On Some of Aristotle’s Arguments against Atomism

Perhaps the most important revolution in history is the one in which a world picture derived from Aristotle was supplanted by one derived from Newton. Of course the Newtonian picture has itself been supplanted, but my aim is to attempt to contrast the Aristotelian and Newtonian pictures. For my purposes the Newtonian picture is in essence the picture of the ancient atomists. Seventeenth-century thinkers were aware of their debt to Greek atomism. In arguing for the superiority of what he calls the ‘corpuscularian philosophy’ over the Aristotelian philosophy Robert Boyle frequently refers to Epicurus and to Lucretius. His references to Leucippus and Democritus are fewer, but they exist, and in any case Epicurus himself was continuing the tradition of the original atomists. In Aristotle’s physical writings there are many references to Leucippus and Democritus,

1 By the ‘Newtonian picture’ I mean the view that the world consists of a collection of ‘atoms’ or ‘corpuscles’ moving around in empty space according to a set of laws of motion. The extent to which Newton himself subscribed to this picture is something about which I have nothing to say, though I suspect that Robert Boyle comes close. I might also add that the purpose of this paper is to attempt to understand Aristotle rather than Newton. My use of the ‘Newtonian picture’ is intended as a way of providing a version of atomism which gives it some credibility as a physical doctrine. I am indebted to Edwin Mares for helpful comments on this paper, particularly concerning Newton.

2 In this paper the physical works I shall be referring to are the Physics, On the Heavens (De Caelo) and On Coming to Be and Passing Away (De Generazione et Corruptione), I am using the translations in Volume II of W.D. Ross Works of
and my aim in this paper is to present and discuss certain of Aristotle’s arguments against the atomists. We now know that Newton turned out to be right as against Aristotle; but this is a contingent matter which could only be decided with the aid of precise and quantitative measuring instruments applied to a mathematically precise theory.

1. Aristotelian causation

Aristotle’s philosophy of nature depends upon his well known doctrine of the four causes. In Physics 2.3 at 194b16-195a2, he distinguishes between the material cause, the efficient cause, the formal cause and the final cause. It is fashionable to point out that ‘cause’ is not a good translation of αίτια, and of course there is some truth in this. But in making this point it is often easy, I believe, to misrepresent Aristotle’s philosophy of science. If, as is often suggested, you translate αίτια as ‘reason’, then you will probably want to gloss the formal cause in some such way as this: Suppose you think that being two-legged is an essential property of a human being. You will say that ‘because he has two legs’ is a reason (perhaps a partial one) why Socrates is a man. It is a reason in the sense that it is one answer to the question ‘Why is Socrates human?’ In this case it might well seem implausible to suggest that having two legs causes Socrates to be human.

This does, though, leave out something important. In place of the two-legged example consider the acorn. The idea is that change is effected by the powers or potencies or potentialities (the Greek is δύναμις).

Aristotle (London, 1905-52). References to the Metaphysics are likewise to the Oxford translation, Volume VIII in the series.

3 See for instance M. Hocutt ‘Aristotle’s Four Because’ Philosophy 49 (1974), 385-99. Julia Annas ‘Aristotle’s Inefficient Causes’ Philosophical Quarterly 32 (1982), 311-26 argues (319) that the efficient cause is a genuine cause. She says, ‘The material, formal and final aitai explain in non-causal fashion, but the efficient aitia is the source of kinesis, motion or change.’ I would argue that there is a genuinely causal role for all the ‘causes’.
of things, and that an essential nature is frequently a potency. Suppose we say that it is essential to an acorn that it is potentially an oak tree. This potentiality is a power that the acorn has, a power which, given the right other causes, will make it develop into an oak tree. Further, this potentiality is itself produced by an actual oak tree. The formal cause is here also the final cause and perhaps even the efficient cause. (Aristotle admits that efficient, formal and final causes can often be identified \[198a25-29\].) It is interesting to note how Aristotle’s metaphysics and semantics go hand in hand with his philosophy of science. I think most of us would acknowledge that speaking of a potential \(F\) only makes sense if understood in terms of actual \(Fs\). Aristotle takes this further in requiring that an actual \(F\) is needed to produce a potential \(F\).

The Newtonian will presumably say that true as it may be that the acorn has the potential to develop into an oak, this potentiality is simply a consequence of the causal properties of the material of the acorn together with its structure. By contrast, it seems generally agreed that the causal properties of living beings are not in Aristotle’s view determined by the features of their material constituents.\(^4\) A Newtonian of course has the

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task of explaining precisely how the teleological behaviour of biological organisms can be predicted from the behaviour of microscopic particles obeying the laws of physics. We have some ideas nowadays about how this can be done, but it is clear that in his discussion of the atomists Aristotle has no conception of just how small particles are and just how complex macro objects are. This in fact is one vital difference between Aristotle, and the seventeenth-century thinkers. Two things in particular impressed the latter. One is the way the few letters of the alphabet can be combined to form innumerable many words. Boyle cites this observation as made by Lucretius. It is not one found in the original atomists or discussed by Aristotle. The other was the complexity of clocks and watches. Both Boyle and Locke refer to the Strasbourg clock. Locke (Essay 3.6.3.) mentions the countryman gazing at the result of a mechanism which the watchmaker, but not the countryman, understands. What the countryman sees is the result of a phenomenon explicable by a mechanism depending on minute operations by small parts each obeying a simple set of rules, but producing a total phenomenon not obviously connected with these.

2. Material causation

In some cases at least, Aristotle believes that the material cause is what does the explaining. If you plant a bed then all that could possibly come up is wood, not a bed (193a12-15, 193b10-11). But he appears to have thought that his predecessors (except perhaps for Plato) considered only material causes, and he clearly thinks that this cannot be right. In Physics 2.9 [200a1-5] he says that this would be like saying that you get a house because the material of which the wall is made, being wood, is lighter and

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5 At least in their extant works. We are of course very much at the mercy of Aristotle and other (often hostile) ancient authors. As Furley (The Greek Cosmologists [as in n.4], 116), notes: 'The total disappearance of all the many books of Democritus is one of the most lamentable literary catastrophes of the classical world.' Boyle's observation appears on 49 and 107 of M.A. Stewart (ed.), Selected Philosophical Papers of Robert Boyle (Manchester, 1979).
so rises to the top, while the foundations, being of stone, are at the bottom. He points out at 200a10-15 that while being made of iron rather than wood is necessary to a saw, it is not sufficient as a cause of the saw. Being made of iron is a consequence of the final cause, that the saw be able to cut. One way of approaching the difference between the material cause and the formal/final cause is to see that the formal/final cause depends on the intrinsic nature of the item itself, while the material cause depends on the nature of something that underlies the item. At Physics 194a12-15 he tells us that ‘nature’ (φύσις) is used in two senses—form and matter. The ancients’, according to Aristotle at 194a20-23, thought physics was concerned only with matter, and he says that Empedocles and Democritus were ‘only very slightly’ (ἐπὶ μικρὸν γάρ τι μέρος) concerned with form. The problem with the material cause is that it simply postpones the question. For it says that if you want to know what makes x do what x does, you need to look at what x is made of and ask why it does what it does, i.e., you need to look for a y which underlies x and ask why y behaves as y does. At 193a17-23 he says:

But if the material of these objects has itself the same relation to something else, say bronze (or gold) to water, bones (or wood) to earth and so on, that (they say) would be their nature and essence.

Suppose the hypothesis is that the only properties of x which explain what x is are the properties of its matter. Then we are owed an account of how the properties of the matter of x come about. Well, argues Aristotle, on this theory it would have to be on the basis of the properties of the matter of the matter of x. And so on down until we reach the elements (193a22-3):

Consequently some assert earth, others fire or air or water, or some or all of these, to be the nature of things that are.

Explanations in terms of the material cause then will ultimately themselves demand an explanation which depends on the properties of the elements—the properties of earth, water, air and fire. But, as he is well
aware, these elements themselves have a form which explains why they behave as they do. If we seek a material cause for the behaviour of the elements then we would need to consider the question of what it is that underlies the elements. That would seem to be what the mediaevals called prime matter. But prime matter has no essential nature and therefore cannot cause anything in virtue of its form. But also it has nothing else that underlies it, and so cannot cause anything in virtue of its matter. So it cannot act by way of a formal cause or by way of a material cause.\(^6\)

That may be why he thinks that the atomists make everything happen by 'necessity', where by this he appears to mean that they simply happen without any reason. He seems to think that necessity is related to spontaneity and chance. In his discussion of these in Physics 2.5.6 he sometimes speaks of chance as something which happens from causes which are unconnected with what is to be explained, as with the man collecting money for a feast who goes to a house for some other purpose and thereby gets his money (196b32-197a4). In this case there are causes, since the man presumably went to the house for some purpose, but the

\(^6\) A similar move seems to me to be made in Metaphysics Z3, where he argues that taking substratum as substance eventually leads to matter as substance, but matter lacks the required features. Admittedly the interpretation of this passage is notoriously controversial. My own views are found at M.J. Cresswell, 'Aristotle's Phaedo' Australasian Journal of Philosophy 65 (1987), 131-55. In neither place does Aristotle explicitly state this as a regress argument, but such an argument seems a very natural construal of his remarks. I am indebted to Gary Matthews for comment on an earlier version of the paragraphs which follow. D.J. Furley, Cosmic Problems (Cambridge, 1989), 233, suggests that the principal difference between the atomists and the Aristotelians lies in the direction of explanation. For Aristotle 'it is because this dog is a dog that he has four paws, a sharp nose, and a tail, and it is because he must have four paws etc., that he contains bone and blood, skin and fur, and it is for the sake of this bone and blood that the animal contains earth and water and air and fire in such and such proportions.' By contrast, 'The atomist is content when he has shown why it is that certain combinations of atoms of certain shapes and sizes make up blood, or bone, or skin, and how it is that these again make up a dog or a cat or a cow or a human being.'
purpose was not connected with the getting of the money, and so cannot form part of a scientific theory of why the man got his money.

In the case of necessity he seems to have in mind things which happen when there is no reason for them, and thus they are not subject to laws. In *Physics* 2.8 he criticizes the view that nature works not because it is better so but by necessity, and his argument is that this cannot explain why things always happen in the way they do. There is an interesting discussion of natural selection at 198b32. Things with sharp teeth survived and those without did not. The criticism is that this cannot explain why sharp teeth are invariably or for the most part present. Obviously if natural selection is to work there must be laws which ensure that what is successful will continue to be successful. At 252a34 he

7 Cooper in ‘Aristotle on Natural Teleology’ (as in n.4), claims (208) that the atomists do think that things happen by chance and not according to laws. At 209 he suggests that Democritus’ postulation of infinitely many worlds is to allow for the view that we just happen to be living in an orderly one (One might of course say that a Humean view of orderliness has in the end to say ‘it just happens’). See also the passages from the *Generation of Animals* discussed in Grene, *A Portrait of Aristotle* (as in n.4), 137-47. Empedocles also might be held to suppose that only sometimes is the world orderly, though in his case the forces of love and strife are presumably intended to give an explanation of why things are so. Furley in *The Greek Cosmologists* (as in n.4) is more cautious. At 148 he notes that necessity is often coupled with spontaneity, but claims (150) that the atomists ‘were not interested enough to speculate about the “free” movement of atoms in the void’. But certainly Aristotle linked them. Furley (182) suggests that Aristotle simply could not envisage an exact science of chemistry or biochemistry. One of the problems which seems to have bothered Newton is the problem of why particles move according to his laws. Locke appears to think that this is a question to which there may be an answer—but it is an answer that only God can know. It’s not clear whether or not he thinks that this should be so in principle, and maybe it was left to Hume to see that perhaps there can be no answer at all to a question like this—that it is not a real question. Aristotle too of course recognizes that explanations must stop somewhere, but he would put it in terms of his own theory of causation, since he feels that there has to be an answer to the why-question, though obviously there must be some point at which why-questions
portrays Democritus as someone (a Humean?) who 'reduces the causes which explain nature to the fact that things happened in the past in the same way as they happen now', and his criticism is that Democritus cannot explain why this always happens.

Aristotle does not himself in the passage quoted above consider the problem of why the elements behave as they do, but that is discussed in Book 2 of *On Coming to Be and Passing Away* (*De Generatione et Corruptione*). The purpose of that book is to consider the question of whether and how the elements can change from one to the other. It is of course controversial whether Aristotle is committed to prime matter. My own view is that although I think Aristotle is committed to it in *De Generatione et Corruptione* 2 he would have been very unwilling to admit this, since he would think that that would commit him to an Anaximandrian view of a formless 'indefinite' stuff which could exist on its own, and he certainly wouldn't want that!

The regress argument only works against a philosopher who thinks that the material cause is the *only* cause. If the elements have form, and if you admit a formal cause, then the elements can have causal powers even if they are made of prime matter. The regress argument applies to all who think that the material cause is the only cause, and that includes the atomists, though in the passage in question Aristotle is not talking just about the atomists, and indeed he seems to have Empedocles mainly in mind. Empedocles would certainly not be vulnerable if he admitted a formal cause, and while he might admit such I'm not sure whether

stop. At the bottom level Hume says—things just happen. But perhaps Aristotle doesn't. Perhaps he says that principles such as 'like causes like' are the stopping places. Newton himself would probably not have accepted the Humean answer. E. McMullin (*Newton on Matter and Agency* [Notre Dame, 1978], 55) says that Newton 'was still as intent as Aristotle had been to find a First Mover at the summit of his mechanical system.' This does not of course mean that Newton or other contemporary thinkers would have accepted self-evident first principles as the stopping place. Locke for instance, in Book 1 of the *Essay*, argues strenuously against the basicness of such general principles.
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Aristotle thought he did. In any event I am assuming that Aristotle’s view is that none of these philosophers admits any causes other than a material cause. That is why Aristotle’s own view would not be subject to the regress.

Aristotle’s diagnosis of why the material cause is insufficient in the case of the changing elements is in *De Generatione et Corruptione* 2.9. He begins by observing (335a33-4) that

... cause, in the sense of material origin, for things which are such as come-to-be is ‘that which can be-and-not-be’: and this is identical with ‘that which can come-to-be-and-pass-away’, since the latter, while it is at one time, at another time is not.

His point in this passage is that even the material and formal causes together are insufficient without an ‘originative source’. His complaint about the *Phaedo* theory at 335b18 is that it cannot explain why the Forms act at some times but not at others. Having dismissed a Platonic account of the cause of change he goes on to discuss those who account for the coming-to-be of an element in terms of matter:

For, to begin with, it is characteristic of matter to suffer action, i.e. to be moved: but to move, i.e. to act, belongs to a different ‘power’. This is obvious both in the things that come to be by art and those that come to be by nature. Water does not produce out of itself an animal: and it is the art, not the wood, that makes a bed. Nor is this their only error. They make a second mistake in omitting the more controlling cause: for they eliminate the essential nature, i.e. the ‘form’. And what is more, since they remove the formal cause, they invest the forces they assign to the ‘simple’ bodies—the forces which enable these bodies to bring things into being—with too instrumental a character.

This passage does seem to acknowledge that matter has *some* causal efficacy. H.H. Joachim, the Oxford translator, in a footnote says ‘Matter
is a δύναμις in the passive sense: that which initiates movement is a δύναμις in the sense of an active force.' Sarah Waterlow locates the importance of matter in the following way: The problem of change is this. Change occurs when something which is not-F becomes F (or an F becomes not-F), and it seems a mystery how something which is not so can cause something which is so. How does matter help? Well, suppose that a change from not-F to F demands something which underlies the change. This something must be the kind of thing which, even while it is not F, has the power to become F. Sometimes what underlies the change is a substance, as when, say, Socrates becomes musical. At other times it is the matter which underlies a substance, or, as here, the matter which underlies the elements. But the power to be F and also to be not-F, by its very nature, cannot explain why anything should be F rather than not F.

Aristotle believes that the behaviour of an animal is not determined by the behaviour of the water which is its matter. Since water is the matter of an animal the matter must have the power both to be and not to be an animal, and so cannot be responsible for the causal powers of the thing as an animal. Those who consider that the only causes are material causes in fact mistakenly attribute to the matter a character which is properly attributable only to the form or to the efficient cause.

3. Accidental causation

The argument of the previous section was that explanations in terms of material causes only defer the problem, since they claim you can explain why x does what x does only if you can explain why some y which underlies x does what y does and that this would seem, at the bottom level, to lead to featureless matter which cannot explain anything. But that, of course, did not consider what the atomists thought might be happening at the bottom level, and in the next section I turn to Aristotle’s discussion of why he thinks that the behaviour of the atoms cannot be explained. Among the many arguments that Aristotle produces against atomism, the

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8 S. Waterlow Nature, Change and Agency (as in n.4), chapter 1.
most serious are probably those which depend on the fact that they are indivisible. David Furley, in a number of works, has discussed Aristotle’s arguments against indivisible magnitudes. What I want to do is to consider some passages in which the most natural interpretation appears to be that Aristotle is arguing against what might be called ‘logical’ indivisibility. By this I mean arguments which show that atoms cannot be Aristotelian individuals. Before I do this I need to make some remarks about accidental causation. At the beginning of *Physics* 2.1 Aristotle tells us what the study of nature is all about (192b9-16):

‘By nature’ the animals and their parts exist, and the plants and the simple bodies (earth, fire, air water)—for we say that these and the like exist ‘by nature’ ...

All the things mentioned present a feature in which they differ from things which are not constituted by nature. Each of them has within itself a principle of motion, and of stationariness (in respect of place or of growth and decrease, or by way of alteration).

One of the things that Aristotle seems to believe is that the difference between natural things and artifacts in the manner of their production is that artifacts are produced by accidents in substances whereas natural things are produced by the substances themselves because of their own nature. In the case of a natural body, it is produced by a body like itself. If we think

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9 D.J. Furley *Two Studies in the Greek Atomists* (Princeton, 1967), Study 1, especially chapters 6 and 8, and Furley *The Greek Cosmologists* (as in n.4), 124-31; also chapters 7-9 of Furley *Cosmic Problems* (as in n.6). Other arguments include those based on Aristotle’s rejection of the void: see Furley *The Greek Cosmologists*, 118-22 and 188-93.

10 It is interesting to note here that one of Plato’s criticisms in the *Phaedo* of earlier thinkers like Anaxagoras, is that their causal theories are deficient because they postulate cases where something *x* can be caused to be *F* by something *y* which is not itself *F*. So perhaps the idea that like causes like is something which has a strong intuitive appeal. Even in the Newtonian case a
of the acorn/oak tree example it goes like this. The acorn becomes an oak
tree because its essential nature is to become one. It has, as one of its
essential properties, the power to become an oak tree. But since
potentiality is dependent on actuality, this potency can only be caused by
an actual oak tree. And this is what happens.

In order to see more clearly how he envisages accidental causation we
need to look at his account of what a principle of nature is (192b22-32):

... nature is a source or cause of being moved and of being
at rest in that to which it belongs primarily, in virtue of itself
and not in virtue of a concomitant attribute.

I say 'not in virtue of a concomitant attribute', because (for
instance) a man who is a doctor might cure himself.
Nevertheless it is not in so far as he is a patient that he
possesses the art of medicine: it merely has happened that the
same man is doctor and patient—and that is why these attributes
are not always found together. So it is with all other artificial
products. None of them has in itself the source of its own
production. But while in some cases (for instance houses and
other products of manual labour) that principle is in something
else external to the thing, in others—those which may cause a
change in themselves in virtue of a concomitant attribute—it
lies in the things themselves (but not in virtue of what they
are).

In this passage he is talking about how something can produce an
accidental change in itself, but the discussion shows how Aristotle’s
account of the generation of artifacts works in general. This might be
clearer with another example that Aristotle uses (191b4, *Metaphysics E2,
1027a1-3). Suppose that a doctor is also a builder. In that sense the
doctor may build a house, and so be the cause of the house. But Aristotle
is fond of saying that although he may be the cause of the house que

body seems only able to communicate to another body a property it has itself.
(Cf. also perhaps the second law of thermodynamics?).
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builder, he is not the cause of the house *qua* doctor. (See also the discussion of Polyclitus the sculptor at 195a32-b3, and Metaphysics Δ2 1013b34-1014a7.) In our present passage 'in virtue of a concomitant attribute' translates *κατὰ συμβεβηκός* and 'not in so far as he is a patient that he possesses the art of medicine' translates *οὐ καθὸ νημαζεται τὴν ἰατρικὴν εὐχεί*. What I take to be going on is this. Suppose we take seriously the doctrine of the *Categories*, that the accidental features are things which are 'in' the substance. A substance together with its accidents—an accidental unity—is what Gary Matthews calls 'a kooky object'. A kooky object is 'an object whose very existence rests on the presence or compresence, of some feature, or features, in a substance.'¹¹ Matthews' example is the musical Coriscus (Metaphysics Δ6 1015b17-34, E2 1026b15-18). Such an 'object' is composed of a substance together with an accident. So suppose we say that a person who is a doctor is a doctor only accidentally, and that a person who is a builder is a builder only accidentally. This means that there is a 'potency for building'—an ability to build—which is present in the person as an accident. If the person is also a doctor then there will also be a medical potency in the person. When the builder builds it is really the building potency which is the cause of the house, and when a doctor heals it is really the medical ability which is the cause of the healing. That the person has both abilities is an accident, and not part of what science need explain.

4. Logical indivisibility

I return now to a consideration of some passages which seem to suggest that Aristotle may be arguing against logically indivisible atoms. The passages I shall consider are from *De Generatione et Corruptione*. In

Chapter 2 of Book 1 (315a33-b16) Aristotle discusses the problem of how the atomists would analyse how it can be that things could come into, or go out of existence. Aristotle distinguishes two kinds of change. ‘Alteration’ is when, say, Socrates becomes musical. When this happens an already existing substance takes on new properties. The other kind of change is when a substance comes into or goes out of existence. According to Aristotle at 315b7-9 the atomists explain coming to be and passing away by ‘the “dissociation” and “association”’ of the atoms, while alteration is explained by ‘their “grouping” and “position”’. Aristotle’s criticism of the atomists is that they do not take sufficiently seriously the difference between the two kinds of change.

In Aristotle’s own ontology substances consist of matter in a certain form. But it is substances which are ontologically basic. Although they have matter, the matter they have is not any more basic kind of thing. Combined with his ideas of essence and accident, Aristotle’s use of matter and form enables him to distinguish clearly between accidental and substantial changes in terms of the analysis of change introduced in Physics 1.7. Later in De Generatione et Corruptione Aristotle appears to take the atomists to task because he claims that they cannot account for the essential and accidental features of their basic substances—the atoms. The section is 325a3—326b7. Aristotle’s criticism is concerned with the proper explanation of why the atoms behave as they do (326a1-5):

The atomists are committed to the view that every ‘indivisible’ (ἀδιαιρήτωρ) is incapable alike of receiving a sensible property (for nothing can ‘suffer action’ except through the void) and of producing one—no ‘indivisible’ can be, e.g., either hard or cold. Yet it is surely a paradox that an exception is made of ‘the hot’—the hot being assigned as peculiar to the spherical figure.

This discussion of ‘the hot’ seems ad hominem, but his point can be generalized. For Aristotle a hot $x$ would be an $x +$ the hotness in it, and so would not be indivisible. From Categories 2a4 we know that the ability to ‘suffer action’ ($πάσχειν$) is one of the categories of being and so anything which suffers action is a ‘kooky object’ in Gary Matthews’s
sense, and so not indivisible. At 326a18 he wonders how, if an atom is indivisible, 'hot' can be an accident of it:

It is also paradoxical that, if other properties do belong to them, only one of these additional properties should attach to each—e.g., that *this* 'indivisible' should be cold and *that* 'indivisible' should be hot. For on that supposition their substance would not even be uniform.

A translator’s note here in the Oxford edition says ‘The uniformity of the substance or “stuff” of the atoms was a fundamental doctrine of the theory’. Even so, I think Aristotle’s point is very much concerned with how this looks from the point of view of his own ontology. The general tenor of these sections is to point out that properties like size, hardness and so on are only recognizable by their effects (326a14). If the atoms have shape and size, how are these causally efficacious? Any property that an atom has must either be because of its essential nature or because of its accidental features. But if an atom is to have causal powers by any of its accidental properties then it must be an Aristotelian substance which is capable of supporting accidents, and it is those accidents which have the causal powers. But on the account of accidental unities mentioned in the last section it seems pretty clear that an atom cannot be an accidental unity (326a19-21):

being indivisible, it will possess these properties in the same point—so that if it 'suffers action' by being chilled, it will also *qua* chilled, 'act' or 'suffer action' in some other way.

If the atom is really indivisible its being chilled would be the *very same accident* as anything else it does or suffers, so that it couldn’t be acting or suffering action in any *other* way. A little later Aristotle wonders why there cannot be large atoms (326a25-8):

It is a further paradox that there should be small ‘indivisibles’, but not large ones. For it is natural enough, from the ordinary point of view, that the large bodies should be more liable to fracture than the small ones, since they (viz the
large bodies) are easily broken up because they collide with many other bodies.

Large atoms look very like Aristotelian substances, and if they are to have effects in terms of their accidental features they must indeed be Aristotelian substances.

Suppose the atomist says that it is in virtue of the essential features of the atoms that they do what they do. It is doubtful whether Aristotle would allow atoms to have essential natures, since as independent entities they would, on his view, have to be substances, and it is the mark of a substance that it can receive contraries (Categories 4a11) and if it does it would no longer be indivisible. In any case he has what I take to be a more specific argument against the possibility of atoms having essential natures (326c30-62):

Again, is the substance of all these solids uniform, or do they fall into sets which differ from one another—as if, e.g., some of them, in their aggregated bulk, were ‘fiery’, others ‘earthy’? For (i) if all of them are uniform in substance, what is it that separated one from another? Or why, when they come into contact, do they not coalesce into one, as drops of water run together when drop touches drop (for the two cases are precisely parallel)? On the other hand (ii) if they fall into differing sets, how are these characterized? It is clear, too, that these, rather than the ‘figures’, ought to be postulated as the ‘original reals’, i.e. causes from which the phenomena result.

Aristotle’s first point here seems to be that if the atoms all have the same essential nature, then it will not be possible for there to be more than one of them. He does not say why, but I take it that his reason would be this: if we assume that you can only have two distinct substances with the same essential nature if they are composed of different matter, then the atoms would have to be composed of form and matter and thus would lose their ‘indivisibility’—they would ‘coalesce into one’ when they came together. On the other hand if you allow each substance to have a different essential nature then it is these essential natures which are doing the causal work.
Next we have a passage which seems to me to provide an explicit link with the account of accidental causation set out in the last section (326b3-7):

Again, what is it that sets them moving? For if their 'mover' is other than themselves, they are such as to 'suffer motion'. If, on the other hand, each of them sets itself in motion, either (a) it will be divisible ('imparting motion' \textit{qua this}, 'being moved' \textit{qua that}), or (b) contrary properties will attach to it in the same respect—i.e. 'matter' will be identical-in-potentiality as well as numerically-identical.

The Greek for "'imparting motion" \textit{qua this}, "being moved" \textit{qua that}' is \textit{κατ' άλλο μεν κινούν κατ' άλλο δέ κινούμενον}, which is exactly the same language as we have seen in the discussion of 192b22-32 above. This locution is Aristotle's way of indicating accidental causation, and so alternative (a) represents the consequences of making the ability to move and be moved an accidental feature of the atoms. For (b) both the Oxford and Loeb translators refer back to \textit{Physics} 190b24 and 194a1ff. 190b24 occurs in 1.7 just after Aristotle's analysis of change. His point there seems to be that the 'matter' (this is where \textit{ΰλη} is introduced) which underlies a change, whether accidental or substantial, although in one sense identical with that of which it is the matter yet in another sense is distinct. Since the matter of an \(x\) has also the potentiality of being a non-\(x\) then that matter in its own nature can no more be said to cause \(x\) than to cause non-\(x\). (b) assumes that it is the same thing which causes both. His line of argument seems to be the following: \(x\) can both move and be moved. But in rejecting (a) we have ruled out that \(x\) has two distinct potencies, and we are left with the (to Aristotle absurd) claim that the ability to move is the very same ability as the ability to be moved.

These arguments of course merely show that atomism is incompatible with Aristotle's own ontology and causal framework when strictly understood. If we interpret Aristotle less strictly there may, at the bottom level, be less to distinguish between Aristotle and Newton than we may suppose. For according to Newton's laws a particle will move in a
straight line unless subjected to certain forces. If we ask why, then the answer is surely ‘Well, that’s just what a particle is, that’s the essential nature of a particle’. At least that’s an answer that could be given—whether or not it is an answer that Newton himself would have given. What makes the Newtonian situation different is that there is just one kind of particle with just one kind of nature, and the complex behaviour of the observable macro world is determined by the micro behaviour of an incredible number of incredibly small particles acting together in incredibly complex ways.¹²

When we think of Aristotle we can catalogue his view of the world as consisting of natural phenomena like the weather, the behaviour of biological organisms, and the nature of artifacts.¹³ It is easy to imagine that natural (non-biological) phenomena depend in an obvious way on the properties of the elements. It is biological organisms and artifacts which cause more problems. For Aristotle, like all the Greeks, the ability to move and to cause movement is a mark of living things. Even more than the seventeenth century we have the advantage of familiarity with

¹² Maybe Newton is wrong here; maybe we have to assume particles of more than one kind. This would make Newton more like Aristotle. As I have observed in n.1, by ‘Newton’ here I do not necessarily mean the historical Newton. Perhaps Newton, like other seventeenth-century thinkers, did not believe that all of nature supervened on the micro. They probably did not believe that the mental supervened on the micro. Nor perhaps did they believe that Newton’s laws of motion explained why particles move as they do, but only that they do so. Newton certainly was adamant that gravity at least was not an essential property of matter (McMullin, Newton on Matter and Agency [as in n.7], 57-74).

¹³ An account of the technology of the ancient world may be found in K.D. White, Greek and Roman Technology (London, 1984). From White’s survey it is pretty clear that the world of Aristotle’s experience would not enable him to envisage a self-moving machine, though Waterlow, Nature, Change and Agency (as in n.4), 51, suggests that he might have had the concept of a divinely made automaton—but would have denied that a living organism was one.
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machines—to say nothing of computers. Machines can move of their own accord, yet we can easily explain how they do it in terms of the behaviour of their constituents. Put in Aristotelian terms, this means that the explanation of the behaviour of a machine is in terms of its matter. This may sound strange, since one might surely say that a machine has a form—a structure. Perhaps it does, but the point still remains that the underlying rules according to which it works are the rules which apply to the parts of which it is made. For its behaviour as a whole is predictable from them. And this is what Aristotelian science is principally concerned to deny.

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