

SENSE AND SENSIBILIA

Translated by *J. I. Beare*²

436a1-436a6 § 1 · Having now considered the soul, by itself, and its several faculties, we must next make a survey of animals and all living things, in order to ascertain what functions are peculiar, and what functions are common, to them. What has been already determined respecting the soul must be assumed throughout. The remaining parts of our subject must be now dealt with, and we may begin with those that come first.

436a7-436a16 The most important attributes of animals, whether common to all or peculiar to some, are, manifestly, attributes of soul and body in conjunction, e.g., *sensation*, *memory*, *passion*, *appetite* and *desire* in general, and, in addition, *pleasure* and *pain*. For these may, in fact, be said to belong to all animals. But there are, besides these, certain other attributes, of which some are common to all living things, while others are peculiar to certain species of animals. The most important of these may be summed up in four pairs, viz. *waking* and *sleeping*, *youth* and *old age*, *inhalation* and *exhalation*, *life* and *death*. We must examine these, determining their respective natures, and the causes of their occurrence.

436a17-436b1 But it behoves the natural scientist to obtain also a clear view of the first principles of *health* and *disease*, inasmuch as neither health nor disease can exist in lifeless things. Indeed we may say of most physical inquirers, and of those physicians who study their art more philosophically, that while the former complete their works with a disquisition on medicine, the latter start from a consideration of nature.

436b2-436b9 That all the attributes above enumerated belong to soul and body in conjunction, is obvious; for they all either imply sensation as a concomitant, or have it

²TEXT: W. D. Ross, *Aristotle: Parva Naturalia*, Clarendon Press, Oxford, 1955

as their medium. Some are either affections or states of sensation, others, means of defending and safe-guarding it, while others, again, involve its destruction or privation. Now it is clear, alike by reasoning and without reasoning, that sensation is generated in the soul through the medium of the body.

We have already, in our treatise *On the Soul*, explained the nature of sensation and perceiving, and the reason why this affection belongs to animals. Sensation must, indeed, be attributed to all animals as such, for by its presence or absence we distinguish between what is and what is not an animal.

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But coming now to the special senses severally, we may say that touch and taste necessarily appertain to all animals, touch, for the reason given in *On the Soul*, and taste, because of nutrition. It is by taste that one distinguishes in food the pleasant from the unpleasant, so as to flee from the latter and pursue the former; and savour in general is an affection of the nutritive part.

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The senses which operate through external media, viz. *smelling, hearing, seeing*, are found in all animals which possess the faculty of locomotion. To all that possess them they are a means of preservation in order that, guided by antecedent perception, they may both pursue their food, and shun things that are bad or destructive. But in animals which have also intelligence they serve for the attainment of a higher perfection. They bring in tidings of many distinctive qualities of things, from which knowledge of things both speculative and practical is generated in the soul.

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Of the two last mentioned, seeing, regarded as a supply for the primary wants of life is in its own right the superior sense; but for developing thought hearing incidentally takes the precedence. The faculty of seeing, thanks to the fact that all bodies are coloured, brings tidings of multitudes of distinctive qualities of all sorts; whence it is through this sense especially that we perceive the common sensibles, viz. *figure, magnitude, motion, number*; while hearing announces only the distinctive qualities of sound, and, to some few animals, those also of voice. Incidentally, however, it is hearing that contributes most to the growth of intelligence. For rational discourse is a cause of instruction in virtue of its being audible, which it is, not in its own right, but incidentally; since it is composed of words, and each word is a symbol. Accordingly, of persons destitute from birth of either sense, the blind are more intelligent than the deaf and dumb.

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§ 2 · Of the distinctive powers of each of the faculties of sense enough has been said already.

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But as to the nature of the sensory organs, or parts of the body in which each of the senses is naturally implanted, some inquire into them with reference to the

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elements of bodies. Not, however, finding it easy to coordinate five senses with four elements, they are at a loss respecting the fifth sense. They all hold the organ of sight to consist of fire, being prompted to this view by a certain affection of whose true cause they are ignorant. This is that, when the eye is pressed and moved, fire appears to flash from it. This naturally takes place in darkness, or when the eyelids are closed—for then, too, darkness is produced.

437a27-437a31 This raises another puzzle; for, unless a man can perceive³ and see without being aware of it, the eye must see itself. But then why does the above affection not occur also when the eye is at rest? The true explanation of this affection, which will contain the answer to our question, and account for the current notion that the eye consists of fire, must be determined in the following way:—

437a32-437b10 Things which are smooth have the natural property of shining in darkness, without, however, producing light. Now, the part of the eye called the black, i.e. its central part, is smooth. The phenomenon of the flash occurs only when the eye is moved, because one object then becomes as it were two. The rapidity of the movement has the effect of making that which sees and that which is seen seem different from one another. Hence the phenomenon does not occur unless the motion is rapid and takes place in darkness. For it is in the dark that that which is smooth, e.g. the heads of certain fishes, and the sepia of the cuttle-fish, naturally shines, and, when the movement of the eye is slow, it is impossible that that which sees and that which is seen should appear to be simultaneously two and one. The eye sees itself in the above phenomenon as it does so in reflexion.

437b11-437b23 If the visual organ were fire, which is the doctrine of Empedocles, a doctrine taught also in the *Timaeus*, and if vision were the result of light issuing from the eye as from a lantern, why should the eye not have had the power of seeing even in the dark? It is totally idle to say, as the *Timaeus* does, that the visual ray coming forth in the darkness is quenched. What is a quenching of light? That which, like a fire of coals or an ordinary flame, is hot and dry is, indeed, quenched by the moist or cold; but heat and dryness are not evidently attributes of light. And if they are attributes of it, but belong to it in a degree so slight as to be imperceptible to us, we should have expected that in the daytime the light of the sun should be quenched when rain falls, and that darkness should prevail in frosty weather. After all, flame and ignited bodies are subject to such extinction, but experience shows that nothing of this sort happens to the sunlight.

437b24-438a2 Empedocles at times seems to hold, as we said before, that vision occurs when light issues forth from the eye, e.g., in the following passage:—

³Ross adds *me* before *aisthanomenon*.

As when one who purposes going abroad prepares a lantern,
A gleam of fire blazing through the stormy night,
Adjusting thereto, to screen it from all sorts of winds, trans-
parent sides,
Which scatter the breath of the winds as they blow,
While, out through them leaping, the fire, i.e. all the more
subtle part of this,
Shines along his threshold with incessant beams:
So the primaeval fire, fenced within the membranes.
And delicate tissues gave birth to a round-eyed daughter—
Tissues bored through with wonderful channels—
And these fended off the deep surrounding flood,
While letting through the fire, i.e. all its more subtle part.

Sometimes he accounts for vision thus, but at other times he explains it by emanations from the visible objects.

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Democritus, on the other hand, is right in his opinion that the eye is of water; not, however, when he goes on to explain seeing as mirroring. The mirroring that takes place in an eye is due to the fact that the eye is smooth, and it really has its seat not in the eye, but in that which sees. For the case is one of reflexion. But it would seem that in his time there was no scientific knowledge of the general subject of the formation of images and the phenomena of reflexion. It is strange, too, that it never occurred to him to ask why the eye alone sees, while none of the other things in which images are reflected do so.

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True, then, the visual organ proper is composed of water, yet vision appertains to it not because it is water, but because it is transparent—a property common alike to water and to air. But water is more easily confined and more easily condensed than air; it is that the pupil, i.e. the eye proper, consists of water. That it does so is proved by facts of actual experience. The substance which flows from eyes when decomposing is seen to be water, and this in undeveloped embryos is remarkably cold and glistening. In sanguineous animals the white of the eye is fat and oily, in order that the moisture of the eye may be proof against freezing. Wherefore the eye is of all parts of the body the least sensitive to cold: no one ever feels cold in the part sheltered by the eyelids. The eyes of bloodless animals are covered with a hard scale which gives them similar protection.

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It is, to state the matter generally, an irrational notion that the eye should see in virtue of something issuing from it; that the visual ray should extend itself all the way to the stars, or else go out merely to a certain point, and there coalesce, as

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some say, with rays which proceed from the object. It would be better to suppose this coalescence to take place in the fundament of the eye itself. But even this would be mere trifling. For what is meant by the coalescence of light with light? Or how is it possible? Coalescence does not occur between any two things taken at random. And how could the light within the eye coalesce with that outside it? For the membrane comes between them.

438b3-438b4 That without light vision is impossible has been stated elsewhere; but, whether the medium between the eye and its objects is air or light, vision is caused by a process through this medium.

438b5-438b6 Accordingly, that the inner part of the eye consists of water is easily intelligible, water being transparent.

438b7-438b15 Now, as vision outwardly is impossible without light, so also it is impossible inwardly. There must, therefore, be some transparent medium within the eye, and, as this is not air, it must be water. The soul or its perceptive part is not situated at the external surface of the eye, but obviously somewhere within: whence the necessity of the interior of the eye being transparent, i.e. capable of admitting light. And that it is so is plain from actual occurrences. It is matter of experience that soldiers wounded in battle by a sword slash on the temple, so inflicted as to sever the passages of the eye, feel a sudden onset of darkness, as if a lamp had gone out; because what is called the pupil, i.e. the transparent, which is a sort of lamp, is then cut off.

438b16-438b29 Hence, if the facts be at all as here stated, it is clear that—if one should explain the nature of the sensory organs in this way, i.e., by correlating each of them with one of the elements,—we must conceive that the part of the eye which sees consists of water, that what is perceptive of sound consists of air, and that the sense of smell consists of fire. (For the organ of smell is potentially that which the sense of smell is actually; since the object of sense is what causes the actualization of each sense, so that it must beforehand have been potentially such and such. Now, odour is a smoke-like evaporation, and smoke-like evaporation arises from fire. This also helps us to understand why the olfactory organ has its proper seat in the environment of the brain; for cold matter is potentially hot. In the same way must the genesis of the eye be explained. Its structure is an offshoot from the brain, because the latter is the moistest and coldest of all the bodily parts.)

438b30-439a3 The organ of touch consists of earth, and the faculty of taste is a particular form of touch. This explains why the sensory organ of both touch and taste is closely related to the heart. For the heart, as being the hottest of all the bodily parts, is the counterpoise of the brain.

439a4-439a5 This, then, is the way in which the characteristics of the bodily organs of sense

must be determined.

§ 3 · Of the sensibles corresponding to each sensory organ, viz. colour, sound, odour, savour, touch, we have treated in *On the Soul* in general terms, having there determined what their function is, and what is implied in their becoming actualized in relation to their respective organs. We must next consider what account we are to give of any one of them; what, for example, we should say *colour* is, or *sound*, or *odour*, or *savour*; and so also respecting *touch*. We begin with *colour*.

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Now, each of them may be spoken of from two points of view, i.e., either as actual or as potential. We have in *On the Soul* explained in what sense the colour, or sound, regarded as actualized, is the same as, and in what sense it is different from, the correlative sensation, the actual seeing or hearing. The point of our present discussion is to determine what each sensible object must be in itself, in order to produce actual sensation.

439a12-439a16

We have already in *On the Soul* stated of light that it is the colour of the transparent incidentally; for whenever a fiery element is in a medium its presence there is light; while the privation of it is darkness. But what we call transparent is not something peculiar to air, or water, or any other of the bodies usually called transparent, but is a common nature and power, capable of no separate existence of its own, but residing in these, and subsisting likewise in all other bodies in a greater or less degree. As the bodies in which it subsists must have some extreme bounding surface, so too must this. Here, then, we may say that light is a nature inhering in the transparent when the latter is without determinate boundary. But it is manifest that, when the transparent is in determinate bodies, its bounding extreme must be something real; and that colour is just this something we are plainly taught by facts—colour being actually either at the limit, or being itself that limit, in bodies. (Hence it was that the Pythagoreans named the superficies of a body its hue.) For it is at the limit of the body, but it is not the limit of the body; but the same natural substance which is coloured *outside* must be thought to be so inside too.

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Air and water, too are evidently coloured; for their brightness is of the nature of colour. But the colour which air or sea presents, since the body in which it resides is not determinately bounded, is not the same when one approaches and views it close by as it is when one regards it from a distance; whereas in determinate bodies the colour presented is definitely fixed, unless, indeed, when the atmospheric environment causes it to change. Hence it is clear that that in them which is susceptible of colour is in both cases the same. It is therefore the transparent, according to the degree to which it subsists in bodies (and it does so in all

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more or less), that causes them to partake of colour. But since the colour is at the extremity of the body, it must be at the extremity of the transparent in the body. Whence it follows that we may define colour as the limit of the transparent in determinately bounded body. For whether we consider the special class of bodies called transparent, as water and such others, or determinate bodies, which appear to possess a fixed colour of their own, it is at the exterior bounding surface that all alike exhibit their colour.

439b15-439b17 Now, that which when present in air produces light may be present also in the transparent; or again, it may not be present, but there may be a privation of it. Accordingly, as in the case of air the one condition is light, the other darkness, in the same way the colours white and black are generated in determinate bodies.

439b18-439b19 We must now treat of the other colours, reviewing the several ways in which they can come about.

439b20-440a6 It is conceivable that the white and the black should be juxtaposed in quantities so minute that either separately would be invisible, though the joint product would be visible; and that they should thus have the other colours for resultants. Their product could, at all events, appear neither white nor black; and, as it must have some colour, and can have neither of these, this colour must be of a mixed character—in fact, a species of colour different from either. Such, then, is a possible way of conceiving the existence of a plurality of colours besides the white and black; and we may suppose that many are the result of a ratio; for they may be juxtaposed in the ratio of 3 to 2, or of 3 to 4, or in ratios expressible by other numbers; while some may be juxtaposed according to no numerically expressible ratio, but according to some incommensurable relation of excess or defect; and, accordingly, we may regard all these colours as analogous to concords, and suppose that those involving numerical ratios, like the concords in music, may be those generally regarded as most agreeable; as, for example, purple, crimson, and some few such colours, their fewness being due to the same causes which render the concords few. The other compound colours may be those which are not based on numbers. Or it may be that, while all colours whatever are based on numbers, some are regular in this respect, others irregular; and that the latter, whenever they are not pure, owe this character to a corresponding impurity in their numerical ratios. This then is one way to explain the genesis of intermediate colours.

440a7-440a19 Another is that the black and white appear the one through the medium of the other, giving an effect like that sometimes produced by painters overlaying a less vivid upon a more vivid colour, as when they desire to represent an object appearing under water or enveloped in a haze, and like that produced by the sun, which in itself appears white, but takes a crimson hue when beheld through a

fog or a cloud of smoke. On this hypothesis, too, a variety of colours may be conceived to arise in the same way as that already described; for between those at the surface and those underneath a definite ratio might sometimes exist; in other cases they might stand in no determinate ratio. To say with the ancients that colours are emanations, and that the visibility of object is due to such a cause, is absurd. For they must, in any case, explain sense-perception through touch; so that it were better to say at once that visual perception is due to a process set up by the perceived object in the medium between this object and the sensory organ; due, that is, to contact, not to emanations.

If we accept the hypothesis of juxtaposition, we must assume not only invisible magnitude, but also imperceptible time, in order that the arrival of the movements may be unperceived, and that the colour may appear to be one because they seem to be simultaneous. On the hypothesis of superposition, however, no such assumption is needed: the stimulatory process produced in the medium by the upper colour, when this is itself unaffected, will be different in kind from that produced by it when affected by the underlying colour. Hence it presents itself as a different colour, i.e. as one which is neither white nor black. So that, if it is impossible to suppose any magnitude to be invisible, and we must assume that there is some distance from which every magnitude is visible, this superposition theory too⁴ might pass as a theory of colour-mixture. Indeed, in the previous case also there is no reason why, to persons at a distance from the juxtaposed blacks and whites, some one colour should not appear to present itself as a blend of both. For it will be shown, in a discussion to be undertaken later on, that there is no magnitude absolutely invisible.

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There is a mixture of bodies, however, not merely such as some suppose, i.e. by juxtaposition of their minimal parts, which, owing to sense, are imperceptible by us, but a mixture by which they are wholly blent together, as we have described it in the treatise on mixture, where we dealt with this subject generally in its most comprehensive aspect. For, on the supposition we are criticizing, the only totals capable of being mixed are those which are divisible into minimal parts as men, horses, or seeds. For of mankind as a whole the individual man is such a least part; of horses the individual horse. Hence by the juxtaposition of these we obtain a mixed total, consisting of both together; but we do not say that by such a process any individual man has been mixed with any individual horse. Not in this way, but by complete interpenetration must we conceive those things to be mixed which are not divisible into minima; and it is in the case of these that natural mixture

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⁴Retaining *kai*.

exhibits itself in its most perfect form. We have explained already in our discourse on mixture how such mixture is possible. It is plain that when bodies are mixed their colours also are necessarily mixed at the same time; and that this is the real cause determining the existence of a plurality of colours—not superposition or juxtaposition. For when bodies are thus mixed, their resultant colour presents itself as one and the same at all distances alike; not varying as it is seen nearer or farther away.

440b18-440b23 Colours will thus, too be many in number on account of the fact that the ingredients may be combined with one another in a multitude of ratios; some will be based on determinate numerical ratios, while others again will have as their basis a relation of quantitative excess. And all else that was said in reference to the colours, considered as juxtaposed or superposed, may be said of them likewise when regarded as mixed.

440b24-440b25 Why colours, as well as savours and sounds, consist of species determinate and not infinite is a question which we shall discuss hereafter.

440b26-441a2 § 4 · We have now explained what colour is, and the reason why there are many colours; while before, in our work *On the Soul*, we explained the nature of sound and voice.⁵ We have next to speak of odour and savour, both of which are almost the same physical affection, although they each have their being in different things. Savours, as a class, display their nature more clearly to us than odours, the cause of which is that the olfactory sense of man is inferior in acuteness to that of the animals, and is, when compared with our other senses, the least perfect of all. Man's sense of touch, on the contrary, excels that of all other animals in fineness, and taste is a modification of touch.

441a3-441a9 Now the natural substance water tends to be tasteless. But either we must suppose that water contains in itself the various kinds of savour, though in amounts so small as to be imperceptible, which is the doctrine of Empedocles; or the water must be a sort of matter, qualified, as it were, to produce germs of savours of all kinds, so that all kinds of savour are generated from the water, though different kinds from its different parts; or else the water is in itself quite undifferentiated in respect of savour, but some agent, such for example as one might conceive heat or the sun to be, is the efficient cause of savour.

441a10-441a16 Of these three hypotheses, the falsity of that held by Empedocles is only too evident. For we see that when pericarpal fruits are plucked and exposed in the sun,⁶ or subjected to the action of fire, their savours are changed by the heat,

⁵Ross, following Freudenthal, excises 'while . . . voice'.

⁶Ross, following Bitterauf, excises 'exposed . . . sun, or'.

which shows that their qualities are not due to their drawing anything from the water in the ground, but to a change which they undergo within the pericarp itself; and we see, moreover, that these juices, when extracted and allowed to lie, instead of sweet become by lapse of time harsh or bitter, or acquire savours of any and every sort; and that, again, by the process of boiling they are made to assume almost all kinds of new savours.

It is likewise impossible that water should be a material qualified to generate all kinds of savour germs; for we see different kinds of taste generated from the same water, having it as their nutriment.

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It remains, therefore, to suppose that the water is changed by passively receiving some affection. Now, it is manifest that water does not contract the quality of sapidity from the agency of heat alone. For water is of all liquids the thinnest, thinner even than oil itself, though oil, owing to its viscosity, is more ductile than water, the latter being uncohesive in its particles; whence water is more difficult than oil to hold in the hand. But since perfectly pure water does not, when subjected to the action of heat, show any tendency to acquire consistency, we must infer that some other agency than heat is the cause of sapidity. For all savours exhibit a comparative consistency. Heat is, however, a co-agent in the matter.

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Now the savours found in pericarpal fruits evidently exist also in the earth. Hence many of the old natural philosophers assert that water has qualities like those of the earth through which it flows, a fact especially manifest in the case of saline springs, for salt is a form of earth. Hence also when liquids are filtered through ashes, a bitter substance, the taste they yield is bitter. There are many wells, too, of which some are bitter, others acid, while others exhibit other tastes of all kinds.

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As was to be anticipated, therefore, it is among plants that tastes occur in richest variety. For, like all things else, the moist is affected only by its contrary; and this contrary is the dry. Thus we see why the moist is affected by fire, which, as a natural substance, is dry. Heat is, however, the essential property of fire, as dryness is of earth, according to what has been said in our treatise on the elements. Fire and earth, therefore, taken absolutely as such, have no natural power to affect, or be affected; nor have any other pair of substances. Any two things can affect or be affected by, one another only so far as contrariety to the other resides in either of them.

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As, therefore, persons washing colours or savours in a liquid cause the water in which they wash to acquire such a quality, so nature, too, by washing the dry and earthy in the moist, and by filtering the latter, that is, moving it on by the agency of heat through the dry and earthy, imparts to it a certain quality. This affection,

441b15-441b23

wrought by the aforesaid dry in the moist, capable of transforming the sense of taste from potentiality to actuality, is savour. Savour brings into actual exercise the perceptive faculty which pre-existed only in potency. The activity of sense-perception in general is analogous, not to the process of acquiring knowledge, but to that of exercising knowledge already acquired.

441b24-442a12

That savours, either as a quality or as the privation of a quality, belong not to every form of the dry but to the nutrient, we shall see by considering that neither the dry without the moist, nor the moist without the dry, is nutrient. For no single element, but only composite substance, constitutes nutriment for animals. Now, among the perceptible elements of the food which animals assimilate, the tangible are the efficient causes of growth and decay; it is *qua* hot or cold that the food assimilated causes these; for the heat or cold is the direct cause of growth or decay. It is *qua* tastable, however, that the assimilated food supplies nutrition. For all organisms are nourished by the sweet, either by itself or in combination with other savours. Of this we must speak with more precise detail in our work on generation: for the present we need touch upon it only so far as our subject here requires. Heat causes growth, and fits the food-stuff for alimentation; it attracts that which is light, while the salt and bitter it rejects because of their heaviness. In fact, whatever effects external heat produces in external bodies, the same are produced by their internal heat in animal and vegetable organisms. Hence it is that nourishment is effected by the sweet. The other savours are introduced into and blended in food on a principle analogous to that on which the saline or the acid is used artificially, i.e. for seasoning. These latter are used because they counteract the tendency of the sweet to be too nutrient, and to float on the stomach.

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As the intermediate colours arise from the mixture of white and black, so the intermediate savours arise from the sweet and bitter; and these savours, too, severally involve either a definite ratio, or else an indefinite relation of degree, between their components, either having certain numbers at the basis of their mixture and motion, or else being mixed in proportions not arithmetically expressible. The tastes which give pleasure in their combination are those which have their components joined in a definite ratio.

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The sweet taste alone is rich, while the saline is fairly identical with the bitter. Between the extremes of sweet and bitter come the harsh, the pungent, the astringent, and the acid. Savours and colours contain respectively about the same number of species. For there are seven species of each, if, as is reasonable, we regard grey as a variety of black (for the alternative is that yellow should be classed with white, as rich with sweet); while crimson, violet, leek-green, and deep blue, come between white and black, and from these all others are derived by mixture.

Again, as black is a privation of white in the transparent, so saline or bitter is a privation of sweet in the nutrient moist. This explains why the ash of all burnt things is bitter; for the potable moisture has been exuded from them.

442a26-442a28

Democritus and most of the natural philosophers who treat of sense-perception proceed quite irrationally, for they represent all objects of sense as objects of touch. Yet, if this is really so, it clearly follows that each of the other senses is a mode of touch; but one can see at a glance that this is impossible.

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Again, they treat the percepts common to all senses as special to one. For magnitude and figure, roughness and smoothness, and, moreover, the sharpness and bluntness found in solid bodies, are percepts common to all the senses, or if not to all, at least to sight and touch. This explains why it is that the senses are liable to err regarding them, while no such error arises respecting their special sensibles; e.g. the sense of seeing is not deceived as to colour, nor is that of hearing as to sound.

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On the other hand, they reduce the special to common sensibles, as Democritus does with white and black; for he asserts that the latter is rough, and the former smooth, while he reduces savours to the atomic figures. Yet surely no one sense, or, if any, the sense of sight rather than any other, can discern the common sensibles. But if we suppose that the sense of taste is better able to do so, then—since to discern the smallest objects in each kind is what marks the acutest sense—taste should have been the sense which best perceived the common sensibles generally, and showed the most perfect power of discerning figures in general.

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Again, all the sensibles involve contrariety; e.g. in colour white is contrary to black, and in savours bitter is contrary to sweet; but no one figure is reckoned as contrary to any other figure. Else, to which of the possible polygonal figures is the spherical figure contrary?

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Again, since figures are infinite in number, savours also should be infinite; for why should one savour be perceived, and another not?

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This completes our discussion of the object of taste, i.e. savour; for the other affections of savours are examined in their proper place in connection with the natural history of plants.

442b24-442b26

§ 5 · Our conception of the nature of odours must be analogous to that of savours; inasmuch as the sapid moist effects in air and water alike, but in a different province of sense, precisely what the dry effects in the moist of water only. We customarily predicate transparency of both air and water in common; but it is not *qua* that either is a vehicle of odour, but *qua* possessed of a power of washing or rinsing the sapid dryness.

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For the object of smell exists not in air only: it also exists in water. This is proved by the case of fishes and testacea, which are seen to possess the faculty of smell, although water contains no air (for whenever air is generated within water it rises to the surface), and these creatures do not breathe. Hence, if one were to assume that air and water are both moist, it would follow that odour is the natural substance consisting of the sapid dry diffused in the moist, and whatever is of this kind would be an object of smell.

443a8-443a20

That the property of odorousness is based upon the sapid may be seen by comparing the things which possess with those which do not possess odour. The elements, viz. fire, air, earth, water, are inodorous, because both the dry and the moist among them are without sapidity, unless some added ingredient produces it. This explains why sea-water possesses odour, for it contains savour and dryness. Salt, too, is more odorous than natron, as the oil which exudes from the former proves, for natron is allied to earth more nearly than salt. Again, a stone is inodorous, just because it is tasteless, while, on the contrary, wood is odorous, because it is sapid. The kinds of wood, too, which contain more water are less odorous than others. Moreover, to take the case of metals, gold is inodorous because it is without taste, but bronze and iron are odorous; and when the moisture has been burnt out of them, their slag is, in all cases, less odorous. Silver and tin are more odorous than the one class of metals, less so than the other, inasmuch as they are watery.

443a21-443a31

Some writers look upon exhalation, which is a compound of earth and air, as the essence of odour. Heraclitus implied his adherence to it when he declared that if all existing things were turned into smoke, the nose would be the organ to discern them with. All writers incline to refer odour to this cause, but some regard it as vapour, others as exhalation; while others, again, hold it to be either. Vapour is merely a form of moisture, but smoky exhalation is, as already remarked, composed of air and earth. The former when condensed turns into water; the latter, into a particular species of earth. Now, it is unlikely that odour is either of these. For vaporous exhalation consists of mere water; and smoky exhalation cannot occur in water at all, though, as has been before stated, aquatic creatures also have the sense of smell.

443b1-443b3

Again, the exhalation theory of odour is analogous to the theory of emanations. If, therefore, the latter is untenable, so, too, is the former.

443b4-443b16

It is clearly conceivable that the moist, whether in air (for air, too, is essentially moist) or in water, should imbibe the influence of, and have effects wrought in it by, the sapid dryness. Moreover, if the dry produces in moist media and air, an effect as of something washed out in them, it is manifest that odours must be

something analogous to savours. Indeed, this analogy is, in some instances, a fact; for odours as well as savours are spoken of as pungent, sweet, harsh, astringent, rich; and one might regard fetid smells as analogous to bitter tastes; which explains why the former are as unpleasant to breathe as the latter are to drink. It is clear, therefore, that odour is in both water and air what savour is in water alone. This explains why coldness and freezing render savours dull, and abolish odours altogether; for cooling and freezing tend to annul the kinetic heat which helps to fabricate sapidity.

There are two species of the odorous. For the statement of certain writers that the odorous is not divisible into species is false; it is so divisible. We must here define the sense in which these species are to be admitted or denied.

443b17-443b19

One class of odours, then, is that which runs parallel, as has been observed, to savours: to odours of this class their pleasantness or unpleasantness belongs incidentally. For owing to the fact that savours are qualities of nutrient matter, the odours connected with these are agreeable as long as animals have an appetite for the food, but they are not agreeable to them when sated and no longer in want of it; nor are they agreeable, either, to those animals that do not like the food itself which yields the odours. Hence, as we observed, these odours are pleasant or unpleasant incidentally, and the same reasoning explains why it is that they are perceptible to all animals in common.

443b20-443b26

The other class of odours consists of those agreeable in their essential nature, e.g. those of flowers. For these do not in any degree stimulate animals to food, nor do they contribute in any way to appetite; their effect upon it, if any, is rather the opposite. For the verse of Strattis ridiculing Euripides—

443b27-443b32

Use not perfumery to flavour soup,

contains a truth.

Those who nowadays introduce such flavours into beverages deforce our sense of pleasure by habituating us to them, until, from two distinct kinds of sensations combined, pleasure arises as it might from one simple kind.

444a1-444a3

Of this species of odour man alone is sensible; the other, viz. that correlated with tastes, is, as has been said before, perceptible also to the other animals. And odours of the latter sort, since their pleasureableness depends upon taste, are divided into as many species as there are different tastes; but we cannot go on to say this of the former kind of odour, since its nature is agreeable or disagreeable *per se*. The reason why the perception of such odours is peculiar to man is found in the characteristic state of man's brain. For his brain is naturally cold, and the blood which it contains in its vessels is thin and pure but easily cooled (whence

444a4-444a18

it happens that the exhalation arising from food, being cooled by the coldness of this region, produces unhealthy rheums); therefore it is that odours of such a species have been generated for human beings, as a safeguard to health. This is their sole function, and that they perform it is evident. For food, whether dry or moist, though pleasant to taste, is often unwholesome; whereas the odour arising from what is fragrant, that odour which is pleasant in its own right, is, so to say, always beneficial to persons in any state of bodily health whatever.

444a19-444a28 For this reason, too, the perception of odour is effected through respiration, not in all animals, but in man and certain other sanguineous animals, e.g. quadrupeds, and all that participate freely in the natural substance air; because when odours, on account of the lightness of the heat in them, mount to the brain, the health of this region is thereby promoted. For odour, as a power, is naturally heat-giving. Thus nature has employed respiration for two purposes: primarily for the relief thereby brought to the thorax, secondarily for the inhalation of odour. For while an animal is inhaling, odour moves in through its nostrils, as it were from a side-entrance.

444a29-444b7 But the perception of the second class of odours above described is confined to human beings, because man's brain is, in proportion to his whole bulk, larger and moister than the brain of any other animal. This is the reason of the further fact that man alone, so to speak, among animals perceives and takes pleasure in the odours of flowers and such things. For the heat and stimulation set up by these odours are commensurate with the excess of moisture and coldness in his cerebral region. On all the other animals which have lungs, nature has bestowed their due perception of one of the two kinds of odour through the act of respiration, guarding against the needless creation of two organs of sense; for in the fact that they breathe the other animals have already sufficient provision for their perception of the one species of odour only, as human beings have for their perception of both.

444b8-444b14 But that creatures which do not breathe have the olfactory sense is evident. For fishes, and all insects as a class, have, thanks to the species of odour correlated with nutrition, a keen olfactory sense of their proper food from a distance, even when they are very far away from it; such is the case with bees, and also with the class of small ants, which some denominate *knipes*. Among marine animals, too, the murex and many other similar animals have an acute perception of their food by its odour.

444b15-444b27 It is not equally certain what the organ is whereby they so perceive. This question, of the organ whereby they perceive odour, may well cause a difficulty, if we assume that smelling takes place in animals only while breathing (for that this is the fact is manifest in all the animals which do breathe), whereas none of those just mentioned breathes, and yet they have the sense of smell—unless, indeed,

they have some other sense not included in the ordinary five. This supposition, is however, impossible. For any sense which perceives odour is a sense of smell, and this they do perceive, though probably not in the same way as creatures which breathe, but when the latter are breathing the current of breath removes something that is laid like a lid upon the organ proper (which explains why they do not perceive odours when not breathing); while in creatures which do not breathe this is always off: just as some animals have eyelids on their eyes, and when these are not raised they cannot see, whereas hard-eyed animals have no lids, and consequently do not need, besides eyes, an agency to raise the lids, but see on the basis of what is possible for them from the start.

Consistently with what has been said above, not one of the animals shows repugnance to the odour of things which are essentially ill-smelling, unless one of the latter is positively pernicious. They are destroyed, however, by these things, just as human beings get headaches from, and are often asphyxiated by, the fumes of charcoal; so the other animals perish from the strong fumes of brimstone and bituminous substances, and they avoid them because of that quality. For the disagreeable odour in itself they care nothing whatever (though the odours of many plants are essentially disagreeable), unless, indeed, it has some effect upon the taste of their food.

444b28-445a4

The senses making up an odd number, and an odd number having always a middle unit, the sense of smell occupies in itself as it were a middle position between the tactual senses, i.e. touch and taste, and those which perceive through a medium, i.e. sight and hearing. Hence the object of smell, too, is an affection of nutrient substances (which fall within the class of tangibles), and is also an affection of the audible and visible; whence it is that creatures have the sense of smell both in air and water. Accordingly, the object of smell is something common to both of these provinces, i.e. it appertains both to the tangible on the one hand, and on the other to the audible and transparent. Hence the propriety of the figure by which it has been described by us as an immersion or washing of dryness in the moist and fluid. Such then must be our account of the sense in which one is or is not entitled to speak of the odorous as having species.

445a5-445a16

The theory held by certain of the Pythagoreans, that some animals are nourished by odours alone, is unsound. For, in the first place, we see that food must be composite, since the bodies nourished by it are not simple. This explains why waste matter is secreted from food, either within the organisms, or, as in plants, outside them. But since even water by itself alone, that is, when unmixed, will not suffice for food—for anything which is to form a consistency must be corporeal—, it is still much less conceivable that air should be so corporealized. But, besides

445a17-445a31

this, we see that all animals have a receptacle for food, from which, when it has entered, the body absorbs it. Now, the organ which perceives odour is in the head, and odour enters with the inhalation of the breath; so that it goes to the respiratory region. It is plain, therefore, that odour, *qua* odour, does not contribute to nutrition; that, however, it is serviceable to health is equally plain, as well by immediate perception as from the arguments above employed; so that odour is in relation to general health what savour is in the province of nutrition and in relation to the bodies nourished.

445b1-445b3 This then must conclude our discussion of the several organs of sense-perception.

445b4-445b6 § 6 · One might ask: if every body is infinitely divisible, are its sensible qualities—colour, savour, odour, sound, weight, cold or heat, heaviness or lightness, hardness or softness—also infinitely divisible? Or, is this impossible?

445b7-445b10 Each of them is productive of sense-perception, since, in fact, all derive their name from the very circumstance of their being able to stimulate this. Hence if their power is divisible, our perception of them should likewise be divisible to infinity, and every part of a body should be a perceptible magnitude. For it is impossible, e.g., to see a thing which is white but not of a certain magnitude.

445b11-445b20 Since if it were not so, we might conceive a body existing but having no colour, or weight, or any such quality; accordingly not perceptible at all. For these quantities are the objects of sense-perception. On this supposition, every perceptible object should be regarded as composed of non-perceptible parts. Yet it must be really composed of perceptible parts, since assuredly it does not consist of mathematical qualities. Again, by what faculty should we discern and cognize these? Is it by thought? But they are not objects of thought; nor does thought think of objects in space, except when it acts in conjunction with sense-perception. At the same time, if this be the case it seems to tell in favour of the atomistic hypothesis; for thus, indeed, the question might be solved. But it is impossible. Our views on the subject of atoms are to be found in our treatise on movement.

445b21-446a19 The solution of these questions will bring with it also the answer to the question why the species of colour, taste, sound, and other sensible qualities are limited. For in all classes of things lying between extremes the intermediates must be limited. But contraries are extremes, and every object of sense-perception involves contrariety; e.g. in colour, white and black; in savour, sweet and bitter, and in all the other sensibles also the contraries are extremes. Now, that which is continuous is divisible into an infinite number of unequal parts, but into a finite number of equal parts, while that which is not *per se* continuous is divisible into species which are finite in number. Since then, the several sensible qualities of things are

to be reckoned as species, while continuity always subsists in these, we must take account of the difference between the potential and the actual. It is owing to this difference that we do not see its ten-thousandth part in a grain of millet, although sight has embraced the whole grain within its scope; and it is owing to this, too, that the sound contained in a quarter-tone escapes notice, and yet one hears the whole strain, inasmuch as it is a continuum; but the interval between the extreme sounds escapes the ear. So, in the case of other objects of sense, extremely small constituents are unnoticed; because they are only potentially not actually visible, unless when they have been parted from the wholes. So the foot-length too exists potentially in the two-foot length, but actually only when it has been separated from the whole. But increments so small might well, if separated from their totals, be dissolved in their environments, like a drop of sapid moisture poured out into the sea. But even if this were not so still, since the increment of sense-perception is not perceptible in itself, nor capable of separate existence (since it exists only potentially in the more distinctly perceivable whole of sense-perception), so neither will it be possible to perceive its correlatively small object when separated in actuality. But yet this is to be considered as perceptible: for it is both potentially so already, and destined to be actually so when it has become part of an aggregate. Thus, therefore, we have shown that some magnitudes and their sensible qualities escape notice, and the reason why they do so, as well as the manner in which they are still perceptible or not perceptible in such cases. Accordingly then, when these are so great as to be perceptible actually, and not merely because they are in the whole, but even apart from it, it follows necessarily that their sensible qualities, whether colours or tastes or sounds, are limited in number.

One might ask:—do the objects of sense-perception, or the movements proceeding from them in whichever of the two ways sense-perception takes place), when these are actualized for perception, always arrive first at a middle point, as odour evidently does, and also sound? For he who is nearer perceives the odour sooner, and the sound of a stroke reaches us some time after it has been struck. Is it thus also with an object seen, and with light? Empedocles, for example, says that the light from the sun arrives first in the intervening space before it comes to the eye, or reaches the Earth. This might plausibly seem to be the case. For whatever is moved, is moved from one place to another; hence there must be a corresponding interval of time also in which it is moved from the one place to the other. But any given time is divisible; so that we should assume a time when the sun's ray was not as yet seen, but was still travelling in the middle space.

Now, even if one always hears and has heard—and, in general, perceives and has perceived—at the same time, and these acts do not come into being but occur

446a20-446b2

446b3-446b13

without coming into being—yet, just as, though the stroke which causes the sound has been already struck, the sound is not yet at the ear (and that this last is a fact is further proved by the transformation which the letters undergo, implying that the local movement takes place in the space between; for the reason why we do not succeed in catching the sense of what is said is that the air in moving towards them has its form changed): is the same also true in the case of colour and light? For certainly it is not true that the beholder sees, and the object is seen, in virtue of some merely abstract relationship between them, such as that between equals. For if it were so, there would be no need that either should occupy some particular place; since to the equalization of things their being near to, or far from, one another makes no difference.

446b14-446b17

Now this may with good reason take place as regards sound and odour, for these, like air and water, are continuous, but the movement of both is divided into parts. This too is the ground of the fact that the object which the person first in order of proximity hears or smells is the same as that which each subsequent person perceives, while yet it is not the same.

446b18-446b27

Some, indeed, raise a question also on these very points; they declare it impossible that one person should hear, or see, or smell, the same object as another, urging the impossibility of several persons in different places hearing or smelling the same object; for the one same thing would thus be divided from itself. The answer is that, in perceiving the object which first set up the motion—e.g. a bell, or frankincense, or fire—all perceive an object numerically one and the same; while, of course, in the special object perceived they perceive an object numerically different for each, though specifically the same for all; and this, accordingly, explains how it is that many persons together see, or smell, or hear the same object. These things are not bodies, but an affection or process of some kind (otherwise this would not have been, as it is, a fact of experience), though, on the other hand, they each imply a body.

446b28-447a7

But with regard to light the case is different. For light is due to the presence of something, but it is not a movement. And in general, even in qualitative change the case is different from what it is in local movement. Local movements, of course, arrive first at a point midway before reaching their goal (and sound, it is currently believed, is a movement of something locally moved), but we cannot go on to assert this in like manner of things which undergo qualitative change. For this kind of change may possibly take place in a thing all at once, without one half of it being changed before the other; e.g. it is possible that water should be frozen simultaneously in every part. But still, for all that, if the body which is heated or frozen is extensive, each part of it successively is affected by the part

contiguous, while the part first changed in quality is so changed by the cause itself which originates the change, and thus the change throughout the whole need not⁷ take place simultaneously and all at once. Tasting would have been as smelling now is, if we lived in a liquid medium, and perceived things at a distance, before touching them.

Naturally, then, the parts of media between a sensory organ and its object are not all affected at once—except in the case of light, for the reason above stated, and also in the case of seeing, for the same reason; for light is an efficient cause of seeing.

447a8-447a10

§ 7 · Another question respecting sense-perception is as follows: assuming, as is natural, that of two movements the stronger always tends to extrude the weaker, is it possible or not that one should be able to perceive two objects simultaneously in the same individual time? The above assumption explains why persons do not perceive what is brought before their eyes, if they are at the time deep in thought, or in a fright, or listening to some loud noise. This assumption, then, must be made, and also the following: that it is easier to perceive each object of sense when in its simple form than when an ingredient in a mixture; easier, for example, to perceive wine when neat than when blended, and so also honey, and a colour, or to discern a note by itself alone, than in a chord; the reason being that component elements tend to efface one another. Such is the effect of all ingredients of which, when compounded, some one thing is formed.

447a11-447a21

If, then, the greater movement tends to expel the less, it necessarily follows that, when they concur, this greater should itself too be less distinctly perceptible than if it were alone, since the less by blending with it has removed some of its individuality, according to our assumption that simple objects are in all cases more perceptible.

447a22-447a24

Now, if the two stimuli are equal but heterogeneous, no perception of either will ensue; they will alike efface one another's characteristics. But in such a case the perception of either stimulus in its simple form is impossible. Hence either there will then be no sense-perception at all, or there will be a perception compounded of both and differing from either. The latter is what actually seems to result from ingredients blended together, whatever may be the compound in which they are so mixed.

447a25-447a30

Since, then, from some a resultant object is produced, while from others no such resultant is produced, and of the latter sort are those things which belong

447a31-447b5

⁷Reading *kai ouk anagke*.

to different sense provinces (for only those things are capable of mixture whose extremes are contraries, and no one compound can be formed from, e.g., white and high, except incidentally, i.e. not as a concord is formed of high and low), there follows logically the impossibility of discerning such concurrent stimuli at the same time. For we must suppose that the stimuli, when equal, tend alike to efface one another, since no one stimulus results from them; while, if they are unequal, the stronger alone is distinctly perceptible.

447b6-447b21

Again, the soul would be more likely to perceive simultaneously, with one and the same sensory act, two things in the same sensory province, such as the low and the high in sound; for the sensory stimulation in this one province is more likely to be simultaneous than that involving two different provinces, as sight and hearing. But it is impossible to perceive two objects simultaneously in the same sensory act unless they have been mixed, for their amalgamation involves their becoming one, and the sensory act related to one object is itself one, and such act when one, is, of course, simultaneous with itself. Hence, when things are mixed we of necessity perceive them simultaneously: for we perceive them by a perception actually one. For an object numerically one means that which is perceived by a perception actually one, whereas an object specifically one means that which is perceived by a sensory act potentially one. If then the actualized perception is one, it will declare its data to be one object; they must, therefore, have been mixed. Accordingly, when they have not been mixed, the actualized perceptions which perceive them will be two; but in one and the same faculty the perception actualized at any single moment is necessarily one, only one stimulation or exertion of a single faculty being possible at a single instant, and in the case supposed here the faculty is one. Hence it is not possible to perceive the possibility of perceiving two distinct objects simultaneously with one and the same sense.

447b22-448a2

But if it be thus impossible to perceive simultaneously two objects in the same province of sense if they are really two, manifestly it is still less conceivable that we should perceive simultaneously objects in two different sensory provinces, as white and sweet. For it appears that when the soul predicates numerical unity it does so in virtue of nothing else than such simultaneous perception while it predicates specific unity in virtue of the discriminating faculty of sense together with the mode in which this operates. What I mean, for example, is this; the same sense no doubt discerns white and black, though they are specifically different from one another, and so, too, a faculty of sense self-identical, but different from the former, discerns sweet and bitter; but while both these faculties differ from one another in their modes of discerning either of their respective contraries, yet in perceiving the co-ordinates in each province they proceed in manners analogous

to one another; for instance, as taste perceives sweet, so sight perceives white; and as the latter perceives black, so the former perceives bitter.

Again, if movements of contraries are themselves contrary, and if contraries cannot subsist together in the same individual subject, and if contraries, e.g. sweet and bitter, come under one and the same sense-faculty, we must conclude that it is impossible to discern them simultaneously. It is likewise clearly impossible so to discern such homogeneous sensibles as are not contrary. For these are, classed some with white, others with black, and so it is, likewise, in the other provinces of sense; for example, of savours, some are classed with sweet, and others with bitter. Nor can one discern the components in compounds simultaneously (for these are ratios of contraries, as e.g. the octave or the fifth); unless, indeed, on condition of perceiving them as one. For thus, and not otherwise, the ratios of the extreme sounds are compounded into one ratio; since we should have together the ratio, on the one hand, of many to few or of odd to even, on the other, that of few to many or of even to odd.

448a3-448a13

If, then, the sensibles denominated co-ordinates though in different provinces of sense (e.g. I call sweet and white co-ordinates though in different provinces) stand yet more aloof, and differ more, from one another than do any sensibles in the same province; while sweet differs from white even more than black does from white, it is still less conceivable that one should discern them simultaneously than sensibles which are in the same province. Therefore, if simultaneous perception of the latter be impossible, that of the former is *a fortiori* impossible.

448a14-448a18

Some of the writers who treat of concords assert that the sounds combined in these do not reach us simultaneously, but only appear to do so, their real successive-ness being unnoticed whenever the time it involves is imperceptible. Is this true or not? One might perhaps, following this up, go so far as to say that even the current opinion that one sees and hears simultaneously is due merely to the fact that the intervals of time escape observation. But this can scarcely be true, nor is it conceivable that any portion of time should be imperceptible, or that any should be unnoticeable; the truth being that it is possible to perceive every instant of time. For if it is impossible that a person should, while perceiving himself or anything else in a continuous time, be at any instant unaware of his own existence, and if there is in the time-continuum a time so small as to be absolutely imperceptible, then it is clear that a person would, during such time, be unaware of his own existence, as well as of his seeing and perceiving.

448a19-448a30

Again, if there is any magnitude, whether time or thing, absolutely imperceptible owing to its smallness, it follows that there would not be either a thing which one perceives, or a time in which one perceives it, unless in the sense that in some

448b1-448b12

part of the given time he sees some part of the given thing. For if one sees a whole line, and perceives it during a time which forms one and the same continuum—in the sense that he does so in some portion of this time—let us suppose the part CB, representing a time in which he was perceiving nothing, to be cut off from the whole. Well, then, he perceives *in* a certain part or perceives *a part* of the line, after the fashion in which one sees the whole earth by seeing some given part of it, or walks in a year by walking in some given part of the year. But in the part CB he perceives nothing: therefore, he is said to perceive the whole object and during the whole time simply because he perceives in some part of AB. But the same argument holds also in the case of AC; for one always perceives only, in some part and perceives only some part; and it is impossible to perceive any whole.

448b13-448b17

Therefore, we must conclude that all magnitudes are perceptible, but their actual dimensions do not present themselves immediately. One sees the sun, or a four-cubit rod at a distance, as a magnitude, but their exact dimensions are not given in their visual presentation: indeed, at times an object of sight appears indivisible, but nothing that one sees is really indivisible. The reason for this has been previously explained. It is clear then, from the above arguments, that no portion of time is imperceptible.

448b18-448b19

But we must here return to the question proposed above for discussion, whether it is possible or impossible to perceive several objects simultaneously; by ‘simultaneously’ I mean perceiving the several objects in a time one and indivisible relatively to one another.

448b20-448b25

First, then, can one perceive different things simultaneously but with different parts of the soul—in a time which is indivisible and forms a continuous whole? Or is it that, first, in the case of a single sense (take, e.g., sight), if we assume it to perceive one colour with one part and another with another, it will have several parts the same in kind? For what it perceives is the same in genus.

448b26-448b30

Should any one urge that, as there are two eyes, so there may be in the soul something analogous, that of the eyes, doubtless, some one organ is formed, and hence their actualization in perception is one; but if this is so in the soul, then in so far as what is formed of both is one, the true perceiving subject also will be one, while if the two parts of soul remain separate, the analogy of the eyes will fail.

448b31-449a1

Furthermore, the senses will be each at the same time one and many, as if we should say that they were each a set of diverse sciences; for neither will an activity exist without its proper faculty, nor without activity will there be sensation.

449a2-449a4

But if the soul does not, in the way suggested, perceive in one and the same individual time sensibles of the same sense, *a fortiori* it is not thus that it perceives

sensibles of different senses. For it is, as already stated, more conceivable that it should perceive a plurality of the former together in this way than a plurality of heterogeneous objects.

If then, as is the fact, the soul with one part perceives sweet, with another, white, either that which results from these is some one part, or else there is no such one resultant. But there must be such one, inasmuch as the general faculty of sense-perception is one. What one object, then, does that one faculty perceive? For assuredly no one object arises by composition of these. We must conclude, therefore, that there is, as has been stated before, some one faculty in the soul with which the latter perceives all its percepts, though it perceives each different genus of sensibles through a different organ.

449a5-449a11

May we not, then, conceive this faculty which perceives white and sweet to be one *qua* indivisible in its actualization, but different, when it has become divisible in its actualization?

449a12-449a13

Or is what occurs in the case of the soul possibly analogous to what holds true in that of the things themselves? For the same numerically one thing is white and sweet, and has many other qualities; for if the qualities are not separable from one another, their being is different in each case. In the same way, therefore, we must assume also, in the case of the soul, that the faculty of perception in general is in itself numerically one and the same, but different in its being: different, that is to say, in genus as regards some of its objects, in species as regards others. Hence too, we may conclude that one can perceive numerically different objects simultaneously with a faculty which is numerically one and the same, but not the same in its account.

449a14-449a19

That every sensible object is a magnitude, and that nothing which it is possible to perceive is indivisible, may be thus shown. The distance whence an object could not be seen is indeterminate, but that whence it is visible is determinate. We may say the same of the objects of smelling and hearing, and of all sensibles not discerned by actual contact. Now, there is, in the interval of distance, some extreme place, the last from which the object is invisible, and the first from which it is visible. This place, beyond which if the object be one cannot perceive it, while if the object be on the hither side one must perceive it, is itself necessarily indivisible. Therefore, if any sensible object be indivisible, such object, if set in the said extreme place whence imperceptibility ends and perceptibility begins, will have to be both visible and invisible at the same time; but this is impossible.

449a20-449a31

This concludes our survey of the characteristics of the organs of sense-perception and their objects, whether regarded in general or in relation to each organ. Of the remaining subjects, we must first consider that of memory and remembering.

449b1-449b3

Book IX (Θ)

§ 1 · We have treated of that which *is* primarily and to which all the other categories of being are referred—i.e. of substance. For it is in virtue of the formula of substance that the others are said to be quantity and quality and the like; for all will be found to contain the formula of substance, as we said in the first part of our work. And since ‘being’ is in one way divided into ‘what’, quality, and quantity, and is in another way distinguished in respect of potentiality and fulfillment, and of function, let us discuss potentiality and fulfillment. First let us explain potentiality in the strictest sense, which is, however, not the most useful for our present purpose. For potentiality and actuality extend further than the mere sphere of motion. But when we have spoken of this first kind, we shall in our discussions of actuality explain the other kinds of potentiality.

1045b28-1046a4

We have pointed out elsewhere that ‘potentiality’ and the word ‘can’ have several senses.¹⁷ Of these we may neglect all the potentialities that are so called homonomously. For some are called so by analogy, as in geometry; and we say things can be or cannot be because in some definite way they are or are not.

1046a5-1046a8

But all potentialities that conform to the same type are starting points, and are called potentialities in reference to one primary kind, which is a starting-point of change in another thing or in the thing itself *qua* other. For one kind is a potentiality for being acted on, i.e. the principle in the very thing acted on, which makes it capable of being changed and acted on by another thing or by itself regarded as other; and another kind is a state of insusceptibility to change for the worse and to destruction by another thing or by the thing itself *qua* other, i.e. by a principle of change. In all these definitions is contained the formula of potentiality in the primary sense.—And again these so-called potentialities are potentialities either of acting merely or of being acted on, or of acting or being acted on *well*, so that even in the formulae of the latter the formulae of the prior kinds of potentiality are somehow contained.

1046a9-1046a18

Obviously, then, in a sense the potentiality of acting and of being acted on is one (for a thing may be capable either because it can be acted on or because something else can be acted on by it), but in a sense the potentialities are different. For the one is in the thing acted on; it is because it contains a certain motive

1046a19-1046a35

¹⁷See V (*D*) 12, where ‘*dynamis*’ was translated ‘capacity’.

principle, and because even the matter is a motive principle, that the thing acted on is acted on, one thing by one, another by another; for that which is oily is inflammable, and that which yields in a particular way can be crushed; and similarly in all other cases. But the other potentiality is in the agent, e.g. heat and the art of building are present, one in that which can produce heat and the other in the man who can build. And so in so far as a thing is an organic unity, it cannot be acted on by itself; for it is one and not two different things. And want of potentiality, or powerlessness, is the privation which is contrary to potentiality of this sort, so that every potentiality belongs to the same subject and refers to the same process as a corresponding want of potentiality. Privation has several senses; for it means that which has not a certain quality and that which might naturally have it but has not got it, either in general of when it might naturally have it, and either in some particular way, e.g. when it *completely* fails to have it, or when it in any degree fails to have it. And in certain cases if things which naturally have a quality lose it by violence, we say they suffer privation.

1046a36-1046b4

§ 2 · Since some such principles are present in soulless things, and others in things possessed of soul, and in soul and in the rational part of the soul, clearly some potentialities will be non-rational and some will be accompanied by reason. This is why all arts, i.e. all productive forms of knowledge, are potentialities; they are principles of change in another thing or in the artist himself considered as other.

1046b5-1046b24

And each of those which are accompanied by reason is alike capable of contrary effects, but one non-rational power produces one effect; e.g. the hot is capable only of heating, but the medical art can produce both disease and health. The reason is that science is a rational formula, and the same rational formula explains a thing and its privation, only not in the same way; and in a sense it applies to both, but in a sense it applies rather to the positive fact. Therefore such sciences must deal with contraries, but with one in virtue of their own nature and with the other not in virtue of their nature; for the rational formula applies to one object in virtue of that object's nature, and to the other, in a sense, accidentally. For it is by denial and removal that it explains the contrary; for the contrary is the primary privation, and this is the entire removal of the positive term. Now since on the one hand contraries do not occur in the same thing, but on the other hand science is a potentiality which depends on the possession of a rational formula, and the soul possesses a principle of movement; therefore, on the other hand, the healthy produces only health and what can heat only heat and what can cool only cold, but the scientific man, on the other hand, produces both the contrary effects. For

there is a rational formula which applies to both, though not in the same way, and it is in a soul which possesses a principle of movement; so that the soul will start both processes from the same principle, applying them to the same object. And so the things whose potentiality is according to a rational formula act contrariwise to the things whose potentiality is non-rational; for the products of the former are included under one principle, the rational formula.

It is obvious also that the potentiality of merely doing a thing or having it done to one is implied in that of doing it or having it done *well*, but the latter is not always implied in the former: for he who does a thing well must do it, but he who does it merely need not do it well.

1046b25-1046b28

§ 3 · There are some who say, as the Megaric school does, that a thing can act only when it is acting, and when it is not acting it cannot act, e.g. he who is not building cannot build, but only he who is building, when he is building; and so in all other cases. It is not hard to see the absurdities that attend this view.

1046b29-1046b33

For it is clear that on this view a man will not be a builder unless he is building (for to be a builder is to be able to build), and so with the other arts. If, then, it is impossible to have such arts if one has not at some time learnt and acquired them, and it is then impossible not to have them if one has not sometime lost them (either by forgetfulness or by some accident or by time; for it cannot be by the destruction of the object itself, for that lasts for ever), a man will not have the art when he has ceased to use it, and yet he may immediately build again; how then will he have got the art? And similarly with regard to lifeless things; nothing will be either cold or hot or sweet or perceptible at all if people are not perceiving it; so that the upholders of this view will have to maintain the doctrine of Protagoras. But, indeed, nothing will even have perception if it is not perceiving, i.e. exercising its perception. If, then, that is blind which has not sight though it would naturally have it, when it would naturally have it and when it still exists, the same people will be blind many times in the day—and deaf too.

1046b34-1047a10

Again, if that which is deprived of potentiality is incapable, that which is not happening will be incapable of happening; but he who says of that which is incapable of happening that it is or will be will say what is untrue; for this is what incapacity meant. Therefore these views do away with both movement and becoming. For that which stands will always stand, and that which sits will always sit; if it is sitting it will not get up; for that which cannot get up will be incapable of getting up. But we cannot say this, so that evidently potentiality and actuality are different; but these views make potentiality and actuality the same, so that it is no small thing they are seeking to annihilate.

1047a11-1047a20

1047a21-1047a29

Therefore it is possible that a thing may be capable of being and not *be*, and capable of not being and yet *be*, and similarly with the other kinds of predicate; it may be capable of walking and yet not walk, or capable of not walking and yet walk. And a thing is capable of doing something if there is nothing impossible in its having the actuality of that of which it is said to have the capacity. I mean for instance, if a thing is capable of sitting and it is open to it to sit, there will be nothing impossible in its actually sitting; and similarly if it is capable of being moved or moving or of standing or making to stand or of being or coming to be, or of not being or not coming to be.

1047a30-1047b2

The word 'actuality', which we connect with fulfillment, has, strictly speaking, been extended from movements to other things; for actuality in the strict sense is identified with movement. And so people do not assign movement to non-existent things, though they do assign some other predicates. E.g. they say that non-existent things are objects of thought and desire, but not that they are moved; and this because, while they do not actually exist, they would have to exist actually if they were moved. For of non-existent things some exist potentially; but they do not *exist*, because they do not exist in fulfillment.

1047b3-1047b14

§ 4 · If what we have described is the possible or a consequence of the possible, evidently it cannot be true to say 'this is capable of being but will not be',—a view which leads to the conclusion that there is nothing incapable of being. Suppose, for instance, that a man (one who did not understand the meaning of 'incapable of being') were to say that the diagonal of the square is capable of being measured but will not be measured, because a thing may be capable of being or coming to be, and yet not be or be about to be. But from the premises this necessarily follows, that if we actually suppose that which is not, but is capable of being, to be or to have come to be, there will be nothing impossible in this; but the result *will* be impossible, for the actual measuring of the diagonal is impossible. For the false and the impossible are not the same; that you are standing now is false, but not impossible.

1047b15-1047b30

At the same time it is clear that if, when *A* is, *B* must be, then, when *A* is possible, *B* also must be possible. For if *B* need not be possible, there is nothing to prevent its not being possible. Now let *A* be supposed possible. Then, when *A* is possible, nothing impossible would follow if *A* were supposed to be; and then *B* must of course be. But we supposed *B* to be impossible. Let it be impossible, then. If, then, *B* is impossible, *A* also must be so. But *A* was supposed possible; therefore *B* also is possible. If, then, *A* is possible, *B* also will be possible, if they were so related that if *A* is, *B* must be. If, then, *A* and *B* being thus related, *B* is

not possible on this condition, *A* and *B* will not be related as was supposed. And if when *A* is possible, *B* must be possible, then if *A* is, *B* must also be. For to say that *B* must be possible, if *A* is possible, means that if *A* is both at the time when and in the way in which it was supposed capable of being, *B* also must then and in that way be.

§ 5 · As all potentialities are either innate, like the senses, or come by practice, like the power of playing the flute, or by learning, like that of the arts, those which come by practice or by rational formula we must acquire by previous exercise, but this is not necessary with those which are not of this nature and which imply passivity.

1047b31-1047b36

Since that which is capable is capable of something and at some time and in some way—with all the other qualifications which must be present in the definition—, and since some things can work according to a rational formula and their potentialities involve a formula, while other things are non-rational and their potentialities are non-rational, and the former potentialities must be in a living thing, while the latter can be both in the living and in the lifeless; as regards potentialities of the latter kind, when the agent and the patient meet in the way appropriate to the potentiality in question, the one must act and the other be acted on, but with the former kind this is not necessary. For the non-rational potentialities are all productive of one effect each, but the rational produce contrary effects, so that they would produce contrary effects at the same time; but this is impossible. That which decides, then, must be something else; I mean by this, desire or choice. For whichever of two things the animal desires decisively, it will do, when it is in the circumstances appropriate to the potentiality in question and meets the passive object. Therefore everything which has a rational potentiality, when it desires that for which it has a potentiality and in the circumstances in which it has it, must do this. And it has the potentiality in question when the passive object is present and is in a certain state; if not it will not be able to act. To add the qualification ‘if nothing external prevents it’ is not further necessary; for it has the potentiality in so far as this is a potentiality of acting, and it is this not in all circumstances but on certain conditions, among which will be the exclusion of external hindrances; for these are barred by some of the positive qualifications. And so even if one has a rational wish, or an appetite, to do two things or contrary things at the same time, one cannot do them; for it is not on these terms that one has the potentiality for them, nor is it a potentiality for doing both at the same time, since one will do just the things which it is a potentiality for doing.

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1048a25-1048b9

§ 6 · Since we have treated of the kind of potentiality which is related to movement, let us discuss actuality, what and what sort of thing it is. In the course of our analysis it will also become clear, with regard to the potential, that we not only ascribe potentiality to that whose nature it is to move something else, either without qualification or in some particular way, but also use the word in another sense, in the pursuit of which we have discussed these previous senses. Actuality means the existence of the thing, not in the way which we express by 'potentially'; we say that potentially, for instance, a statue of Hermes is in the block of wood and the half-line is in the whole, because it might be separated out, and even the man who is not studying we call a man of science, if he is capable of studying. Otherwise, actually. Our meaning can be seen in the particular cases by induction, and we must not seek a definition of everything but be content to grasp the analogy,—that as that which is building is to that which is capable of building, so is the waking to the sleeping, and that which is seeing to that which has its eyes shut but has sight, and that which is shaped out of the matter to the matter, and that which has been wrought to the unwrought. Let actuality be defined by one member of this antithesis, and the potential by the other. But all things are not said in the *same sense* to exist actually, but only by analogy—as *A* is in *B* or to *B*, *C* is in *D* or to *D*; for some are as movement to potentiality, and the others as substance to some sort of matter.

1048b10-1048b17

The infinite and the void and all similar things are said to exist potentially and actually in a different sense from that in which many other things are said so to exist, e.g. that which sees or walks or is seen. For of the latter class these predicates can at some time be truly asserted without qualification; for the seen is so called sometimes because it is being seen, sometimes because it is capable of being seen. But the infinite does not exist potentially in the sense that it will ever actually have separate existence; its separateness is only in knowledge. For the fact that division never ceases to be possible gives the result that this actuality exists potentially, but not that it exists separately.

1048b18-1048b34

Since of the actions which have a limit none is an end but all are relative to the end, e.g. the process of making thin is of this sort, and the things themselves when one is making them thin are in movement in this way (i.e. without being already that at which the movement aims), this is not an action or at least not a complete one (for it is not an end); but that in which the end is present is an action. E.g. at the same time we are seeing and have seen, are understanding and have understood, are thinking and have thought: but it is not true that at the same time we are learning and have learnt, or are being cured and have been cured. At the same time we are living well and have lived well, and are happy and have

been happy. If not, the process would have had sometime to cease, as the process of making thin ceases: but, as it is, it does not cease; we are living and have lived. Of these processes, then, we must call the one set movements, and the other actualities. For every movement is incomplete—making thin, learning, walking, building; these are movements, and incomplete movements. For it is not true that at the same time we are walking and have walked, or are building and have built, or are coming to be and have come to be—it is a different thing that is being moved and that has been moved, and that is moving and that has moved; but it is the same thing that at the same time has seen and is seeing, or is thinking and has thought. The latter sort of process, then, I call an actuality, and the former a movement.

§ 7 · What and what sort of thing the actual is may be taken as explained by these and similar considerations. But we must distinguish when a thing is potentially and when it is not; for it is not at any and every time. E.g. is *earth* potentially a man? No—but rather when it has already become *seed*, and perhaps not even then, as not everything can be healed by the medical art or by chance, but there is a certain kind of thing which is capable of it, and only this is potentially healthy. And the definition of that which as a result of *thought* comes to be in fulfillment from having been potentially is that when it has been wished it comes to pass if nothing external hinders it, while the condition on the other side—viz. in that which is healed—is that nothing in it hinders the result. Similarly there is potentially a house, if nothing in the thing acted on—i.e. in the matter—prevents it from becoming a house, and if there is nothing which must be added or taken away or changed; this is potentially a house, and the same is true of all other things for which the source of their becoming is external. And in the cases in which the source of the becoming is in the very thing which suffers change, all those things are said to be potentially something else, which will be it of themselves if nothing external hinders them. E.g. the seed is not yet potentially a man; for it must further undergo a change in a foreign medium.¹⁸ But when through its own motive principle it has already got such and such attributes, in this state it is already potentially a man; while in the former state it needs another principle, just as earth is not yet potentially a statue, for it must change in order to become bronze.

1048b35-1049a18

It seems that when we call a thing not something else but ‘of’ that something (e.g. a casket is not wood but of wood, and wood is not earth but made of earth,

1049a19-1049b3

¹⁸Omitting *pesein*.

and again perhaps in the same way earth is not something else but made of that something), that something is always potentially (in the full sense of that word) the thing which comes after it in this series. E.g. a casket is not earthen nor earth, but wooden; for wood is potentially a casket and is the matter of a casket, wood in general of a casket in general, and this particular wood of this particular casket. And if there is a first thing, which no longer is called after something else, and said to be of it, this is prime matter; e.g. if earth is airy and air is not fire but fiery, fire then is prime matter, not being a 'this'. For the subject and substratum differ by being or not being a 'this'; the substratum of *accidents* is an individual such as a man, i.e. body and soul, while the accident is something like musical or white. (The subject is called, when music is implanted in it, not music but musical, and the man is not whiteness but white, and not ambulation or movement but walking or moving,—as in the above examples of 'of' something.) Wherever this is so, then, the ultimate subject is a substance; but when this is not so but the predicate is a form or a 'this', the ultimate subject is matter and material substance. And it is only right that the 'of' something locution should be used with reference both to the matter and to the accidents; for both are indeterminates. We have stated, then, when a thing is to be said to be potentially and when it is not.

1049b4-1049b12

§ 8 · We have distinguished the various senses of 'prior', and it is clear that actuality is prior to potentiality. And I mean by potentiality not only that definite kind which is said to be a principle of change in another thing or in the thing itself regarded as other, but in general every principle of movement or of rest. For nature also is in the same genus as potentiality; for it is a principle of movement—not, however, in something else but in the thing itself *qua* itself. To all such potentiality, then, actuality is prior both in formula and in substance; and in time it is prior in one sense, and in another not.

1049b13-1049b16

Clearly it is prior in formula; for that which is in the primary sense potential is potential because it is possible for it to become actual, e.g. I mean by 'capable of building' that which can build, and by 'capable of seeing' that which can see, and by 'visible' that which can be seen. And the same account applies to all other cases, so that the formula and the knowledge of the one must precede the knowledge of the other.

1049b17-1049b29

In time it is prior in this sense: the actual member of a species is prior to the potential member of the same species, though the individual is potential before it is actual. I mean that the matter and the seed and that which is capable of seeing, which are potentially a man and corn and seeing, but not yet actually so, are prior in time to this particular man who now exists actually, and to the corn and to the

seeing subject; but they are posterior in time to other actually existing things, from which they were produced. For from the potential the actual is always produced by an actual thing, e.g. man by man, musician by musician; there is always a first mover, and the mover already exists actually. We have said in our account of substance that everything that is produced is something produced from something and by something, and is the same in species as it.

This is why it is thought impossible to be a builder if one has built nothing or a harpist if one has never played the harp; for he who learns to play the harp learns to play it by playing it, and all other learners do similarly. And thence arose the sophistical quibble, that one who does not know a science will be doing that which is the object of the science; for he who is learning it does not know it. But since, of that which is coming to be, some part must have come to be, and, of that which, in general, is changing, some part must have changed (this is shown in the treatise on movement), he who is learning must, it would seem, know some part of the science. It is surely clear, then, in this way, that the actuality is in this sense also, viz. in order of becoming and of time, prior to the potentiality.

1049b30-1050a3

But it is also prior in substance; firstly, because the things that are posterior in becoming are prior in form and in substance, e.g. man is prior to boy and human being to seed; for the one already has its form, and the other has not. Secondly, because everything that comes to be moves towards a principle, i.e. an end. For that for the sake of which a thing is, is its principle, and the becoming is for the sake of the end; and the actuality is the end, and it is for the sake of this that the potentiality is acquired. For animals do not see in order that they may have sight, but they have sight that they may see. And similarly men have the art of building that they may build, and theoretical science that they may theorize; but they do not theorize that they may have theoretical science, except those who are learning by practice; and these do not theorize except in a limited sense, or else they have no need to theorize.¹⁹ Further, matter exists in a potential state, just because it may attain to its form; and when it exists *actually*, then it is in its form.

1050a4-1050a16

And the same holds good in cases in which the end is a movement, as well as in all others. Therefore as teachers think they have achieved their end when they have exhibited the pupil at work, so also does nature. For if this is not the case, we shall have Pauson's Hermes over again; for it will be hard to say about the knowledge, as about the statue, whether it is within or without. For the action is the end, and the actuality is the action. Therefore even the *word* 'actuality' is derived from 'action', and points to the fulfillment.

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¹⁹Omitting *hoti*.

1050a24-1050a29

And while in some cases the exercise is the ultimate thing (e.g. in sight the ultimate thing is seeing, and no other product besides this results from sight), but from some things a product follows (e.g. from the art of building there results a house as well as the act of building), yet none the less the act is in the former case the end and in the latter more of an end than the mere potentiality is. For the act of building is the thing that is being built, and comes to be—and is—at the same time as the house.

1050a30-1050b1

Where, then, the result is something apart from the exercise, the actuality is in the thing that is being made, e.g. the act of building is in the thing that is being built and that of weaving in the thing that is being woven, and similarly in all other cases, and in general the movement is in the thing that is being moved; but when there is no product apart from the actuality, the actuality is in the agents, e.g. the act of seeing is in the seeing subject and that of theorizing in the theorizing subject and the life is in the soul (and therefore well-being also; for it is a certain kind of life).

1050b2-1050b6

Obviously, therefore, the substance or form is actuality. From this argument it is obvious that actuality is prior in substance to potentiality; and as we have said, one actuality always precedes another in time right back to the actuality of the eternal prime mover.

1050b7-1050b28

But actuality is prior in a higher sense also; for eternal things are prior in substance to perishable things, and no eternal thing exists potentially. The reason is this. Every potentiality is at one and the same time a potentiality for the opposite; for, while that which is not capable of being present in a subject cannot be present, everything that is capable of being may possibly not be actual. That, then, which is capable of being may either be or not be; the same thing, then, is capable both of being and of not being. And that which is capable of not being may possibly not be; and that which may possibly not be is perishable, either without qualification, or in the precise sense in which it is said that it possibly may not be, i.e. either in respect of place or quantity or quality; ‘without qualification’ means ‘in substance’. Nothing, then, which is without qualification imperishable is without qualification potentially (though there is nothing to prevent its being potentially in some respect, e.g. potentially of a certain quality or in a certain place); imperishable things, then, exist actually. Nor can anything which is of *necessity* be potential; yet these things are primary; for if these did not exist, nothing would exist. Nor does eternal movement, if there be such, exist potentially; and, if there is an eternal mover, it is not potentially in motion (except in respect of ‘whence’ and ‘whither’; there is nothing to prevent its having matter for this). Therefore the sun and the stars and the whole heaven are ever active, and there is no fear

that they may sometime stand still, as the natural philosophers fear they may. Nor do they tire in this activity; for movement does not imply for them, as it does for perishable things, the potentiality for opposites, so that the continuity of the movement should be laborious; for it is that kind of substance which is matter and potentiality, not actuality, that causes this.

Imperishable things are imitated by those that are involved in change, e.g. earth and fire. For these also are ever active; for they have their movement of themselves and in themselves. But the other potentialities, according to the distinction we have drawn above, are all potentialities for opposites; for that which can move another in this way can also move it not in this way, i.e. if it acts according to a rational formula. But the same *non-rational* potentialities can produce opposite results only by their presence or absence.

1050b29-1050b34

If, then, there are any entities or substances such as the dialecticians say the Ideas are, there must be something much more scientific than the Idea of science and something more mobile than the Idea of movement; for these will be more of the nature of actualities, while the Ideas are potentialities for these. Obviously, then, actuality is prior both to potentiality and to every principle of change.

1050b35-1051a3

§ 9 · That the good actuality is better and more valuable than the good potentiality is evident from the following argument. Everything of which we say that it can do something, is alike capable of contraries, e.g. that of which we say that it can be healthy is the same as that which can be ill, and has both potentialities at once; for one and the same potentiality is a potentiality for health and illness, for rest and motion, for building and throwing down, for being built and being thrown down. The capacity for contraries is present at the same time; but contraries cannot be present at the same time, and the actualities also cannot be present at the same time, e.g. health and illness. Therefore one of them must be the good, but the capacity is both the contraries alike, or neither; the actuality, then, is better. And in the case of bad things, the end or actuality must be worse than the potentiality; for that which can is both contraries alike.

1051a4-1051a17

Clearly, then, the bad does not exist apart from bad things; for the bad is in its nature posterior to the potentiality. And therefore we may also say that in the things which are from the beginning, i.e. in eternal things, there is nothing bad, nothing defective, nothing perverted (for perversion is something bad).

1051a18-1051a21

It is by actualization also that geometrical relations are discovered; for it is by dividing the given figures that people discover them. If they had been already divided, the relations would have been obvious; but as it is the divisions are present only potentially. Why are the angles of the triangle equal to two right angles?

1051a22-1051a28

Because the angles about one point are equal to two right angles. If, then, the line parallel to the side had been already drawn, the theorem would have been evident to any one as soon as he saw the figure. Why is the angle in a semicircle in all cases a right angle? Because if three lines are equal—the two which form the base, and the perpendicular from the centre—the conclusion is evident at a glance to one who knows this premise.

1051a29-1051a33

Obviously, therefore, the potentially existing relations are discovered by being brought to actuality (the reason being that thinking is the actuality of thought); so that potentiality is discovered from actuality (and therefore it is by an act of construction that people acquire the knowledge), though the single actuality is later in generation.

1051a34-1051b17

§ 10 · The terms ‘being’ and ‘non-being’ are employed firstly with reference to the categories, and secondly with reference to the potentiality or actuality of these or their opposites, while being and non-being in the strictest sense are truth and falsity²⁰. The condition of this in the objects is their being combined or separated, so that he who thinks the separated to be separated and the combined to be combined has the truth, while he whose thought is in a state contrary to that of the objects is in error. This being so, when is what is called truth or falsity present, and when is it not? We must consider what we mean by these terms. It is not because we think that you are white, that you *are* white, but because you are white we who say this have the truth. If, then, some things are always combined and cannot be separated, and others are always separated and cannot be combined, while others are capable either of combination or of separation, being is being combined and one, and not being is being not combined but more than one; regarding contingent facts, then, the same opinion or the same statement comes to be false and true, and it is possible at one time to have the truth and at another to be in error; but regarding things that cannot be otherwise opinions are not at one time true and at another false, but the same opinions are always true or always false.

1051b18-1051b33

With regard to *incomposites*, what is being or not being, and truth or falsity? A thing of this sort is not composite, so as to be when it is compounded, and not to be if it is separated, like the white wood or the incommensurability of the diagonal; nor will truth and falsity be still present in the same way as in the previous cases. In fact, as truth is not the same in these cases, so also being is not the same; but truth or falsity is as follows—contact and assertion are truth (assertion not being the same as affirmation), and ignorance is non-contract. For it is not possible to

²⁰Ross excises ‘in the strictest sense’.

be in *error* regarding the question what a thing is, save in an accidental sense; and the same holds good regarding non-composite substances (for it is not possible to be in error about them). And they all exist actually, not potentially; for otherwise they would come to be and cease to be; but, as it is, being itself does not come to be (nor cease to be); for if it did it would have to come out of something. About the things, then, which are essences and exist in actuality, it is not possible to be in error, but only to think them or not to think them. Inquiry about their ‘what’ takes the form of asking whether they are of such and such a nature or not.

As regards being in the sense of truth and not being in the sense of falsity, in one case there is truth if the subject and the attribute are really combined, and falsity if they are not combined; in the other case, if the object is existent it exists in a particular way, and if it does not exist in this way it does not exist at all; and truth means thinking these objects, and falsity does not exist, nor error, but only ignorance,—and not an ignorance which is like blindness; for blindness is akin to a total absence of the faculty of thinking.

1051b34-1052a3

It is evident also that about unchangeable things there can be no error in respect of time, if we assume them to be unchangeable. E.g. if we suppose that the triangle does not change, we shall not suppose that at one time its angles are equal to two right angles while at another time they are not (for that would imply change). It is possible, however, to suppose that one member of such a class has a certain attribute and another has not, e.g. while we may suppose that no even number is prime, we may suppose that some are and some are not. But regarding a single number not even this form of error is possible; for we cannot in this case suppose that one instance has an attribute and another has not; but whether our judgement be true or false, it is implied that the fact is eternal.

1052a4-1052a14

V • PHILOSOPHICAL WORKS

*F 185-208 R³**F 185 R³ (Syrianus, Commentarius in Metaphysica 120.33-121.4):*

That he [sc. Aristotle] has nothing more than this to say against the theory of Forms is shown both by the first book of this treatise [i.e. the *Metaphysics*] and by the two books he wrote *On the Forms*; for it is by taking everywhere practically these same arguments, and sometimes cutting them up and subdividing them, sometimes putting them forward more concisely, that he tries to correct his predecessors in philosophy.

F 186 R³ (Scholiast to Dionysius Thrax, 116.13-16 Hilgard):

And one must realize that it is of universals and things eternal that there are definitions, as Aristotle too has said in *On Ideas*, which he wrote against Plato's Ideas. For while particular things all change and never remain in the same condition, universals are unchangeable and eternal.

(Alexander, Commentarius in Metaphysica 79.3-88.2):

They [sc. the Platonists] made further use of the sciences in establishing the Ideas, and in more ways than one, as he [sc. Aristotle] says in the first book of *On Ideas*; and the arguments he seems to have in mind at the present moment [i.e. in the *Metaphysics*] are the following sort. If every science performs its task by referring to some one and the same thing and not to any of the particulars, then there will be with respect to each science something different apart from perceptible individuals, eternal and a pattern for the things produced in each science; and such a thing is the Idea. Again, the things of which there are sciences exist; the sciences are of certain different things apart from particulars (for the latter are infinite and indeterminate, while the sciences are of determinate things); so there are certain things apart from particulars, and these are the Ideas. Again, if medicine is not a science of this particular health but of health simply, there will be a certain health-itself; and if geometry is not a science of this particular equal and this particular commensurate, but of equal simply and the commensurate simply, there will be a certain equal-itself and a commensurate-itself; and these are the Ideas.

Now such arguments do not prove the thesis at issue, which was that there are Ideas; but they do prove that there are certain things apart from particulars and perceptibles. But it does not follow that if there are certain things which are apart from particulars, these are Ideas; for the common objects, which we say are also

the objects of the sciences, are apart from the particulars. Again, these arguments show that there are also Ideas of the things that fall under the arts. For every art too refers what is produced by it to some one thing, and things of which there are arts exist, and the arts are of certain different things apart from particulars. And the second argument, besides equally failing to prove that there are Ideas, will also be thought to establish Ideas of things for which they do not wish there to be Ideas. For if, because medicine is not a science of this particular health but of health simply, there is some thing health-itself, then such will be the case also in each of the arts. For an art is not of the particular nor of *this*, but of that simply which is its concern, e.g. carpentry is of chair simply but not of this particular one, and of bed simply but not of this particular one; and sculpture, painting, building, and each of the other arts are similarly related to the things that fall under them. So there will be an Idea of each of the things that fall under the arts—which they do not want.

They also use the following argument to establish the Ideas. If each of the many men is a man, and each of the animals is an animal, and similarly in the other cases; and if in the case of each of these it is not that something is predicated of itself but that some one thing is being predicated of all of them while not being the same as any one of them, then there will be something which is apart from the particulars which exist, separated from them and eternal; for it is predicated always alike of all the changing particulars. And that which is one over many, both separated from them and eternal, is an Idea; so there are Ideas.

This argument, he [sc. Aristotle] says, establishes Ideas even of negations and of things that do not exist. For one and the same negation is predicated of many things and of things which do not exist, and is not the same as any one of the things which it is truly predicated of. For ‘not-man’ is predicated of horse and of dog and of everything apart from man, and for this reason is one thing over many and is not the same as any one of the things of which it is predicated. Again, it always remains alike true of like things; for ‘not-musical’ is true of many things (of everything non-musical), and similarly ‘not-man’ of non-men; consequently, there are Ideas also of negations. But that is absurd; for how could there be an Idea of non-being? For if one were to accept that, there would be a single Idea for things that are of *different* kinds and that differ in every respect—of, as it might be, line and man; for all these are non-horses. Again, there will be a single Idea both of things that are indeterminate and of things that are infinite. But also of what is primary and what is secondary; for both man and animal are non-wood, of which the one is primary, the other secondary—and they did not want there to be either genera or Ideas of such things. Clearly, this argument too fails to show that there

are Ideas; but it too tends to show that what is commonly predicated is other than the particulars of which it is predicated. Again, the very people who wish to prove that what is commonly predicated of several things is some single thing and in fact an Idea, try to establish it from negations. For if someone in denying something of several things will do so by referring to some single thing (for someone who says of a man that he is not white and of a horse that it is not white is not in each case denying something peculiar to it but is making reference to some single thing and denying the same white of each), then someone in affirming the same thing of several things will not be affirming something different in each case but there will be some single thing which he is affirming, e.g. man, with reference to some one and the same thing; for as with negation so with affirmation. So there is something that is different apart from what is in the perceptibles, which is the cause of the affirmation that is both true of several things and common, and this is the Idea. Now this argument, he says, produces Ideas not only of things that are affirmed but also of things that are denied; for in both cases there is a similar reference to something single.

The argument that tries to establish that there are Ideas from thinking is as follows. If whenever we think of man or footed or animal, we are thinking of something that is both among the things that exist yet is not one of the particulars (for when the latter have perished the same thought remains), clearly there is something apart from particulars and perceptibles, which we think of whether the latter exist or not; for we are certainly not then thinking of something non-existent. And this is a Form and an Idea. Now he says that this argument also establishes Ideas of things that are perishing and have perished, and in general of things that are both particulars and perishable—e.g. of Socrates, of Plato; for we think of these men and keep some image of them even when they no longer exist. And indeed we also think of things that do not exist at all, like a Hippocentaur, a Chimaera; consequently neither does this argument show that there are Ideas.

The argument that tries to establish Ideas from relatives is as follows. In those cases where some same thing is predicated of several things not homonymously but as revealing some single nature, it is true of them either by their strictly being what is indicated by what is predicated, as when we say Socrates is a man and Plato is; or by their being likenesses of the genuine things, as when we predicate man of painted men (for in the case of these latter we reveal the likenesses of men by indicating the same particular nature in all of them); or on the grounds of one of them being the pattern, while the rest are likenesses, as if we were to call both Socrates and likenesses of him men. And we predicate the equal itself of things here, although it is predicated of them only homonymously; for neither

does the same account fit all of them, nor do we indicate things that are truly equal; for among perceptibles quantity changes and shifts continuously and is not determinate. Nor moreover do any of the things here accurately receive the account of the equal. And no more indeed on the grounds of one of them being pattern, the other likeness; for one is no more pattern or likeness than the other. And even if someone were to accept that the likeness is not homonymous with its pattern, it still follows that these equal things are equal as likenesses of that which is strictly and truly equal. And if this is the case, there is some equal itself quite strictly, relative to which things here, as likenesses, are both produced and called equal, and this is an Idea, a pattern for those things which are produced relative to it.

This argument, Aristotle says, establishes Ideas even of relative terms. At any rate the present proof has been advanced in the case of the equal, which is a relative; but they used to say that there were no Ideas of relatives because while Ideas, being for them kinds of substances, existed in their own right, relatives had their being in their relationship to one another. And again, if the equal is equal to an equal, there will be more than one Idea of the equal; for the equal-itself is equal to an equal-itself; for if it were not equal to something, it would not be equal at all. Again, by the same argument there will have to be Ideas of unequals too; for opposites are in a similar case—there will or will not be Ideas of both; and the unequal is admitted by them too to involve more things than one.

The argument which introduces the third man is as follows. They say that what are commonly predicated of substances both are strictly such things and are Ideas. And again, things that are like each other are like each other by sharing in the same certain thing, which is strictly the thing in question; and this is the Idea. But if this is the case, and what is commonly predicated of certain things, if it is not the same as any one of those things of which it is predicated, is some other thing apart from it (for that is why man-himself is a genus—because while being predicated of the particulars it is not the same man as any of them), then there will be some third man apart both from the particular, e.g. Socrates and Plato, and from the Idea; and this too will be itself one in number.

And there was an argument presented by the sophists introducing the third man as follows. If when we say ‘a man is walking’ we are saying neither that man as an Idea is walking (for the Idea is not capable of motion) nor that some particular individual is (how could we when we do not know who it is? For while we know that a man is walking we do not know which particular man it is of whom we are saying it), we are saying that some other third man apart from these is walking: so there will be a third man of whom we predicated the walking.

Now this argument, which is sophistical, is given encouragement by those who separate what is common from the particulars, as those who posit the Ideas do. And Phantias says, in *Against Diodorus*, that the sophist Polyxenus introduced the third man by saying “If it is both by participation and sharing in the Idea, i.e. in man-himself, that man exists, then there must be some man who will have his existence relative to the Idea. But neither man-himself, i.e. the Idea, exists by participation in the Idea, nor does any particular man. It remains then that there is some third man who has his existence relative to the Idea.”

The third man is proved also in the following way. If what is predicated truly of several particulars is also something other apart from the things of which it is predicated, separated from them (for it is this that those who posit the Ideas think to prove; for in their opinion man-himself is something because man is predicated truly of particular men, who are more than one in number, and is different from these particular men)—but if this is so, there will be some third man. For if the man that is predicated is different from those of whom he is predicated, and exists on his own, and man is predicated both of the particular men and of the Idea, then there will be some third man apart both from the particular and from the Idea. On this basis there will be also a fourth man, predicated of the third man, of the Idea, and of the particulars; and similarly also a fifth, and so on *ad infinitum*.

This argument is the same as the first; this comes about for them because they supposed that like things were like by sharing in the same thing; for both men and the Ideas are like. Now he refuted both these arguments though they were thought to be rather refined, the one on the grounds that it established Ideas even of relative terms, and the other because it introduces a third man and then multiplies men to infinity. And a similar multiplication will be suffered by any of the other things of which they say there are Ideas. While others have used the first exposition of the third man—there is a specially clear use by Eudemus in his *On Diction*—the last was used by Aristotle himself both in the first book of *On Ideas* and a little later on in the present work [i.e. the *Metaphysics*].

Now they are more—in fact most—concerned to establish that there are first principles; for first principles are for them first principles of the Ideas themselves. And the one and indefinite dyad are first principles, as he has said a little earlier and has himself explained in his *On the Good*; but in their view these are the first principles of number too. Now he says that these arguments for establishing the Ideas destroy these first principles.

And if these are destroyed, the things after the first principles will also be destroyed, given that they come from the first principles; so consequently the Ideas too will be. For if in the case of all things which have a common predicate it

is both separated and an Idea, and if the dyad is predicated of the indefinite dyad too, there will be something primary and an Idea of this latter; and consequently the indefinite dyad will no longer be a first principle. But nor will the dyad in its turn be both primary and a first principle; for number is predicated of it in its turn since it is an Idea; for the Ideas are assumed by them to be numbers: consequently number, being a kind of Idea, will be primary for them. And if this is so, number will be prior to the indefinite dyad, which is for them a first principle, but not the dyad to number; and if this is so, the dyad would no longer be a first principle, if it is what it is by sharing in something. Again, while it is assumed to be a first principle of number, yet according to the argument just stated number becomes prior to it; but if number is relative (for every number is a number of something), and number is first of the things that exist, given that it is prior even to the dyad which they assumed as a first principle, then on their view what is relative will be prior to what exists in its own right. And that is absurd; for everything relative is secondary. For a relative indicates the condition of a pre-existing nature, which is prior to that condition which happens to belong to it. . . . But even if someone were to say that number is a quantity and not a relative, it would have as a consequence that quantity was prior to substance.

Again, they are committed to saying that what is relative is both a first principle of and prior to what exists in its own right, in so far as the Idea is in their view a first principle of substances, and what it is for an Idea to be an Idea lies in its being a pattern, and a pattern is relative; for a pattern is a pattern of something. Again, if being for Ideas lies in their being patterns, then things that come into being in relation to them and of which they are Ideas will be likenesses of them; and so someone might say that according to them all naturally constituted things become relative; for all things are likenesses and patterns. Again, if being for Ideas lies in their being patterns, and a pattern exists for the sake of what comes into being relative to it, and what exists on account of something else is less worthy than that thing, then the Ideas will be less worthy than what comes into being relative to them.

The following are some of the arguments which, in addition to those already stated, through the positing of Ideas destroy their first principles. If what is commonly predicated of certain things is both the first principle and Idea of those things, and if first principle is commonly predicated of the first principles and element of the elements, there will be something prior to and a first principle of the first principles and of the elements; and in this way there will be neither first principles nor elements. Again Idea is not prior to Idea; for all Ideas similarly are first principles. And the one-itself and the dyad-itself are alike Ideas—as is man-itself

and horse-itself and each of the other Ideas; so there will not be any of these that is prior to any other—so that none will be a first principle either; so it is not the case that the one and the indefinite dyad are first principles. Again, it is absurd that an Idea should be given form by an Idea; for all are Forms; but if the one and the indefinite dyad are first principles, there will be Ideas given form by Ideas; for the dyad-itself will be given form by the one-itself; for it is in this way that they say that these are first principles—in the sense that one is form, the dyad matter; so these are not first principles. And if they say that the indefinite dyad is not an Idea, then first there will be something prior to it although it is a first principle; for there is the dyad-itself, by sharing in which even this is a dyad, since this is not the dyad-itself; for it is by virtue of sharing that dyad will be predicated of it, since the same goes for particular dyads. Again, if the Ideas are simple, they will not come from different first principles, but the one and the indefinite dyad are different. Again, the number of dyads will be amazing if one is the dyad-itself, another the indefinite dyad, another the mathematical dyad, which we use in counting and which is not the same as either of the former, and again besides these another in numerable and perceptible things. This is absurd; so that clearly by following the very assumptions made by them it is possible to destroy the first principles, which are for them more important than the Ideas.

(Alexander, Commentarius in Metaphysica 97.27-98.24):

That it is not, as Eudoxus and some others thought, by mixture with the Ideas that other things exist: Aristotle says it is easy to infer many impossibilities as consequences of this opinion. If the Ideas are mixed with the other things, in the first place, they will be bodies; for it is of bodies that there is mixture. Again, they will be contrary to each other; for mixture occurs with respect to contrariety. Again, mixture will occur in such a way that either a whole Idea will be in each of the things with which it is mixed or else part of one. But if a whole, then what is one in number will be in several things; for an Idea is one in number. While if in parts, a man will be what participates in a part of man-himself, not what participates in man-himself as a whole. Again, Ideas will be divisible and partible, although they are impassive. Then they will be uniform if all things which have some part from it are like each other. But how can the Forms be uniform? For part of man cannot be a man, as a part of gold is gold. Again, as Aristotle himself says a little later [sc. in the *Metaphysics*], in each thing there will not be one Idea mixed but many; for if there is one Idea of animal and another of man, and a man is both an animal and a man, he will participate in both Ideas. And man-himself, the Idea, insofar as it is also an animal, will also itself participate in animal; and consequently the Ideas will no longer be simple but composed from

many, and some of them primary, others secondary. But if it is not an animal, surely it is absurd to say that man is not an animal? And again, if they are mixed with things that are relative to them, how can they still be patterns, as they say they are? For it is not in this way, as the result of a mixture, that patterns are causes of the similarity that their likenesses have to them. And again, they will be destroyed along with the destruction of the things they are in. Nor yet will they be in themselves separable, but will be in the things that participate in them. In addition to these points, they will no longer be unchangeable—and all the other absurdities which Aristotle in his examination of this opinion in the second book of his *On Ideas* showed it to have. For it was for this reason that he said ‘for it is easy to infer many impossibilities against this view’—for they were inferred there.

F 191 R³ (Apollonius, historiae mirabiles 6):

Again in Caulonia, according to Aristotle . . .³⁹ in addition to much other information about him, he says that in Tyrrhenia he killed a deadly biting snake by biting it himself. He also says that Pythagoras foretold to the Pythagoreans the coming political strife; that is why he departed to Metapontum unobserved by anyone, and while he was crossing the Cosas he, with others, heard the river say “Good morning, Pythagoras”—and those present were terrified. He once appeared both at Croton and at Metapontum on the same day and at the same hour. Once, while sitting in the theatre, he stood up—so Aristotle tells—and showed those sitting there his own thigh, which was golden.

F 191 R³ (Aelian, varia historia II 26):

Aristotle says that Pythagoras was called by the people of Croton the Hyperborean Apollo. The son of Nicomachus adds that Pythagoras was once seen by many people, on the same day and at the same hour, both at Metapontum and at Croton; and at Olympia, during the games, he got up and showed that one of his thighs was golden.⁴⁰ The same writer says that while crossing the river Cosas he was hailed by the river, and that many people heard him so hailed.

F 192 R³ (Iamblichus, vita pythagorica VI 31):

Aristotle relates in his books *On the Pythagorean Philosophy* that the following division was preserved by the Pythagoreans as one of their greatest secrets: of rational living creatures, some are gods, some men, and some beings like Pythagoras.

F 193 R³ (Apuleius, de deo Socratis XX 166-7):

³⁹There is a lacuna here.

⁴⁰Text uncertain.

But I suppose Aristotle is a sufficient witness to the fact that the Pythagoreans marvelled greatly at anyone who said he had never seen a divine being.

F 194 R³ (Aulus Gellius, IV xi 12):

Since the fact is unexpected, I add Plutarch's own words: 'Aristotle says the Pythagoreans abstain from eating womb and heart, the sea anemone, and certain other such things, but use all other kinds'.

F 194 R³ (Diogenes Laertius, VIII 19):

Aristotle says that at times they [sc. the Pythagoreans] abstain from womb and red mullet.

F 195 R³ (Diogenes Laertius, VIII 34):

Aristotle says in his work *On the Pythagoreans* that he [sc. Pythagoras] enjoyed abstention from beans either because they are like the genitals or because they are like the gates of Hades . . .⁴¹ (for they alone have no joints), or because they are destructive, or because they are like the nature of the universe, or because they are oligarchical (being used in the choice of rulers by lot).

F 196 R³ (Porphyry, Vita Pythagorae 41):

Pythagoras used to say certain things in a mystical and symbolic way, and Aristotle has recorded many of these; e.g. that he called the sea the tears of Cronos, the Bears the hands of Rhea, the Pleiades the lyre of the Muses, the planets the dogs of Persephone; the ringing sound of bronze when struck was, he said, the voice of a divine being imprisoned in the bronze.

F 197 R³ (Porphyry, Vita Pythagorae 42):

There was also another kind of symbol, of the following sort: 'Do not step over a balance', i.e. do not be covetous; 'Do not poke the fire with a sword', i.e. do not vex with sharp words a man swollen with anger; 'Do not pluck the crown', i.e. do not offend against the laws which are the crowns of cities. Or again, 'Do not eat heart', i.e. do not vex yourself with grief; 'Do not sit on the corn ration', i.e. do not live in idleness; 'When on a journey do not turn back', i.e. when you are dying, do not cling to this life; 'Do not walk the highway', i.e. do not follow the opinions of the many but pursue those of the few and educated; 'Do not receive swallows in your house', i.e. do not take into your house talkative men who cannot control their tongues; 'Add to the burdens of the burdened, do not lighten them', i.e. contribute to no man's sloth, but to his excellence; 'Do not carry images of the gods in your rings', i.e. do not make your thought and speech about the gods manifest and obvious, nor show it to many; 'Make your libations to the gods at the ear of the cup', i.e. celebrate and honour the gods with music,

⁴¹There is a lacuna in the text.

for this goes through the ears.

F 198 R³ (Martianus Capella, VII 731):

(Philosophy speaks). ‘Although Aristotle, one of my followers, reasoning from the fact that it [sc. the unit] itself is one alone and wishes always to be sought after, asserts that it is called Desire because it desires itself, since it has nothing beyond itself and, never carried beyond itself or linked with other things, turns its own ardours on itself’.

F 199 R³ (Theo of Smyrna, p. 22. 5-9 Hiller):

But Aristotle in his *Pythagoreans* says that the One partakes of the nature of both; for added to an even number it makes an odd, and added to an odd an even, which it could not do if it did not share in both natures; and that for this reason the One was called even-odd.

F 200 R³ (Simplicius, Commentarius in de Caelo, 386.20-23):

Right, above and before they called good, and left, below and behind evil, as Aristotle himself related in his collection of Pythagorean doctrines.

F 201 R³ (Stobaeus, Eclogae I xviii 1c):

In the first book of his work *On the Philosophy of Pythagoras* Aristotle writes that the heaven is one, and that time and breath and the void, which divides for ever the regions of different things, are drawn in from the infinite.

F 202 R³ (Alexander, Commentarius in Metaphysica 75.15-17):

Of the arrangement in the heavens which the Pythagoreans assigned to the numbers, Aristotle informs us in the second book of his work *On the Belief of the Pythagoreans*.

F 203 R³ (Alexander, Commentarius in Metaphysica 38.8-41.2):

He [sc. Aristotle] has shown what likenesses the Pythagoreans said there were between numbers and the things that exist and come into being; for assuming that reciprocity and equality were properties of justice and finding them to exist in numbers, they said, for this reason, that the first square number was justice, for in every case the first of a number of things that admit of the same definition is most truly that which it is said to be. Now this number some declared to be the number 4, because, being the first square number, it is divided into equals and is itself equal (being twice 2), while others declared it to be the number 9, which is the first square number produced by multiplying an odd number (3) by itself. Again, they said the number 7 was season; for natural things seem to have their perfect seasons of birth and completion in terms of sevens, as in the case of man. Men are born after seven months, they begin to grow their teeth in seven months, they reach puberty about the end of the second set of seven years, and grow beards about the end of the third. The sun, too, since it is itself thought to be (as he says)

the cause of seasons, they maintain to be established where the number 7 resides, which they identify with season; for the sun holds the seventh place among the ten bodies that move round the centre and hearth of the universe; it moves after the sphere of the fixed stars and the five spheres of the planets; after it come the moon, eighth, and the earth, ninth, and after the earth the counter-earth. Since the number 7 neither generates nor is generated by any of the numbers in the decad, for this reason they also said that it was Athene. For the number 2 generates 4, 3 generates 9 and 6, 4 generates 8, and 5 generates 10, and 4, 6, 8, 9 and 10 are generated, but 7 neither generates any number nor is generated from any; and so too Athene was motherless and ever virgin. Marriage, they said, was the number 5, because it is the union of male and female, and according to them the odd is male and the even female, and 5 is the first number generated from the first even number, 2, and the first odd number, 3; for the odd is for them (as I said) male, and the even female. Mind (which was the name they⁴² gave to soul) and substance they identified with the One. Because it was unchanging, alike everywhere, and a ruling principle they called mind both a unit and one; but they also applied these names to substance, because it is primary. Opinion they identified with the number 2 because it can move in both directions; they also called it movement and addition. Picking out such likenesses between things and numbers, they assumed numbers to be the first principles of things, saying that all things are composed of numbers.

But they also saw the harmonies to be constituted according to particular numbers, and said that numbers were the first principles of these also; the octave depends on the ratio 2:1, the fifth on the ratio 3:2, the fourth on the ratio 4:3. They said, too, that the whole universe is constructed in accordance with a certain harmony . . . because it consists of numbers and is constructed in accordance with number and harmony. For the bodies that move round the centre have their distances in a certain ratio, and some move faster and others slower, and in their movement the slower strike a deep note and the faster a high one, and these notes, being proportionate to the distances, make the resultant sound harmonious; and since they said that number was the first principle of this harmony, they naturally made number the first principle of the heavens and of the universe. For they thought the sun to be, say, twice as far from the earth as the moon, Venus to be three times as far, Mercury four times, and each of the others to be in a certain ratio, and the movement of the heavens to be harmonious, and the bodies that move the greatest distance to move the fastest, those that move the least distance the slowest, and the intermediate bodies to move in proportion to the size of their

⁴²Reading *eipon*.

orbit. On the basis of these likenesses between things and numbers, they supposed existing things both to be composed of numbers and to be particular numbers.

Thinking numbers to be prior to nature as a whole as to natural things (for nothing could either exist or be known at all without number, while numbers could be known even apart from other things), they laid it down that the elements and first principles of numbers are the first principles of all things. These elements were, as has been said, the even and the odd, of which they thought the odd to be limited and the even unlimited; of numbers they thought the unit was the first principle, composed of both the even and the odd; for the unit was at the same time even-odd, which he used to prove from its power of generating both odd and even number: added to an even it generates an odd, added to an odd it generates an even.

As regards the agreements which they found between numbers and harmonious combinations on the one hand, and the attributes and parts of the heavens on the other, they took these for granted straight off, as being obvious, and showed that the heavens are composed of numbers and arranged in harmony. If any of the celestial phenomena seemed to fail to conform with the numerical principles, they made the necessary additions themselves and tried to fill the gap so as to make their whole treatment of the matter consistent. At least, treating the decad straight off as the perfect number, and seeing that in the visible world the moving spheres are nine in number—seven spheres of the planets, the eighth that of the fixed stars, the ninth the earth (for this, too, they thought, moves in a circle about the resting hearth of the universe, which according to them is fire)—they added, in their system, a counter-earth, which they supposed to move in an opposite direction to the earth, and to be for that reason invisible to those on earth.

Aristotle speaks of these matters both in the *De Caelo* and, with greater precision, in his *Beliefs of the Pythagoreans*.

F 204 R³ (*Simplicius, Commentarius in de Caelo 511.26-31*):

The Pythagoreans . . . do not say that the earth is about the centre, but that the centre of the universe is a fire, and that about the centre the counter-earth moves, being itself an earth but called a counter-earth because it is on the opposite side to our earth. ‘After the counter-earth came our earth, itself also moving about the centre, and after the earth the moon’: so he himself [sc. Aristotle] relates in his work *On the Pythagorean Doctrines*.

F 204 R³ (*Simplicius, Commentarius in de Caelo 512.12-13*):

For this reason, some call it [sc. fire] the tower of Zeus, as Aristotle himself related in his work *On the Pythagorean Doctrines* . . .

F 205 R³ (*Simplicius, Commentarius in de Caelo 392.16-32*):

How can he [sc. Aristotle] say that the Pythagoreans place us in the upper part and on the right side of the universe, and those opposite to us in the lower part and on the left side if, as he himself relates in the second book of his collection of Pythagorean doctrines, they say that one part of the whole universe is up and the other down, and that the lower part is right and the upper left, and that we are in the lower part? Is it that he has used the words ‘upper’ and ‘on the right’ here [sc. in the *de Caelo*] in accordance not with his own view but with that of the Pythagoreans? They coupled up and before with right, down and behind with left. But Alexander thinks that the statement in Aristotle’s collection of Pythagorean doctrines has been altered by someone and should run thus—‘the upper part of the universe is on the right, the lower part on the left, and we are in the upper part,’ not in the lower as the text now runs. In this way it will agree with what he says here, that we, who say we live in the lower part and therefore on the left side (since the lower part is coupled with the left side) are in opposition to the Pythagorean statement that we live in the upper part and on the right side. That the text has been altered is perhaps likely, since Aristotle knows that the Pythagoreans coupled the higher position with the right side and the lower with the left.

F 206 R³ (*Simplicius, Commentarius in de Caelo* 296.16-18):

In his epitome of Plato’s *Timaeus* he [sc. Aristotle] writes: ‘He says it [sc. the universe] is generated; for it is perceptible, and he is assuming that what is perceptible is generated and that what is intelligible is not generated.’

F 207 R³ (*Damascius, dubitationes et solutiones* 306):

Aristotle in his work on Archytas relates that Pythagoras too called matter ‘other’, as being in flux and always becoming other.

F 208 R³ (*Simplicius, Commentaria in de Caelo* 294.33-295.22):

A few words quoted from Aristotle’s *On Democritus* will reveal the line of thought of those men [sc. the Atomists]:—Democritus thinks the nature of the eternal entities consists of small substances infinite in number; he supposes a place for them, different from them and infinite in extent, and to this he applies the names ‘void’, ‘nothing’, and ‘the infinite’, while to each of the substances he applies the names ‘thing’, ‘solid’, and ‘existent’. He thinks the substances are so small as to escape our senses, but have all sorts of shapes and figures, and differences of size. From these, then,⁴³ as from elements, are generated and compounded visible and perceptible masses. The substances are at variance and move in the void because of their dissimilarity as well as the other aforesaid differences, and as they move they collide with each other and interlock in such a way that,

⁴³Reading *ede* for *edei*.

while they touch and get close to each other, yet a single substance is never in reality produced from them; for it would be very simple-minded to suppose that two or more things could ever become one. The cause of these substances remaining with one another for some time he ascribes to the bodies fitting into one another and catching hold of one another; for some of them are scalene, others hook-shaped, others concave, others convex, and others have countless other differences. He thinks that they cling to one another and remain together until some stronger necessity arriving from the environment scatters them apart and separates them. He ascribes the genesis and the separation opposed to it not only to animals but also to plants, and to worlds, and generally to all perceptible bodies.