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# Aristotle on the Principles of Perceptible Body (Gen. Corr. 2.1-3)

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# Aristotle on the Principles of Perceptible Body (Gen. Corr. 2.1-3)

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Aristotle's explanation of all physical change presupposes the existence of some perceptible body in which the change may occur.[1] Even the most fundamental change, genesis and destruction, cannot occur, Aristotle claims, apart from perceptible body (*Gen. Corr.* 2.1.328b32-34). A knowledge of the principles (ἀρχαί) and elements (στοιχεῖα) is therefore fundamental to understanding all physical changes.[2] In the first three chapters of book two of *On Generation and Corruption*, Aristotle presents his most comprehensive and detailed analysis of these principles.[3] His conclusion is that there are, in fact, three sorts of principles, possessing different degrees of ontological priority: (1) the substrate matter or potentially perceptible body, (2) four perceptible contrarieties, hot, cold, wet, and dry, which qualify the matter to constitute perceptible body; and (3) four primary, actually perceptible bodies, fire, air, water, and earth, which change into one another and combine to form everything in the universe (2.1.329a 28-b1).

The interest of his discussion lies not only in the identification of

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[1] Many of the ideas in this paper were first aired in the Faculty Seminar on Aristotle's *Gen. Corr.* held at the University of Cambridge (1990-91). I would like to thank the members of the seminar for piquing my interest in and helping me better understand this work. I am especially indebted to Myles Burnyeat, Geoffrey Lloyd, and David Furley for many specific suggestions and criticisms, which helped me to clarify my interpretation of the text. Work on this paper was supported by a Faculty Professional Leave and Seed Grant from the Ohio State University and by Corpus Christi College, Cambridge, which graciously extended me an appointment as Visiting Fellow.

[2] Aristotle has a terminological problem because he himself believes that the material stuffs that earlier philosophers called "elements" (στοιχεῖα) are analyzable into more ultimate elements or principles. His solution was to use the term "element" (στοιχεῖον) and "principle" (ἀρχή) synonymously as generic terms for all three kinds of principles that he will identify: (1) matter; (2) the four contrarieties, hot, cold, wet, and dry; and (3) the four primary perceptible bodies, earth, water, air, and fire. The latter (earth, water, air, and fire), which he regards as a subset of the generic principles or elements, he typically designates by three terms: "the first bodies" (τὰ πρῶτα σώματα), "the simple bodies" (τὰ ἁπλᾶ σώματα), or, in deference to the traditional usage, "the so-called elements" (τὰ καλούμενα στοιχεῖα).

[3] Hereafter I shall cite this work only by book, chapter, and page. For other Aristotelian works I shall specify titles. Any unspecified references are to *Gen. Corr.*

Aristotle ignores their disagreement, and instead finds merit in the fact that all of them use these primary bodies to explain the genesis and destruction of everything, either by the (monist) hypothesis of the alteration (ἀλλοιουμένων, μεταβαλλόντων) of a single substrate substance or by the (pluralist) hypothesis of aggregation and separation (σύγκρισις καὶ διάκρισις) of multiple elements.[6] To Aristotle's way of thinking this entails that they have correctly identified one type of principle or element of perceptible bodies. As a result, he expresses agreement with them that these primary (material bodies) are rightly ranked as "principles and elements" (ἀρχάς καὶ στοιχεῖα, 329a5-8).

His agreement, however, is not unqualified; he does not agree that the corporeal bodies that they have postulated as principles and elements are, in fact, the "substrate matter" that they claim them to be. To articulate their deficiency on this point, he compiles a second list of predecessors who have postulated "something alongside the previously mentioned [elemental bodies]" (παρὰ τὰ εἰρημένα, 329a8-9). One of these was an advocate of a single "matter" (ὕλη) who treated this matter as unqualified corporeal (σωματικὴν) matter, existing as separable matter alongside the elemental bodies. Aristotle does not mention any names, but his allusion to this "unqualified" matter as "infinite" or "undifferentiated" (ἄπειρον) leaves little doubt that he was thinking of Anaximander. This theory Aristotle considers mistaken on the grounds that it is impossible for any body to exist without some perceptible contrariety. It has to be at least either light or heavy or cold or hot; it cannot be completely undifferentiated.

A better, but still inadequately developed, intuition of substrate matter is to be found, Aristotle claims, in the *Timaeus*, where Plato introduces the receptacle (πανδεχές) as a substrate prior to the so-called elements (ὑποκείμενόν τι τοῖς καλουμένοις στοιχείοις πρότερον) and compares it to the gold of which golden objects are made (329a13-17).[7] Aristotle finds two shortcomings in this theory: first, it does not adequately differentiate the receptacle from the elements that come to be in it and so does not define whether the receptacle is separable from the elements. Aristotle no doubt thinks that insofar as the πανδεχές is conceived as a container, it will be separate from and independent of the elements and as such will be

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[6] These theories are discussed in more detail in *Gen. Corr.* 1.1.

[7] The reference is to *Tim.* 48b-51b, and esp. 50a-c.

detail on other occasions.

However, since the first bodies are *derivative* from matter in precisely (καὶ) this way (*i.e., as matter plus perceptible contrariety*), we *now really* have to differentiate even these things (*i.e., matter, contrariety, and the so-called elements*) *basing our differentiation* on the belief that the matter, which is inseparable *from the perceptible bodies*, but underlying the contrarieties, is a principle and *indeed absolutely* primary (πρώτην). We have drawn this conclusion *regarding its primacy* from the fact that (γὰρ) the hot is not matter for the cold nor the cold for the hot, but the underlying substrate is matter for both of them. Consequently (ὥστε), *(in order to articulate the differentiation that our account requires and believing that the matter underlying the perceptible contrarieties is a principle and ultimate) we contend that*, first of all (1), the potentially perceptible body is a principle; secondly (2), the contrarieties (I mean, for example, heat and cold) *are principles*; and only (ἤδη) in the third place (3), fire, water and the like *are principles. I rank fire, water, etc.; in the third place* because (γὰρ) they change into one another (not as Empedocles and others *mistakenly* claim; for otherwise there would be no *such thing as* alteration), whereas the contrarieties do not change.

Nevertheless, even so, *even having differentiated the principles of perceptible body and ranked their degree of ultimacy, we cannot leave the subject of the elements and principles of perceptible body, but* we must discuss the particular identity and the particular number of the *various* principles *of body*. For the others *(our predecessors)* have *simply* posited and used them, without giving any account of why they are these particular ones and this particular number (329a24-b6).

In the first paragraph of this passage, Aristotle presents the conception of the underlying substrate matter that he himself accepts as the ultimate principle of perceptible bodies. He presents it in explicit contrast to the two predecessors who had intuitions of it. This he does by two pairs of interlocked μέν . . . δέ antitheses. The $\mu\acute{\epsilon}\nu_1$ clause critiques the views of Anaximander and Plato (329a8-24), while the $\delta\acute{\epsilon}_1$ clause gives Aristotle's alternative (329a24-27). This alternative itself consists of a $\mu\acute{\epsilon}\nu_2$ . . . $\delta\acute{\epsilon}_2$ opposition. The first $\mu\acute{\epsilon}\nu_2$

brought too many answers to the questions asked. By introducing competing types of principles (matter and the so-called elements) and, what is worse, competing sets of so-called elements, the theories of Aristotle's predecessors create a need for some kind of adjudication of their competing claims. This is precisely what Aristotle begins to do in the last two paragraphs of the chapter (329a27-b3).

Adjudication of the claims of the competing types of principles is accomplished easily. Aristotle simply specifies the principles of perceptible bodies in order of priority and in each case gives the reason for his prioritization. Substrate matter, the first principle, is prior to the contrarieties because it is a necessary condition for the existence of the contrariety. One contrariety cannot be matter for another; the substrate of both must be matter and hence primary (329a31-32). The third set of principles, the actually perceptible bodies which come from the combination of potentially perceptible body and perceptible contrariety, is posterior to the contrarieties because the perceptible bodies change into one another, whereas the contrarieties themselves are unchanging (329a35-b3). In this way, Aristotle differentiates and ranks the three kinds of principles of perceptible body: (1) the potentially perceptible body (matter), (2) the perceptible contrarieties which cause the perceptibility of bodies, and (3) the composite of these two, the first actually perceptible bodies, of which fire and water are examples.

In a final paragraph, Aristotle confronts the much harder task of adjudicating among the sets of perceptible bodies that are competing for the title of first (actually perceptible) bodies. This will occupy him for the next two full chapters. Here he only announces his agenda and his reasons for undertaking it. His agenda is to establish the number and identity of the principles he has just differentiated. The differentiation (διορισμός) of different *kinds* of principles and their ontological relationships did not and could not establish the identity of the *particular* principles that fall under each kind. Matter, of course, presented no further problem, because it is by definition undifferentiated and single (cf. 1.6.322b17-19); but the number and specific identity of the perceptible contrarieties and of the first bodies constituted by them is another matter.[9]

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[9] Commentators usually take Aristotle here to be referring *only* to the contrarieties and to introduce only *Gen. Corr.* 2.2; but Aristotle does not say anything here that would restrict the scope of his inquiry to the contrarieties either in his announcement of his agenda or in his justification for undertaking the task. More

step in his undertaking. Our senses tell us that bodies have all sorts of perceptible properties, but not all are primitive and constitutive of a primary perceptible body. Aristotle's challenge is to decide which ones they are. The number and nature of primary contrarieties, in turn, will determine the number and nature of primary bodies. Every different combination of primary contrarieties will constitute a different primary body; one pair will constitute two primary bodies, two pairs will make four primary bodies, three pairs will produce eight bodies, and so forth. Also, whatever particular contrarieties are primary will determine the nature of the first perceptible bodies from which everything comes and in terms of which everything must be explained. In short, the coherence and efficacy of Aristotle's entire scheme of explanation in physical philosophy hangs on his determination of the primary qualities.

The approach that Aristotle choses for this critical project is the method of elimination. Therein lies one of the challenges of his project for the modern reader. For Aristotle never ennumerates his criteria of primacy; they must be deduced from his practice. That is a challenging undertaking. Given the interdependence of the number and nature of primary contrarieties and the number and nature of primary bodies, there are two ways Aristotle can approach the problem of their number and nature. He can start by establishing the number and nature of the primary bodies and then examine how many and which contrarieties will be required to produce these bodies. Or he can determine independently how many and which contrarieties are primary and then derive the number and nature of the primary bodies from these. Aristotle choses the second. Starting from the full range of perceptible properties, he eliminates all that fail to meet the criteria of "primacy."

Aristotle conducts his elimination in two stages. First he eliminates all but tangible contrarieties from consideration (329b7-16); then he eliminates all but four of the tangible contrarieties, specifically, hot, cold, wet, and dry (329b16-330a29). The first stage is performed so swiftly that we hardly notice what has happened:

> Since (a) we are seeking principles of perceptible body, (b) that is of tangible body, and (c) tangible is that of which touch is the sensation, clearly (d) not all contrarieties constitute species of body and principles (e.g. the primary bodies), but only those

contrariety" (κατ' ἐναντίωσίν τε γὰρ διαφέρουσι, καὶ κατὰ ἁπτὴν ἐναντίωσιν, 329b10-11).

The usual explanation for Aristotle's lack of explanation is that he equated perceptible body with tangible body. Some interpreters have suggested he did so on the grounds that all perceptible bodies possess at least some of the tangible qualities, whereas not all exhibit qualities that are the objects of vision, hearing, taste, or smell.[10] Another has cited Aristotle's thesis in *De An.* 2.2-3.413a11-415a13 that touch is the most fundamental sense and the only sense universal to all animals, though he must acknowledge that this does not yield a valid argument that tangible contrarieties are the defining properties of perceptible matter.[11] Still it is strange that Aristotle would leave an important premise like the claim that perceptible body is equivalent to tangible body not only unsupported, but unexpressed. In both declarations of the move, Aristotle skips over the assumed equation and simply adds the alleged equivalent ("tangible") to the previous proposition, in the first instance as a self-evident replacement for "perceptible," in the second as an addition (τε . . . καὶ).

I suggest that all these explanations are wrong. I would further suggest that Aristotle does not and could not equate perceptible body with tangible body, but that he understands "tangible" and "tangible body" in their natural sense as species of "perceptible" and "perceptible body." Then his claim is not that one must seek the principles of tangible body because tangible body is logically equivalent to perceptible body or universally assumed in Greek culture, but that we must seek the principles of tangible body *because its specific principles are, in fact, the only principles for all perceptible body.*

The key to understanding Aristotle's move here and the rapidity with which he makes it must be his discussion in *Gen. Corr.* 1.6. There, justifying his philosophical agenda for the rest of the treatise, he says that a discussion of the status and genesis of the so-called elements is a necessary precondition for discussing the genesis of compound bodies; but prior to such a discussion of the first bodies, he declares, one must clarify two hitherto inadequately articulated topics (1.6.322b1-6). Everyone agrees, he argues, that the generation of the so-called elements themselves and of compounds from these elements

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[10] E.g., Joachim (above, note 4) 201-202.

[11] Williams (above, note 4) 157.

that genesis and destruction presuppose *mutual* contact. Only tangible body is capable of *mutual* contact, so only tangible body can function as principle in the explanation of genesis and destruction and only tangible contrarieties qualify as principles.[15]

The second step in Aristotle's search for the number and identity of the contrarieties that constitute primary perceptible bodies gives Aristotle more difficulty. He must determine which contrarieties are primary and constitutive and which are not. He does this by collecting all the recognized tangible contrarieties, then eliminating those that do not qualify as principles. The tangible contrarieties that he starts with are: hot-cold, dry-wet, heavy-light, hard-soft, elastic-brittle, rough-smooth, and coarse-fine (329b18-20).

His first elimination is of heavy and light, which are disqualified as being capable neither of causing action nor of being affected. The criterion itself (capable of causing action or being affected) he justifies on the same grounds that we just considered with reference to tangibility. The elements must be capable of mutual acting and being affected, if they are to change into one another and mix to form compounds. Any contrariety that does not act on something or is not affected by something is disqualified. But then we must ask what he means by saying that the heavy and the light "are not said to do anything to something else (ποιεῖν τι ἕτερον) or to be affected by something else" (329b21-22). He admits that everything physical is either heavy or light or both (1.6.323a7-9), and he has even admitted that heavy and light things have the capacity to act or be affected" (1.6.323a7-10). We can only assume that he holds that heavy and light things do not act or experience effects *qua* heavy or light.[16] Even

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[15] This claim entails that tangible contrarieties are prior to non-tangible contrarieties. In a short digression he (329b14-16) reconciles this with suggestions he made elsewhere that vision is more valuable that touch and hence prior (cf. *Eth. Nic.* 1176a1; *Probl.* 886b35). This might suggest that visible contrarieties might be prior to tangible. Aristotle does not deny that, but points out that the visible contrarieties of tangible body are not properties of tangible body *qua* tangible. Since only the contrarieties of body *qua* tangible qualify as principles of genesis and destruction, the priority of visible contrarieties in another sense does not affect the priority of tangible contrarieties as principles of genesis and destruction.

[16] Cf. Joachim (above, note 4) 204; and Williams (above, note 4) 158. Williams' explanation that heavy and light do not communicate their contrariety to other things is not a sufficient explanation. While it may be true that a heavy body does not make light bodies heavy, in the way that a hot body warms a cooler body, Aristotle does not construe the action of heating as transmitting its own power, but he defines it as "causing association among homogeneous things" (329b26-27). Heavy and light,

that qualifies them to serve as causes of elemental and other kinds of change in the world.

This last point bears further examination. Aristotle's decision to make perceptible qualities serve as constitutive principles of the physical world obligated him to give the contrarieties an objective physical status that the terms themselves tend to obscure. To the modern reader "hot" and "cold" suggest a continuum of temperature within which the alleged contrarieties cannot be located without a percipient to distinguish the hotter from the colder. "Wet" and "dry" have an additional problem. They suggest a mixture of ontologically prior bodies (water and waterless stuff), and hence a derivative rather than primary status. Aristotle had to escape both these implications if he was to use these tangible properties as principles.[18]

Aristotle's definitions show how he did it. He escaped the subjectivity implied by hot and cold by grounding their difference in a qualitative difference in the activity that defines their essence. Both hot and cold possess the generic capacity of causing association (σύγκρισις); but the specific kind of "association" is inherently different for each. That difference can be recognized from the kinds of objects that are susceptible to it. Hot causes association only of things that are of the same kind (τὰ ὁμογενῆ); cold brings together and causes association of things of the same kind (ὁμογενῆ) as well as of things that are unrelated (τὰ μὴ ὁμόφυλα). Hot and cold differ, therefore, in their objectively real effects.[19] When hot acts upon something, it segregates things by kind, causing aggregation and coalescence of the things that are the same in kind. Its specific effect on a body or mixture of bodies will depend on the nature of the object, specifically its homogeneity or the nature of its heterogeneity,

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[18] To avoid this implication some translators prefer "fluid" and "solid," but this obscures the fact that the ambiguity is not only modern, but was felt already by the Greeks themselves. When Aristotle explicitly discusses various senses in which "wet" and "dry" were used, he shows that the Greek terms "wet" and "dry" ambiguously denote either physical states or different mixtures of water and dry stuff (2.2.330a12-24). This shows it to be a real problem facing Aristotle, not merely a problem of translation into English.

[19] Aristotle adds a clarification and rebuttal of those who claim that fire (which must be hot) "separates" (διακρίνειν) things, presumably by reducing compounds into more elementary stuffs. Aristotle explains that this activity is really "association" (συγκρῖνειν) viewed from a different perspective. The destruction and separation really produces association of things of the same kind by removing what is not of the same kind ( 2.2.329b27-29).

are all referred (ἀναγονται) to the primary four" (2.2.330a24-25). The word "led up to" or "referred to" (ἀνάγεσθαι) suggests that he believes the remaining four pairs of contrarieties can be explained in terms of the primary four and hence do not themselves qualify as additional or prior principles. How precisely he thinks they are to be explained has to be deduced from his practice.

One of the four pairs, smooth and rough, he simply ignores. We can understand why. His definition of smooth and rough, given in the *Categories* is that the smooth consists in "all the parts lying on a flat plane," while the rough consists in "[some parts] extending beyond and [others] not quite meeting [the surface] (*Cat.* 8.10a17, 22). Smooth and rough are, therefore, specific characteristics of the surface or boundary of a body. Since the boundary has been stipulated by Aristotle's definitions to be the result of the contrarieties of wet and dry, the pair of smooth and rough may be dismissed as derivative of wet and dry directly, without further discussion. The other three pairs are more problematic and philosophically interesting.

The first of these, thick and thin, Aristotle treats at some length, thereby revealing his rationale (329b34-330a4). He begins with the premise that the capacity to fill something (τὸ ἀναπληστικόν) belongs to the wet. His justification shows that he derived his first premise from his definition of the wet. The wet, he says, is (1) "not bounded by its own boundary, but (2) easily shaped or bounded." Then to this definition he adds a contingent condition (contact with another body) and the consequence of that contact, i.e., that it (3) "follows (ἀκολουθεῖν) the thing that touches it." This consequence, conforming to the container with which it is in contact, is equivalent to "the capacity of filling [something]." In other words, he argues that to fill something is a capacity that wet derives from its nature as absolutely shapeable with no capacity whatsoever to retain shape on its own; but, he contends, it is only present under one condition, an interaction with another body. Thus it is a reactive affection that occurs under a particular interactive condition. As a result, Aristotle does not say "the wet is capable of filling" or "the capacity to fill is the wet," but rather "the capacity to fill *belongs to* (literally "is of") the wet." By this he means that it is *one* of the capacities of the wet when the wet finds itself in the stipulated circumstances (in contact with a container).

After having established this premise, Aristotle adds his second

characteristic of physical body that is denoted by the term "thin" (λεπτόν). He concludes by saying that the fine is "especially like that" (μάλιστα τοιοῦτον), viz. (metaphorically) fine-parted, capable of total contact with the surface of a container, and capable of "filling [something]."

What Aristotle has done in this argument is to derive the "capacity of filling [something] analytically from the nature of "the fine," which he understands to be such as to cause its possessor to react in the way that a body made of very small particles would react under the same conditions. In the limiting case of small-parted stuff, which will be identical with the case of continuous "thin" matter, there will be total contact with another body. In other words:

Thin <—> Total contact <—> Capable of filling

The derivation of the capacity for filling from the definition of the fine follows the same strategy that he used in deriving the capacity for filling something from the definition of the wet. In both cases the capacity to fill is regarded as a logical implication of the definition of the term under the condition of contact with another body. The fact that the definitions logically imply the same affective response to contact with a container gives Aristotle his warrant for claiming they are not independent constitutive principles. Though Aristotle goes on to use this warrant to exclude the thin and the thick from the status of principles, he does not then draw the conclusion that they are identical, that is, merely two names for the same property. He treats each as a real physical property. This is enough to eliminate thin and thick as a third pair of contrariety principles alongside hot and cold and wet and dry, but it is not enough to warrant privileging wet and dry over thin and thick. To discover Aristotle's grounds for privileging wet and dry, we must look more carefully at his procedure here and in subsequent examples.

The only way Aristotle can show one of the two equivalent contrarieties to be primary is to show that the other is derived from it. Here Aristotle must show that thin is in some way a derivative of the wet. He expresses its derivative relationship unmistakably by claiming that "the thin is *of* the wet" (τοῦ ὑγροῦ). We must consider what he means by that.

His actual argument runs as follows:

state of easy shapeability.[22] Aristotle gives us a clue as to what that modification might be in *Gen. Corr.* 1.10, where in a discussion of mixture he ranks wet things as the most easily mixed because they are most divisible (διαιρετά). This he then explains by saying that "the wet is most easily shaped (εὐόριστον), *unless it is elastic*" (γλίσχρον, 1.10.328b1-5).

Evidently, he has in mind to treat elastic and brittle like fine and thick. Elasticity is to be defined in terms of divisibility, as thinness was defined in terms of the ability to fill (something). Specifically, the elastic is less easily divided than the wet. The wet, for its part; possesses divisibility as a consequence of the shapeability (εὐόριστον) by which it was defined. Consequently, the elastic is derived from the wet and may be explained in terms of the shapeability of the wet. But in the case of the elastic, unlike the case of the thin, we are not left in doubt as to why the wet is primary and the elastic is derived. The elastic conforms only partially to the definition of the wet; the elastic is easily shaped, but not nearly as easily as the wet. To some extent, the elastic retains a shape of its own, at least enough to allow it to be stretched somewhat without breaking. In so far as it is somewhat shape-retentive, it possesses a defining characteristic of the dry. It is, therefore, a contrariety that is not as totally "wet" as the wet itself, but has some admixture of "dry" in it.

The conception of the pair of contrarieties elastic and brittle as derived by "mixing" dry and wet is reflected even more clearly in the description of brittle as "*completely* dry (τὸ τελέως ξηρόν) so as to be solidified on account of its *lack of wetness* (δι' ἔλλειψιν ὑγρότητος, 330a6-7).[23] This description of what is brittle leaves no doubt that Aristotle regarded the contrarieties as being mixed in the objects in which they reside.

We are now beginning to get a clearer picture of how Aristotle thought he could justify ranking wet and dry as principles while making thin and thick, or elastic and brittle derivatives of wet and dry. Wet and dry constitute a continuum that may be explained as a

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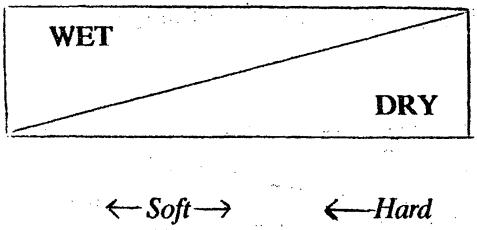
[22] In *Meteor.* 4-9.387a.11-12 he describes elastic as being "ductile" as well as wet or soft (ἑλκτὸν ἢ ὑγρὸν ὃν ἢ μαλακόν). Bodies whose compostion is like a chain become elastic, he says, by interlocking (τῇ ἐπαλλάξει) and so can extend and contract to some degree (*Meteor.* 4.9.387a11-14). This makes it clear that this contrariety implies a higher degree of cohesion than wet does.

[23] Brittle is characterized as "breaking quickly" (θραύεται τὰ κραῦρα ταχέως, *Part. An.* 2.9.655a32).

When a (solid) object comes into contact with the wet, the wet moves away and, in fact, flows around the invading object.[24] When a (solid) object comes into contact with the soft, the soft retains its own boundary, but that boundary yields into itself." Elsewhere, Aristotle cites water and wax as examples of the difference between the wet and the soft and points out that in the case of wax, but not of water, the surface yields inward and becomes indented (*Meteor.* 4.9.386a 18-26). Thus the soft belongs to the wet by virtue of possessing the same characteristics of shapeability, but in lesser degree.

At the other end of the continuum, we find "the hard," which he argues is a property of the solidified (πεπηγός). Since the solidified is dry, he concludes that hard belongs to the dry (2.2.330a11-12). His reasoning here is similar to that regarding the brittle. There he maintained that solidification is the result of being completely dry and that solidity is equivalent to brittleness. Here he claims that hardness is another result of the solidification that accompanies dryness.[25]

We may depict the relationship as follows:




Aristotle's rationale for making wet and dry principles and deriving the other tangible qualities from them appears to have been the greater *explanatory* power of wet and dry. Wet and dry, by mixing, could explain the widest range of states of shapeability. The fact that

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[24] In 2.2.330a9 Aristotle says the wet changes position (μεθιστάμενον). In a parallel explanation in *Meteor.* 4.4.382a11-14, he uses the word "flow around" (ἀντιπεριίστασθαι). At *Meteor.* 4.9.386a.25-26 he uses ἀντιμεθίστατα,

[25] The argument is excessively brief and, as it stands, not very clear; but its parallelism to the argument for the derivation of brittle from dry seems obvious. Cf. Williams (above, note 4) 211.

## III. The First Bodies

Once Aristotle has established the number and identity of the primary contrarieties, the number and identity of the primary bodies follows naturally and immediately. Though Aristotle does not mention it again, the defining characteristic of any primary body is the capacity to act and be affected, which leads him to assume without discussion that the first bodies will be characterized by a pair of contrarieties, one active and one passive. The four active and passive contrarieties logically make four possible pairings. Theoretically, four items can form six combinations, but since these items are contrarieties and contrarieties cannot be combined with each other, two combinations are impossible (*viz.* hot with cold and wet with dry).[28] That means that there can only be four combinations: (1) hot and dry, (2) wet and hot, (3) cold and dry, and (4) cold and wet. These, Aristotle points out, accompany the four simple bodies that appear to our senses (τοῖς ἁπλοῖς φαινομένοις σώμασι) in a rational pattern (κατὰ λόγον).[29] Fire is hot and dry, air hot and wet, water cold and wet, and earth cold and dry. Then, having stipulated the first bodies that qualify as principles, Aristotle appears to conclude his argument by affirming that the differentiating characteristics are distributed in a rational pattern (εὐλόγως) to the first bodies and that the number of first bodies is rationally grounded (κατὰ λόγον).

This might seem to be the end of the matter. He has fulfilled his agenda of articulating the different kinds of principles of perceptible matter, of identifying them, and of showing why they have to be the particular number and particular ones that he claims. As he suggested in raising the question in the first place, he is following in the wake of

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[28] We might note that they would also be ruled out on the grounds of lacking capacity for *mutual* action and affection, for a combination of two active or two passive contrarieties would yield first bodies which could only act or only experience affection, not both.

[29] Williams (above, note 4) 160 takes the phrase τοῖς ἁπλοῖς φαινομένοις σώμασι to mean "the apparently simple bodies," which he then takes as a reference to a later paragraph where Aristotle seems to say fire is not pure unmixed "hot-dry" first body. Against this interpretation is Aristotle's word order (ἁπλοῖς φαινομένοις) and the fact that the whole movement of the argument demands that "simple bodies" refer to the theoretically constituted hot-dry first body. φαινομένοις, I should think, ought to be explained, not by a paragraph later in the chapter, but by the very next sentence, which is linked by γάρ. On this interpretation, see Joachim (above, note 4) 213. The meaning of κατὰ λόγον is disputed. I shall return to it later.

this point.

The conclusion that Aristotle reached regarding the number and identity of the primary bodies is followed immediately by a review of the predecessors that postulated one or more of the primary bodies as principles or elements. This cannot fail to remind readers, if they have forgotten, that Aristotle's entire theory of the principles of perceptible body was presented as a rigorously argued clarification and correction of his predecessors. The task that Aristotle just completed, i.e., showing why the first bodies had to be precisely four (earth, water, air, and fire) fell to Aristotle, by his own admission, because this group of predecessors had declared a specific number of corporeal bodies to be principles and elements without demonstrating why. But their failure, in Aristotle's eyes, could not have been only a failure to justify their choice of number and nature of the primary body or bodies. Their lack of agreement signaled a more fundamental failure. At least some of them had failed even to discern the correct answer. That raises the question: why did Aristotle cite predecessors who not only had followed an insufficiently rigorous method, but were also patently wrong?

It must be noted that Aristotle did not cite all his predecessors on the subject of the elements of perceptible body; he omitted Anaxagoras and the atomists, though he included them in his review of predecessors in *Gen. Corr.* 1.1.[31] His reason can only be that Anaxagoras and the atomists held the number of elements or principles to be infinite and the earth, water, air, and fire of our experience, not to be simple, but composite bodies.[32] But if these predecessors were omitted because of their erroneous conception of the principles or elements, why did he include others who also had an erroneous conception, albeit one that was slightly closer to the truth?

When we look at the predecessors that Aristotle cited for his conception of substrate matter, we see that *both* of them had seen something of the truth. Plato was much closer; his only failure was leaving some aspects undefined and failing to apply the concept as extensively as he might have. But the other predecessor, Anaximander, wrong as he was in making his principle corporeal, had in his "Unbounded" at least a partially correct intuition that there

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[31] The absence of Anaxagoras' theory from the catalog of *Gen. Corr.* 1.1 shows that the omissions there cannot be based on Aristotle's prior rejection of atomism.

[32] Aristotle characterizes their views in *Gen. Corr.* 1.1.314a14-b1.

they divide the intermediate into one or two, Aristotle holds that their theories may be taken together for conceptual analysis. Both recognize as elements a pair of extremes (earth and fire) and an intermediate which is explained as a mixture of the two extreme elements (330b13-19). Aristotle does not draw any explicit parallels between this theory and his own, as he did in the case of the monists; but he does use two words, "mean" (μέσον) and "mixture (μῖγμα), that remind us of concepts that play important roles in his own theory of the formation of compounds.[34]

Finally, he gets to Empedocles, who starts off immediately with the four simple bodies as elements. This, of course, does resemble an aspect of Aristotle's theory, but that resemblence turns out not to be Aristotle's concern here. Instead, he focuses attention on the fact that when using his four elements as explanatory principles, he sets up an opposition (ἀντιτίθησιν) between fire and the other three (330b19-21). This opposition so struck Aristotle that he noted it in *Metaph.* 1.4 as well, where he goes further and says that Empedocles treated earth, air, and water as "one nature" (φύσις).[35] Thus in Empedocles' theory of four principles of genesis and destruction Aristotle discovers a significant opposition or antithesis operative in their interaction, an opposition that sets fire against all the other elements.

As in the case of the proponents of two or three elements, Aristotle draws no explicit parallels between the theory of Empedocles and his own; but if we look ahead ten lines to the last major segment of the chapter, we find a series of observations on the relationships among the elements in Aristotle's own theory (330b30-331a6). The order in which he makes these observations and the nature of the relationships held up for scrutiny shows a remarkable coincidence with the theories just elucidated and suggests an overarching unity and purpose in this final section.

The first observation Aristotle makes is that of the four elements two belong to each of the two major regions of the universe. Fire and air belong to those that move toward the periphery, whereas earth and water belong to those that move toward the middle (330b30-33). The natural movements of the four first bodies thus make an unmistakable statement about an essential dichotomy underlying the four first

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[34] Cf. esp. *Gen. Corr.* 2.7.

[35] Fragment 62 (Diels-Kranz) may have been the kind of text to which Aristotle is alluding.

he attributed to the dualists and triadists, namely, that fire and earth are the two elements whose mixture constitutes the intermediate element or elements. Aristotle's treatment of extreme elements as "purest" and intermediate as "mixed," which Aristotle draws as a corollary of their division into extremes and means, makes little sense as a description of the theory he has been developing in *Gen. Corr.* 2.1-3; but it does make sense when it is construed as an observation of the first bodies in the natural world.[36] In the natural world of our experience we never encounter pure elemental hot-wet "air," but we live in an atmosphere in which hot and wet are mixed with hot and dry in such a way that the proportion of hot and dry diminishes as one approaches the periphery of the sublunar world (*Meteor.* 1.3.340b14-29; 1.4.341b6-24; 2.4.359b27-34, 360a21-27). Similarly, water and earth tend to be mixed near the surface of the earth, whereas the purest cold and dry is to be found near the center. Thus Aristotle seems to be claiming in *Gen. Corr.* 2.3, not that some elemental bodies are constituted from a mixture of others, but that they are encountered in the world mixed with the extreme elemental bodies.

Aristotle in *Gen. Corr.* 2.3 does not explain why this should be; he simply asserts it. But in *Gen. Corr.* 1.10, in his explanation of mixture, he tells us that one of the properties derivable from wet and dry is ease of divisability and difficulty of divisability. Ease of divisability, in turn, he stipulates to be a necessary condition of mixture (1.10.328a33-b23). On this theory, bodies endowed with "wetness" could be expected to be more susceptible to mixture, whereas dry bodies could be expected to be less susceptible. Thus he can ground this second observable feature of the natural world in the contrarieties and their distribution.

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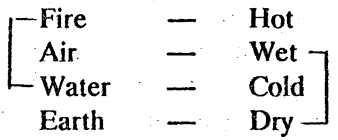
[36] Joachim (above, note 4) 218 attempts to make it refer to the motions of the intermediate first bodies on the grounds that the previous observation referred to the two natural motions (toward the periphery and toward the middle); but though Aristotle does say the intermediate bodies (air and water) move both up and down, he never calls this characteristic "mixed" motion. In fact, he explicitly claims single bodies never possess mixed motions; mixed motions are indicative of compounds (*De Cael.* 3.3.302b5-7).

of which is more noticeable to a percipient than the other. The perceived pattern of opposition, however, is still the same:




This pattern of opposition (ἐναντία) is peculiarly relevant to Aristotle's analysis of Empedocles in his final review of predecessors (330b19-21), since Empedocles made use of the process of opposition (ἀντιτίθησιν) in explaining the interaction of the four elements; but its relevance does not end with providing a parallel for the nature of the relationship between sets of elements. Aristotle's pattern of opposition gives an explanation for the one opposition of Empedocles' theory that he had not yet explained.

Aristotle's explanation of the monists' intuition of contrariety between upward moving hot bodies and downward moving cold bodies explained the opposition between fire and earth. His explanation of the dualists' and triadists' intuition of contrariety between extreme (unmixed), dry elements and intermediate (mixed), wet elements explained the opposition between fire and the intermediate body, the triadists' air, the only intermediate *primary* body postulated by any members of this group (dualists and triadists).[37] Now, last of all, Aristotle's explanation of the opposition of fire and water on the basis of a doubly opposed pair of contrarieties caps his explanation of Pre-Socratic intuitions by providing an explanation that, combined with the previous two, accounts for Empedocles' intuition of an antithesis between fire and the other three elements.

Strictly speaking, it was unnecessary. Aristotle's explanation of the opposition between extremes and intermediates on the basis of the contrarieties dry and wet had already grounded fire's opposition to water, which like air is wet. Why Aristotle added this final observation on the double opposition of air and water (contrary in two affections) is not explained. He may very well have wished to find a Pre-Socratic intuition for each of the three possible divisions of the

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[37] Aristotle's explanation also covered the pair of perceptible bodies that Parmenides postulated as intermediate; but on Aristotle's interpretation of him as a dualist, these bodies had to be regarded as compounds.

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There are problems, however, with such an interpretation. The most serious is that it cannot be reconciled with what we have found to be Aristotle's grounds for assigning primacy to the contrarieties, hot, cold, wet, and dry. Aristotle's principal reason for regarding these as primary to other definitionally related contrarieties was the fact that they are the extremes, within which the others can be explained as mixtures and hence derivative. It seems incredible that after a procedure like that Aristotle could turn around and claim the simple bodies are constituted by *moderate* degrees of their constitutive contrarieties.

I suggest that he never did. This passage, following immediately upon his account of the theory of Empedocles and preceding his correct (Aristotelian) explanation of the Pre-Socratic intiutions is, I contend, a continuation of his account of Empedocles.[38] It was, then, Empedocles, not Aristotle, who alleged that the elemental bodies that we perceive in the natural world are not simple, but mixtures, viz. of more than one simple body, yet named after the one that predominates.[39] It was Empedocles, too, who explained fire and ice as excesses, again, of one of the (Empedoclean) simple bodies. Aristotle's terminology and conceptualization in this passage is, naturally, Aristotelian. Aristotle had shortly before, reinterpreted the monists' rarefaction and condensation as effects of the (Aristotelian) active principles, hot and cold. Now, I suggest, he is reinterpreting Empedocles in terms of his own Aristotelian theories. It is perhaps not accidental that in his "interpretations" of all three categories of Pre-Socratics, the Pre-Socratic explanatory principles turn out to be ones that also appear in Aristotle's own *Meteorology* and biological works: boiling (ζέσις) and solidification (πῆξις), mixture, and condensation and rarefaction.

If we take 330b21-30 as Aristotle's description of an Empedoclean intuition of the role of heat in boiling and solidification, his explanation of the paired opposition of elements (fire vs. water; air vs. earth) and the perceived dominent tangible property of each element has more point than if it only serves as one part of an explanation of

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[38] So it is treated by C. Mugler, *Aristote: De la Génération et de la Corruption* (Paris 1966) 50-51.

[39] The theory here described is consistent with and implicit in Aristotle's discussion of Empedocles in *Gen. Corr.* 1.1. See Appendix below.

of his predecessors' errors (330b7-331a6) becomes clear. Aristotle concluded his declaration of the distribution of the primary qualities among the primary bodies with the claim that as a result the distribution is rational (εὐλόγως) and the number of elements is "rational" or "proportional" (κατὰ λόγον, 330b6-7). The precise meaning of εὐλόγως and κατὰ λόγον in this sentence is not obvious; but if Aristotle was attempting to explain his predecessors' errors in counting the elements on the basis of this very distribution, we cannot help suspecting that κατὰ λόγον refers to the rational pattern of distribution of contrarieties, which displays different patterns when viewed from different perspectives. Then he is claiming that this rational pattern of distribution was noticed already by the earliest theoreticians, but they misconstrued it. It took Aristotle to discover the truth about this rational structure in nature and its role in the history of philosophy.

With this clarification of the philosophical significance of the Pre-Socratic theories of elements Aristotle brings to a close his discussion of the principles of perceptible bodies. He had embarked on this subject with the intent of explaining the first bodies and their role as principles of genesis and destruction. Jumping off from the theories of the Ionian philosophers who first proposed simple elemental bodies as principles of change, he probed behind these to discover even more fundamental principles, one of which was anticipated by another Ionian and by his teacher Plato. These ultimate principles will become for Aristotle the foundation of all explanations of material change in the natural world. In the end Aristotle's exposition comes around full circle to those Ionians from which it began, to show them not so much as confused misadventurers in the quest for truth, but as successful explorers who, without realizing what they had really done, had caught a glimpse of the new world of imperceptible reality lying at the very foundations of the universe. By showing how even the errors of their incompatible and incorrect theories derived from the true structure of the natural world as he himself had come to understand it, Aristotle gained for his own theories the support of the wisest philosophers of the past and at the same time forged the first links with the phenomenal world that he proposed to explain.

they are only "hot-white", "cold-wet," "heavy-hard," etc. Thus Aristotle can claim that these "simple bodies" are "fiery, "watery," etc., but not "fire," "water," etc. However, after they have separated out and collected into masses in which one kind predominates enough to warrant the name "fire," "air," etc., they still are not completely separated from each other. The apparent genesis of one element from another is evidence of that. The only way Empedocles can explain the (apparent) genesis of one element from another is to assume that even relatively pure aggregations of the same kind of element are nevertheless mixtures, including small portions of all the others (cf. *De Cael.* 3.7). So fire must be deemed a mixture in which there is a predominance of hot-white, which Aristotle then may describe in his own vocabulary as an "excess of heat," or (translating Empedocles' "hot-white" into his own "hot-dry") a "boiling of the hot and dry."