detailed treatment here. The traditional account goes back to Philoponus (in *GC*: 44, 18-24; 45, 11-22; 48, 6-9; 145, 27 – 146, 5) and became entrenched in the scholastic notion of *materia prima.* It is endorsed by Solmsen (1958), Robinson (1974), Dancy (1978), Williams (1982), and Bostock (2006), among others. Opponents of prime matter include King (1956), Charlton (1970), Jones (1974), Furth (1988), Gill (1989), and Broadie (2004) (reversing the position she took in Waterlow (1982: 46)). The trend among recent scholars is to reject the traditional interpretation. Cf. Algra (2004: 91): "… today the politically correct view appears to be that there is no such thing as prime matter in Aristotle at all, and that this is in fact how it *should* be, the notion itself being basically un-Aristotelian, or even intrinsically incoherent."

traditional camp, but the reader is advised to consult the copious literature on this topic for alternative readings on points of detail.

Aristotle begins *GC* i.4 by pointing out (319b8-10) that all changes involve both a subject (*hupokeimenon*) and an attribute (*pathos*) of a sort that can be predicated of the subject, and says that either one of these is capable of "change" (*metabolê*). Clearly he does not mean that either can *undergo* change, since a *pathos* is not capable of change in that sense—it cannot undergo change. Rather, he means that either is capable of being *replaced.*[19] The difference between alteration and generation depends which of these gets replaced.

Aristotle begins with alteration (319b10-12):

> It is alteration when the *hupokeimenon* remains, being something perceptible, but change occurs (*metaballei*) in the *pathê* which belong to it, whether these are contraries or intermediates.

This characterization of accidental change accords with our expectations. For the subject is a persisting substance, and the *termini* are a pair of opposed attributes, one of which "replaces" the other. Since Aristotle says that either *hupokeimenon* or *pathos* can be replaced, one might assume that he is also suggesting that either can persist. If so, substantial change would occur when a *pathos* remains but the *hupokeimenon* of which it is a *pathos* gets replaced by another *hupokeimenon*.[20] But this reading is problematic.

First, how can a *pathos* remain if the *hupokeimenon* of which it is a *pathos* gets replaced? Aristotle's usual doctrine is that *pathê* are ontologically dependent items that depend for their existence on the subjects in which they inhere. Second, since there are cases in which one element is transformed into another with which it shares no *pathos* (e.g., fire into water, as Aristotle explicitly recognizes at *GC* ii.4, 331b6 and ii.5, 332b24), there are substantial changes in which no *pathos* can be the persisting item. So it is not likely that he is claiming in *GC* i.4 that in substantial change the *pathos* persists after the *hupokeimenon* of which it was an attribute has ceased to exist.

We had better examine Aristotle's text more closely. As we will see, he does not in fact assert that in substantial change a *pathos* is the persisting item, but strongly suggests that an imperceptible *hupokeimenon* does persist. In contrast to alteration, in which a perceptible *hupokeimenon* remains (319b10), Aristotle says this about substantial change (319b14-17):

> When, however, the whole thing changes without anything perceptible remaining as the same *hupokeimenon*, but the way the seed changes entirely into blood, water into air, or air entirely into water, then … it is a case of generation (and corruption of something else) ….

[19] Cf. Gill (1989: 53-57), Broadie (2004: 124).

[20] Thus King (1956: 376ff.), Furth (1988: 221-227), Broadie (2004: 124).

There is no mention here of a *pathos* persisting. Indeed, the passage does not strictly assert that *anything* persists, and Aristotle's claim that there is "nothing perceptible remaining as the same *hupokeimenon*" (*mê hupomenontos aisthêtou tinos hôs hupokeimenou tou autou*) has been taken to mean that there is nothing at all that persists as *hupokeimenon* (i.e., no underlying matter persists) and hence that the only thing left that could persist is a *pathos* of the *terminus a quo*. But the claim that nothing perceptible persists *as subject* (*hôs hupokeimenou*) does not entail that nothing persists.[21] Nor does it entail that something does persist, of course, but at the very least it invites the question: And what if something imperceptible persists as subject?[22] This question seems even more appropriate given that Aristotle has characterized alteration as a change in which a *perceptible* subject persists. If he thought that *nothing* persisted as subject in substantial change, there would have been no point in saying that something *perceptible* persists in alteration. It would have more to the point to say simply that in alteration the subject persists, and in substantial it does not.

It is true, of course, that in one sense the *hupokeimenon* of a substantial change does not persist (the subject in that sense is the substance generated or destroyed). But that leaves room, as we have seen, for a subject in another sense that does persist—something that stands to the substance as bronze does to the statue, the matter that persists through the change (as Aristotle has told us in *Physics* i.9 there must be in every change). Since the changes under consideration are at the elemental level, the persisting *hupokeimenon* will be imperceptible.

It is true that in the next (unfortunately convoluted) paragraph (319b20-23), Aristotle does discuss cases in which a *pathos* persists through a change, but this can hardly be a basis for saying that that in substantial change the persisting item must be a *pathos*. For although his precise point here is somewhat obscure, it is clear that he takes the possibility of a *pathos* persisting to threaten the substantiality of the change and to make it count, instead, as an alteration. There is no suggestion that substantial changes are ones in which a *pathos* is the persisting item. Nor is there any suggestion that in substantial changes *nothing* persists. The point, rather, is that nothing *perceptible* persists.

GC i.4 thus seems to support the following interpretation: (1) although in substantial change a *terminus* as *hupokeimenon* is generated or destroyed, a *hupokeimenon* in another sense persists through the change, and (2) in the case of elemental transformation, what persists is imperceptible prime matter. It is now time to see whether this interpretation is supported by Aristotle's discussion of elemental transformation in *GC* ii.

In *GC* ii.1-5, Aristotle lays out his theory of "the so-called elements (*stoicheia*)" (328b31) and how they are generated and destroyed. He has in mind the four elements of the sublunary realm first hypothesized by Empedocles—earth, air, fire, and water—and he uses the term "so-called" (*kaloumena*) advisedly, since on his theory they are not

[21] Cf. Code (1976: 365).

[22] Brunschwig (2004: 41). It seems scarcely credible that Aristotle might have in mind the (irrelevant) possibility of something perceptible persisting, but not as subject.

really elemental in the sense of being basic, ungenerable, and indestructible principles (*archai*). He prefers to call them "primary bodies" (*sômata prôta*) or "simple bodies" (*hapla sômata*), typically reserving the term *stoicheia* for the differentiae (essential properties) of these bodies.[23] The reason the primary bodies are not truly elements, on his view, is that they can be generated and destroyed, in that they are capable of being transformed into one another. It is the burden of these chapters to give an account of such transformations.

GC ii.1 announces that the generation of the primary bodies involves both matter and "contrarieties," i.e., pairs of contrary properties such as wet-dry and hot-cold (329a24-26):

> Our view is that there is a matter of the perceptible bodies , but that this is not separable but is always together with a contrariety, from which the so-called 'elements' come to be.

The wording is ambiguous: the grammatical antecedent of the word "which" (*hês*) in "from which" might be "matter" (*hulên*) or "contrariety" (*enantiôseôs*).[24] But although both readings are grammatically possible, better sense is made of the passage if we take "matter" to be the antecedent.[25] For although the thing "from which" a primary body comes to be might be in one sense the persisting matter and in another the *terminus a quo*, that *terminus* would always be a contrary (e.g., wet) not a contrariety (e.g., the pair wet-dry).

So there is matter underlying the primary bodies, and this matter is involved in their generation. But is it prime matter, i.e., matter that is devoid of perceptible essential properties? We are told that this matter is "not separable" (*ou chôristên*) and "always together with a contrariety." And this might suggest that the matter in question is ordinary empirical matter, the kind which is "inseparable" and "together with a contrariety" in the sense that it cannot exist without the perceptible characteristics which make up its essential properties. Thus, for example, air is not separable from its essential properties of wetness and hotness, for air just *is* the primary body that is defined by this pair of characteristics. But this cannot be what Aristotle means here. For air cannot be an example of the matter underlying the primary bodies, since air *is* one of the primary bodies.

So it must be prime matter that Aristotle here has in mind. In what sense, then, can *it* be said to be "not separable"? The point cannot be that the matter in question is inseparable from (i.e., cannot be devoid of) its perceptible essential properties, for it has no such properties. Rather, the point is that it can never be found "neat," that is, without being the matter of one of the primary bodies and hence underlying the essential

[23] At 330a30b1 Aristotle uses the term *stoicheia* to refer to the basic properties *hot*, *cold*, *wet*, and *dry*. At 331a15-16 he calls these properties differentiae of the primary bodies.

[24] Pace Broadie (2004: 140), who says that there is "no doubt" that it refers grammatically to *enantiôseôs*.

[25] Williams (1982: 155-156) provides an excellent detailed discussion of this passage. See also Broadie (2004: 140-142), who comes to a different conclusion about it.

properties of whatever primary body it is the matter of at a given point in time. "Separate" here does not mean "without its essential properties" but "on its own, without underlying something or other."

Aristotle goes on (329a29) to describe the matter thus identified as "a principle that is really first" (*archên men kai prôtên*); he gives a secondary status to the contrarieties that it underlies, and "only thirdly are fire and water and the like" (329a35). Elemental transformation will thus be accounted for in terms of the basic contrarieties and the matter that underlies them. The next chapter, *GC* ii.2, investigates these contrarieties.

The basic contrarieties provide the "forms and principles" (*eidê kai archas*, 329b9) of the primary bodies, but not all contrarieties do so. Whiteness and blackness, for example, or sweetness and bitterness, do not "make an element" (*ouden poiei stoicheon*, 329b14). This means that such properties are not differentiae of any of the primary bodies. In order to be a differentia of a primary body, a property has to be tangible, i.e., perceptible by the sense of touch. This narrows down the candidate contrarieties to the following: hot-cold, dry-wet, heavy-light, hard-soft, viscous-brittle, rough-smooth, and coarse-fine (329b18). Of these it is the first two (hot-cold and dry-wet) that are basic, and it is the burden of the rest of the chapter to show that the remaining ones are reducible to these two. Aristotle concludes that there are really only four tangible properties that serve as the differentiae for all four of the primary bodies (329b24-25):

> … all the other differentiae are reducible to these four primary ones [heat, cold, wetness, dryness], whereas these cannot further be reduced to any smaller number.

GC ii.3 shows how the four primary bodies—fire, air, water, and earth—can be accounted for in terms of combinations of these four basic tangible properties. Abstractly, Aristotle notes, four properties can combine pair-wise in six different ways, but of the four properties we are dealing with (HCWD) there are only four possible combinations: HD, HW, CD, CW. "It is impossible," Aristotle notes, "for one and the same thing to be both hot and cold, or, again, wet and dry" (329b32). So each of the four primary bodies has as its differentiae one of these four logically consistent pairs of elemental properties: fire is dry and hot, air is hot and wet, water is wet and cold, earth is cold and dry. Note that so arranged, the four primary bodies form a cyclical order in which each has exactly one elementary property in common with each of its neighbors.

In *GC* ii.4, Aristotle turns to the topic of the reciprocal transformation of the primary bodies. His aim is to describe how the transformations occur, and to determine whether "every one can come to be from every other one" (331a11). The last question is important for our purposes, since it bears on the issue of whether a *pathos* might be the persisting ingredient in an elemental transformation. If a persisting *pathos* were required, only some such transformations could occur. Fire could turn into air (since both are hot), but not into water (since they have no differentia in common that might persist through the transformation); likewise, air could turn into water (since both are wet), but not into earth. But in fact, Aristotle asserts, "all are by nature able to change into each other" (331a13; cf. also 332b27). He notes that when two primary bodies do not have a

differentia in common—are not "consecutive" (*ephexês*) in the cycle,[26] he says—the transformation is "more difficult" (331b7) and "takes longer" (331b12).

Aristotle describes the primary bodies (such as fire and water) that do not have a differentia in common as "contraries" (331a2). It is possible that he thinks that the transformation of a body into its contrary takes longer because the transformation would have to be indirect. Fire would not transform directly into water, but would first have to transform into one of the two, air or earth, that are next to it in the cyclical order.[27] For example, if the dryness of fire is replaced by wetness, it would transform into air, which could in turn transform into water when its warmth is replaced by coldness. But even if Aristotle thinks that this is the only way the reciprocal transformation of contraries can take place, it does not support the "persisting *pathos*" interpretation. For even if Aristotle thinks that fire transforms into water only by becoming air or earth first, he explicitly states, as we have seen above, both that fire can transform into water and that no *pathos* of fire persists in the water it turns into. The only thing that can persist in the transformation of non-neighbors in the cycle is their common matter.

Finally, Aristotle argues in *GC* ii.5 that no one of the four primary bodies is more basic than any of the others, and that therefore none of them is the fundamental material principle of all things. For our purposes, it is important only to note that it is precisely the reciprocal transformation of the primary bodies that ensures this result. Aristotle's argument for this conclusion (332a4-17) is less than pellucid, but the idea seems to be this. Suppose one of the four primary bodies were the single basic element. For example, Aristotle says, "if it were air, given that it persisted, what there would be would be alteration not generation" (332a8). Each primary body would be, fundamentally, a kind of air. So when air transforms into fire, what it becomes is hot, dry, air. But this is just alteration of the underlying air, and not generation at all. What is worse, if air were to change into water, the result of the transformation would be cold (since it is water), but also hot (since it is air). But this is impossible, "because the same thing would then be simultaneously hot and cold" (332a17). We may safely infer, I think, that the matter underlying elemental transformations cannot have any member of the basic contrarieties as an essential property. So none of the four primary bodies is the "first element." And

[26] The cycle of elements is: fire, air, water, earth, fire, etc.… Thus, fire and air are consecutive, as are fire and earth; water and air are consecutive, as are water and earth. The non-consecutive elements (fire and water, air and earth) are "contraries."

[27] At issue here is whether the *changes into* relation is transitive. The transformation of fire into water described above would presuppose transitivity if it depends on the presence of an intermediate (either air or earth) into which fire would change directly. Although *Metaph.* ix.7, 1049a17-18 is often taken to deny transitivity ("earth is not yet potentially a statue, for it must first change into bronze"), I think this is a mistake. The point of this passage, rather, is that a thing that is made of *x* can be described as "*x*-en" only if *x* is its *proximate* matter. Thus, Aristotle allows (1049a20) that a chest made of wood is wooden, and that wood (which is made of earth) is earthen, but denies that the chest is correctly described as "earthen." (To be earthen a chest would have to be made of *earth*, i.e., have earth as its proximate matter.) This does not imply that the earth cannot be transformed, albeit indirectly, into a chest made of wood, and hence does not rule out the transitivity of the *changes into* relation. Further evidence of transitivity can be found at 1044a20-22: "There come to be several matters for the same thing, when the one matter is matter for the other; e.g. phlegm comes from the fat and [hence also] from the sweet, if the fat comes from the sweet …." On the issue of transitivity, see also Cohen (1996: 183-184) and Bostock (2006: 17).

this is because if there were a first element, it would have to persist through substantial changes.

It thus appears that the place of prime matter in Aristotle's account of substantial change as the thing that persists through elemental transformation is secure.[28] What remains at issue, however, is precisely what it is for prime matter to underlie such changes. The topic is too large and difficult for us to take up here, but we can at least note some of the contenders.

On the traditional interpretation, prime matter is imperceptible stuff that that is devoid of essential properties—it is matter without form. "It is nothing in actuality, whereas it is everything in potentiality."[29] In spite of the fact that it has no essential properties, it can be the bearer of accidental properties. It persists when the substance it is the matter of goes out of existence. For example, when air is transformed into water, the air goes out of existence by losing the heat that is essential to it, but the prime matter underlying the air persists. It ceases to be (accidentally) hot, but remains (accidentally) wet. When it becomes cold, water (which is essentially wet and cold) comes into existence. The reason why this is a case in which air *turns into* water—rather than simply vanishing and being replaced by water that is created *ex nihilo*—is that the prime matter which was formerly hot and wet becomes cold and wet.

Such a conception of prime matter is difficult, to say the least. Even some of those who attribute it to Aristotle concede that it is inconsistent with other views that he holds,[30] or even simply incoherent on its own.[31] Still, the textual evidence for prime matter is strong, and there have been some recent efforts to reconstruct on Aristotle's

[28] Aristotle makes this explicit at *De Caelo* iv.5, 312a31-32: "There must be a common matter of all four [primary bodies]—especially if they come to be out of one another…." Although this seems to clinch the case for Aristotle's commitment to prime matter, opponents have been resourceful in trying to avoid it. Broadie (2004), for example, who thinks that the matter underlying a substantial change does not persist but rather is the pre-existing thing that undergoes the change, suggests that any one of the four primary bodies can be the common matter for all elemental transformations if it is the one from which the cyclical process of transformations begins. There are a number of problems with this interpretation: (1) it denies that there is anything that persists in elemental transformation; (2) as Charles (2004: 168) points out, it does not explain why there is just *one* common matter, since a cycle of elemental transformations can begin with any of the four primary bodies, and Aristotle never gives any indication that he thinks there is a single favored primary body (e.g., fire) from which all cyclical transformations begin; (3) it conflicts with the conclusion of *GC* ii.5 that none of the primary bodies is a fundamental material principle; (4) it requires a tortuous reinterpretation of the account of the principles of substantial change in *GC* ii.1 (329a33-35). Aristotle there claims that there are three principles: first, "potentially perceptible body"; second, the contrarieties; and third, "fire and water and such." Broadie must construe "potentially perceptible body" to refer not to prime matter but to the very same simple bodies—fire, water, etc.—that are explicitly identified as the third principle. Her reasoning is that "the simple bodies play two roles in this scheme" and that an actually perceptible body such as water may be picked out as only "potentially perceptible" because "its potential for such change is not something about it that is perceptible" (p. 142). One might just as well describe a magician whose sleight of hand is so good that one cannot see him palm a card as an "imperceptible magician."

[29] Brunschwig (2004: 40).

[30] Loux (1991: 239-252) claims that it is inconsistent with the essentialism of *Metaph.* vii and viii, but that Aristotle is nevertheless committed to it.

behalf a conception of prime matter that is more palatable than the traditional notion of a physically indeterminate stuff. Dorothea Frede (2004: 304) suggests that "'prime matter' is nothing but the *potential* of the simple bodies to engage in different basic combinations," but this seems to be an endorsement of prime matter in name only. For Frede also says that "the simple bodies are … strange entities: they consist of two *differentiae* with no underlying matter" (p. 304) and "there is no further substrate (*hupokeimenon*) that underlies the elementary compound" (p. 305).

Sheldon Cohen (1984) argues that although for Aristotle there is a common matter underlying the four elements, it is not the characterless prime matter as traditionally conceived. He takes Aristotle's insistence (329a26) that the underlying matter is "always with contrariety" to mean precisely that this matter is *not* bare. ("Why accuse Aristotle of holding to a bare stuff if he insists that it is always clothed?" p. 176.) Of course, even if prime matter is not bare, it may still be insisted that that it is at any rate devoid of essential properties. But Cohen replies that Aristotle does not require this. All he needs is a basic matter that does not have any of the differentiae of the four primary bodies as an essential property. It is thus free to have other essential properties, and Cohen offers as candidates: spatial extension, the potentiality for rectilinear motion, and the inability to underlie transformations into *aithêr*.[32] Finally, even apart from the considerations above, a common matter for elemental transformation need not be the basic matter underlying all change, for it does not underlie the generation of "flesh and bones, milk and blood, houses and bricks, bronze and pitch, and many, many, other things" (p. 179). Cohen's reason for this last claim is that he thinks that Aristotle denies that the *is potentially* relation is transitive (p. 183). Prime matter, so construed, is not an unintelligible part of an incoherent metaphysical theory, but merely an intelligible part of a false physical theory.

It is clear that prime matter on Cohen's scaled-back conception of it is immune to many of the problems that plague it on the traditional conception. The question is whether Aristotle's text can sustain the reading Cohen gives it. The reader will note several points (the transitivity of *is potentially*, the reading of 329a26) on which Cohen's interpretation is at odds with the one presented here.

David Charles (2004) offers a nontraditional account of prime matter as a logical entity, not a material one. He notes that Aristotle's language in describing the matter underlying earth and fire is very much like the language he uses in the *Physics* to describe the *now*. The matter of the elements is "the same, in so far as it is that thing, whatever it is, that underlies" (319b5); similarly, the *now* is "the same [sc. from one occasion to another] in so far as it is that thing, whatever it is, that is the now" (219b12-13). What is the same, from one occasion to another, is the role that numerically distinct moments play in dividing time into before and after. Similarly, what is the same in the case of the matter

[31] Williams (1982: 219): " … there is … a real confusion in Aristotle's thinking, a notion of prime matter which is internally incoherent … but it is nevertheless there in much of what Aristotle wrote."

[32] *Aithêr* is the matter of the non-terrestrial realm that includes the moon, sun, and stars. Its natural movement is circular, unlike the four simple bodies of the sublunary realm, whose natural movement is rectilinear. *Aithêr* is ungenerated and indestructible, which means that it cannot reciprocally transform into earth, water, air, or fire. Cf. *De Caelo* i.2-3.

of the elements is the role that these matters play in underlying basic elemental change. Just as we do not need to suppose that there is a special kind of *now* over and above such ordinary *now*s as 1:01 or 1:02, in order to hold that the *now* is what divides time into before and after, so too "there is no need to postulate an imperceptible material underlier to account for elemental change" (Charles, 2004: 161). Charles agrees that prime matter is the "one thing in virtue of being which all matters, involved in basic elemental change, are the same" (p. 155) but claims that prime matter is a logical (or abstract) object,[33] not a material object (p. 162-3):

> In one case [prime matter] will be the matter of fire and in another the matter of earth. Prime matter, so understood, will be a distinctive logical (or abstract) object. … In the case of elemental change, there need … be no single material substratum which persists throughout the elemental change from earth to fire via air.

Charles's resourceful deflation of Aristotelian prime matter is perhaps the most detailed and sophisticated such effort to date. Yet it leaves some nagging questions behind. Here are two. (1) As Charles himself admits, his account of prime matter requires him to read Aristotle as engaged in "a systematic attempt to modify his *Physics*-style view that a material substratum must persist throughout any case of change" (p. 165). Yet there is no word in *GC* that any such abandonment of a fundamental principle of the *Physics* is taking place. (2) Charles frequently tells us that the specific kinds of matter that play the role of the abstract object *prime matter* are, e.g., "the matter of earth" and "the matter of air." But what are these kinds of matter? On Charles's view, there have to be some specific *kinds* of matter—some kinds of *material* object—that play the role of the (abstract object) prime matter. But what kinds of matter are these? Charles never tells us. And there is no indication in *GC* that Aristotle had any such kinds of matter in mind. Nowhere does he tell us that he thinks that the matter of air is a different kind of matter from the matter of earth, even though both can play the role of prime matter. Nor does Aristotle's physical theory make room for the properties that might distinguish these specifically different kinds of matter. So even if Charles has carved out a logical space in which a theory of prime matter as an abstract object might be made to fit, it seems doubtful that Aristotle's is such a theory.

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[33] Charles likens his "logical objects" to Kit Fine's "arbitrary objects"; cf. Fine's *Reasoning with Arbitrary Objects* (Oxford: 1985).

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