Ronald Polansky
Aristotle's *Parva naturalia*

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Text, Translation, and Commentary

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For Ella, Ben, Noah, Elijah, and Jesse

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Acknowledgments

Aristotle clearly intends his short works in the *Parva naturalia* to form a united group. It seems appropriate to treat them together, since much that occurs in one inquiry also occupies others. Yet, commenting on them all has been infrequently attempted. You have the fortune or misfortune, then, of nine hundred pages, of which about three hundred are the Greek text and translation, with another six hundred pages my commentary covering the treatises. I hope that you will be enticed to read all these pages, but maybe that is a lot to expect. So, whether you seek some insight into a single passage or any one of these treatises or all of them, my wish is that you will find what you are looking for, or at least enough to inspire you to do better yourself.

The project was suggested by Jim Lennox, who recommended that I go on from the *De anima*. Along the way Hendrik Lorenz requested inclusion of Aristotle's text. My understanding of Aristotle has benefited from student reactions in courses and interactions with colleagues. I am very grateful to Christopher Kurfess for his reading, comments, and proposals on parts of the manuscript. I thank Klaus Corcilius and Andrea Falcon, along with the other participants, for the stimulating conference in Gargnano in May 2023. Thank you to Chelsea Harry and Giouli Korobili for encouraging continuation of the project. Aristotle wrote a set of powerful and carefully constructed treatises. The aim has been to be as helpful as possible in giving access to his thought. Perhaps treating all these works together will assist in doing justice to each of them and the entire collection.

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Abbreviations

Aristotle

DA	*De anima*
DC	*De caelo*
De insom.	*De insomniis*
De long.	*De longitudine*
DS	*De sensu*
De som.	*De somno*
EE	*Eudemian Ethics*
GA	*Generation of Animals*
GC	*On Generation and Corruption*
IA	*Incessu Animalium (Progression of Animals)*
Meta.	*Metaphysics*
Meteor.	*Meterorology*
NE	*Nicomachean Ethics*
PA	*Parts of Animals*
Phys.	*Physics*
PN	*Parva naturalia*
Pol.	*Politics*
Post. An.	*Posterior Analytics*
Pr. An.	*Prior Analytics*
Rhet.	*Rhetoric*

DK	Diels and Kranz
DL	Diogenes Laertius

Homer

Il.	*Iliad*
Od.	*Odyssey*

LSJ	Liddell-Scott-Jones

Plato

Apol.	*Apology of Socrates*
Soph.	*Sophist*
Tht.	*Theaetetus*
Tim.	*Timaeus*

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Introduction

A The unity of the *Parva naturalia* and its continuity with the *De anima*

Parva naturalia is a Latin name indicating short works on natural philosophical topics, traditionally taken to follow Aristotle's work on the soul, the *De anima*. The use of *Parva naturalia* as a title for this collection of treatises goes back at least to Giles of Rome, a student of Thomas Aquinas.[1] There is no corresponding Greek title for the collection, but this did not prevent Medieval and earlier commentators, while sometimes differing over precisely which works to include in it, from recognizing the basic unity of the collection. We also endorse the unity of the collection, and view it as comprising the treatises generally known by the following Latin titles:

De sensu et sensibilibus (*On Sense and Sensible Objects*),
De memoria et reminiscentia (*On Memory and Recollection*),
De somno et vigilia (*On Sleep and Waking*),
De insomniis (*On Dreams*),
De divinatione per somnum (*On Prophecy on account of Sleep*),
De motu animalium (*On Motion of Animals*),
De longitudine et brevitate vitae (*On Length and Shortness of Life*),
De juventute et senectute (*On Youth and Agedness*).[2]

It is debatable whether these titles go back to Aristotle himself, but they are convenient and serve to indicate the general themes of the various parts of the collection. Each of these works provides a complete scientific treatment of its announced topic or topics, and the entire series forms a coordinated whole. That certain of the treatises were planned to fit together is obvious, as shown by the programmatic opening of the *De sensu* and by transitional passages in some further treatises. Nevertheless, the overall design may hardly be apparent, for what

1 See Freudenthal 1869, 81 on this. For an overview of the reception of the *Parva naturalia*, see Bydén 2018.

2 Since the appearance of Bekker's edition, the *De motu animalium* is not generally included within the *Parva naturalia*, although the earlier tradition regularly included it, as Rashed 2004, 191-194 and Primavesi 2020, 98 contend. We defend the *De motu*'s forming an integral part of the collection as here situated. On the titles of the treatises, consult Morel 2003.

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unites consideration of such topics as sense, memory, sleep, dreams, prophecy, animal motion, life length, and respiration?[3]

Grasping the unity in these writings requires attention to the wider project beginning with the *De anima*. Explicit references to the *De anima* appear often in the *Parva naturalia*, e.g., 436a1-6, b6-10, b14-15, 439a8, a16, 440b28, 449b30-31, 454a11-15, 455a8-9, a12-27, 459a15, 700b4-6, 704a3-b1, 467b13-18, 474b10-12. There also appear many less explicit references to it, e.g., 437a18-19, 438b2-3, 450a22-23, a25-32, 454a7-11, 458a33-b3, b10-15, b28-33, 468b2-4, b13-14, 469b3-6, b14-16, 470a19-20, 472a1-10, 474a25-b2, 477a17, 478a28-30.

Indeed, references go the other way as well, from the *De anima* forward to the *Parva naturalia*. Near the *De anima*'s beginning, Aristotle states, "We seek to consider and to cognize the soul's nature and being, then however many things are attributed to it, some of which seem to be affections proper to the soul, while others, on account of that, to belong in fact to living beings" (*DA* i 1.402a7-10). This says that what we seek is what the soul is, and its attributes, both those proper to it and those that living beings have from being ensouled. The attributes proper to the soul may be its parts: nutritive, perceptive, and intellective parts, or the operations and affections attributed to the soul on account of its parts. The soul's nature, principal parts, and leading affections are then studied in the *De anima*. Yet, what living things possess on account of the soul, to judge from 402b9-403a28, includes what is treated within the *Parva naturalia*, i.e., what is common to body and soul, for most of what living beings do they do in common with the body. Thus, the series encompassing the *De anima* and *Parva naturalia* is projected from the *De* anima's start. The *Parva naturalia* considers what follows from the accounts in the *De anima*, supporting and supplementing what is established there.[4]

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3 That Aristotle's treatises are often supposed lecture notes may encourage taking them to lack careful design. Yet they seem too complicated for oral delivery, and too fully constructed for mere notes. Viewing them instead as materials circulated to be read and discussed is more plausible. Probably they were primarily for use within his school, while still suitable for and intended for wider circulation, and they were surely in some circulation outside Aristotle's school.

4 The rest of the natural treatises about mortal living beings, e.g., *HA*, *PA*, *GA*, *IA* also clearly relate to the *DA*, with other focus than the *PN*, at least as we expose this focus in the *PN*. These other "biological works" may follow from the *PN* as well as the *DA*, or possibly some may precede them: Stephen Menn suggests the investigative and pedagogical order *PA* and *IA*, then *DA* and *PN*, though with the *GA* between the *De motu* and *De long*. Menn's ordering of preceding treatises little interferes with our account of the arrangement, though we shall later argue against placing the *Generation of Animals* after the *De motu*. The structure of the *DA* and *PN* can be complete while still being part of a larger construction. That an author could write so many works with so much detail on different topics and yet have the overall project quite so well-conceived and

Explicit reference in the *De anima* to treatises in the *Parva naturalia* comes in *De anima* iii 9.432b7-14:

> And to be sure indeed concerning what now the discussion is on, what is it that moves the living being according to place? For the motion of growth and decay, belonging to all, that which is belonging to all, the reproductive and nutritive, would seem the moving [cause]; concerning inhalation and exhalation, and sleep and waking, later one ought to consider; for these indeed have much perplexity. But concerning motion according to place, what is moving the animal with progressive motion, one ought to consider.

This clearly refers to the *De juventute* on respiration and the *De somno* on sleep and waking. While *De anima* iii 9-11 treats the soul as causing animal progressive motion, the passage 432b7-14 acknowledges that even the living being's motion of growth and inhalation and exhalation involve some motion in place, though not progressive locomotion.[5] The wider reflection on motion of living beings will be in the *De motu* in *Parva naturalia*, as announced in *De anima* iii 10.433b18-21, "the thing moved is the animal; the instrument by which desire moves it, this already is bodily—hence in the things common to body and soul one ought to consider concerning it".[6] Such passages anticipate further treatment in the *Parva naturalia*, and hence foreseen connections of the *De anima* with the *Parva naturalia*.

The *De anima* has soul as the nature and form of mortal living beings—plants and animals—governing their activities so long as these live. Aristotle announces that his predecessors identify two phenomena distinguishing ensouled beings:

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realized may be hard to accept. Burnyeat 2001, 113 suggests, however, that all Aristotle's writings are contemporaneous because, being unpublished, he could revise them. Or perhaps he is just an amazingly comprehensive and orderly thinker?

5 *DA* ii 2.413a22-31 already indicates that growth in plants and animals involves some place change.

6 The *PN* deals with things "common to body and soul" (see *DS* 1.436a6-12). Eijk 2005, 207 says, "[P]sychology, in Aristotle's view, amounts to psycho-physiology, an analysis of both the formal and the material (i.e. bodily aspects) of psychic functions. The fact that in *On the Soul* itself we hear relatively little of these bodily aspects might then be explained as a result of a deliberate distribution and arrangement of information over *On the Soul* and the *Parva naturalia*, which should be seen as complementary parts of a continuous psycho-physiological account which is in its turn complementary to the zoological works." Cf. Corcilius and Gregoric 2013, 57 on the *De anima*: "Explanations of digestive processes, episodes of perception or occurrences of thoughts, we believe, is *not* on the agenda. The agenda is, rather, to give an account of the formal principle of living beings which is going to be as general as possible and as specific as necessary, in order to be both applicable to all kinds of living beings and genuinely informative…we hear little about the material structures and bodily organization an animal must have in order to possess a soul with the perceptual part, and still less about perceptual motions that take place inside the body."

motion (*kinêsis*) and perceiving (*aisthanesthai*, *DA* i 2.403b24-27). "Perceiving" here broadly means being aware or cognizing, while "motion" means the self-motion characteristic of living beings.[7] Throughout the *De anima* he returns repeatedly to these two criteria of being ensouled: 403b24-31, 404b7-11, b27-30, 405b11-12, 409b19-28, 410b16-18, 411a24-b3, b19-22, 413a20-31, 413b11-24, 414a29-b19, 415a1-11, 415b21-28, 416b32-35, 427a17-b8, 432a15-22, 434a22-b2, and 435b13-19. The full exploration of perception and motion occupies *both* the *De anima* and the *Parva naturalia*. We show this by displaying these treatises' general order.[8]

Following his announcement of the predecessors' criteria for being ensouled and his criticism of the ways they employ soul to explain motion and perception (*DA* i 2-5), Aristotle works out his own general account of soul (*DA* ii 1-3). Then the *De anima* treats the soul's principal powers in this order: nutritive (*DA* ii 4), sense-perceptive (ii 5-iii 2), intellective (iii 4-8), and locomotive powers (iii 9-11).[9]

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7 *Aisthêsis* can be broadly used by Presocratics, Plato, and Aristotle (see Frede 1987, 3-5). Frede indicates that perception is first narrowed to sense perception in Plato's *Theaetetus*. So, Aristotle can mean any sort of awareness, including sense perceiving or thinking. *Kinêsis* pertinent to living beings should be self-motion, rather than either compelled motion or the merely straight up or down natural motion of elemental bodies. The locomotion of animals and the growth and other nutritive operations of both animals and plants are self-motion and in various directions. Even the perception of animals is self-motion, for it is "motion of a sort" (see *DA* ii 5.416b33-35 and iii 4.429a13-15). The predecessors discussed in *DA* i tend to explain mortal living beings' motion by the soul itself being in motion; the *DA* and *PN* consistently resist any motion of the soul itself, except accidentally along with the body in motion.

8 Bydén 2018, 10 misleadingly states, "it must be conceded that Aristotle's treatment of the attributes of the soul [in the *Parva naturalia*] is not particularly systematic" (cf. the complaint in Leroi 2014, 118). Yet, Eijk 2017, 183-184 aptly states: "What is particularly striking is Aristotle's use of arrangement... The order in which Aristotle presents his arguments, the way in which he revisits and refines them, and even the order of these refinements themselves, is by no means arbitrary but displays a keen sense of didactic and rhetorical skill... Aristotle's works often display a careful structure, possibly motivated by pedagogic and/or rhetorical considerations, in which arguments and ideas gradually unfold in the course of a thought process that the audience is meant to go through. ...This more positive evaluation of Aristotle's writing style, in particular the dynamic, progressive structure of his argument, ...makes it easier and more natural to apply to our reading of Aristotle one of the key principles of textual interpretation. This is the assumption—which can be seen as a variant of the well-known principle of charity—that the author is in control of his or her material, both intellectually and in terms of its formal and literary organization and presentation, and that any difficulties in the explanation of the text are, at least in the first instance, the interpreter's problem, not the author's."

9 Corcilius and Gregoric 2010, 103-105 argues that these four are the soul's principal *powers* or *capacities*, "the soul is naturally divided into these four capacities...distributed among living beings by way of ordered series. This distribution, Aristotle maintains, sorts out the main genera of living beings, which allow Aristotle to assume...that providing successive accounts of the four

This progression through the powers is from the most basic and widely shared, nutritive capacity, to the least widely shared capacity, intellection, except that the locomotive power comes last, since both perception and intellection, at least for humans, can enter the locomotive power's operation, and it is therefore not truly one part of the soul. Thus, the *De anima* already begins considering the soul as principle of perceptive awareness and self-motion.

Aristotle's starting with the most widely shared nutritive power and giving priority to actuality over potentiality offers readier access to a principal soul power (see *DA* ii 4.415a14-22), and he proceeds methodically from what is initially more intelligible to us towards what is more intelligible by nature, intelligence ultimately being most intelligible to itself. Advancing toward the higher capacity, he can consider the ways it functions analogously or not to the lower power. Now each of the main powers of soul has a primary object, e.g., the nutritive power works on food and the sensitive power is acted on by sensible objects.[10] The intellective power relates to intelligible objects, especially simple essences; the locomotive power aims at an object of desire. Each power is a potentiality for an operation or several operations relating to its object, which permits causal analysis of the power. Beginning with the object of the power locates what occasions the soul power's operation with respect to the object, giving access to the *moving cause*. The operation has some aim and end and is for the sake of something, which is the *final cause*. The power itself is the potentiality for this operation, the power being the *formal cause*. The powers besides mind have some bodily organ or instrument by means of which the power operates, e.g., warmth for nutrition and sense organs for sense perception including the heart as ultimate organ, which bodily instrument links with the *material cause*. Thus, four causes for each

capacities amounts to a satisfactory account of the soul, an account which is explanatory of the souls that actually exist in the world, namely the souls of plants, animals (sessile and mobile), and humans" (105). Yet, among these *powers* only three are *parts* of soul, for the nutritive, perceptive, and intellective powers are also strict *parts* of soul. Corcilius and Gregoric argue that a part should not be defined in terms of any further parts, which disqualifies the locomotive power, which must be defined in terms of the perceptive and intellective parts.

10 The 'Divided Line' in Plato's *Rep*. vi, e.g., considers analogies of cognitive powers and their objects and is a precedent for Aristotle's approach. Coates and Lennox 2020 argues for the ensouled body as the object of the nutritive power, rather than food. Yet, since Aristotle states that soul, esp. nutritive soul, is the cause of the ensouled body, with the body as its instrument (415b8-27), ensouled body as object of nutrition would not be much like the objects of perception and intellection, for which the object is proper to the power and prior to it and mover of it. Food thus seems more analogous to the cognitive object. Yet, for our point about his approach, it matters little whether food or the living being is the object of nutrition.

of the main soul powers, from nutritive to locomotive, emerge from the analogous treatments, based on the primary object and how the soul power relates to it.

The *De anima*'s order is clearly upwards from the nutritive, to the perceptive, and to the intellective part, with the locomotive power coming laterally after the cognitive powers as relating to both. The *Parva naturalia* treatises go in the opposite direction: from perception, to self-motion, to nutrition, with self-motion embracing both perception and nutrition. The *De sensu*, *De memoria*, *De somno*, *De insomniis*, and *De divinatione* cover sense perception and the awareness powers deriving generally from sense perception. The *Parva naturalia* focuses on perception and what follows from it, rather than intellection, since the *De anima* completes the treatment of mind, having covered what mind is, its operation, and its primary object, simple intelligible essences. Not depending on a bodily organ, mind needs little further clarification in the *Parva naturalia*, which investigates what is "common to soul and body".[11] Intellection as what is most naturally intelligible for us is fully illuminated in the *De anima*, but perception common to body and soul, which contributes to intellection and is natural to all animals, stands in need of further inquiry, as do the powers of self-motion and nutrition.[12] The *Parva naturalia*'s path is, then, from sense perception to its

11 For Aristotle, human thinking can think all things, though simple essences that are the primary intelligible objects. Such thinking requires having gained dispositional knowledge, i.e., universals in the soul, to serve as moving and formal causes for thinking. Putting the dispositional universal knowledge into activity for episodes of thinking involves initiation by *phantasia*, as analogously desire is dispositional and needs the occasion provided by a *phantasma* to get the desire operative (see Polansky 2007, 462-465; cf. Steel 2018 on *phantasmata* and thought). Bartoš 2012, 205-210 and 215-218 argues that rational soul is not truly a subject matter for natural science since what belongs strictly to natural science develops naturally, without an external agent, while mind develops through education (see *GA* ii 3.736b27-29). Yet, the *De anima* must discuss mind as a power and part of soul, though the *PN*, by dealing with what involves soul and body, sticks more tightly to what belongs within natural science.

12 There is yet a further reason to begin with sense perception and then what follows from it, which explains the downward direction of the treatises of the *Parva naturalia* as coordinated with the upward direction of the *De anima*. The *DA* utilizes analysis of the basic capacity of nutrition, with its readily apparent causal factors—object, operation, faculty, bodily organ/instrument—as framework for clarifying by analogy the more complicated, if ultimately more intelligible, powers. In contrast, the *PN*, dealing with sense, memory, sleep, dreams, self-motion, respiration, some of these lacking any definite object and difficult of access, focuses especially on *human* involvement with these, for best access. Aristotle traces human experience of the more obscure powers to gain causal accounts that can apply to the beasts. Explicating the cognitive faculties readies for taking up motion in the *De motu*, which similarly covers human motion. This gives access to the motion of other animals, and remarkably, it also prepares for understanding

consequences, getting down to the lowest level cognition, dreamy awareness in sleep. Following these "perception" treatises is the *De motu* on the common cause of motion, the soul, before concluding the series at the level of nutrition, the *De longitudine* and *De juventute* being about the maintenance of life, and so clearly about nutritive functioning.[13] If, as will be seen, the *De motu* investigates self-motion generally as applicable to animals and plants, then it properly fits between the treatises on cognition and those on nutritive functioning, for both perception and nutrition are kinds of self-motion. Thereby, we will have justified our claim that both the *De anima* and *Parva naturalia* are about soul as cause of self-motion and perception.[14]

If the *De anima* goes primarily upwards, from nutrition up to intellection and locomotion, with the *Parva naturalia* correspondingly traveling largely downwards, from perception down to dreaming, to self-motion, to nutrition, we may then recognize that the *De anima* and the *Parva naturalia* form a grand *ring composition*. What could give greater evidence of careful authorial contrivance and design than such a massive ring?[15] In working out this overall ring, Aristotle

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plant self-motion. Plants alter and grow, the soul surely causing this self-motion. Thus, the upward direction of the *De anima* is methodologically crucial for his causal analysis, and the downward direction of the *Parva naturalia* is methodologically justified for gaining access to what is less intelligible for us.

13 The *De motu*'s dealing with voluntary animal motion makes the treatise seem merely a lateral shift from treatises on perception, as treating locomotion after perception and intellection seemed a lateral sequencing in the *De anima*. Yet, since the *De motu* deals too with not-voluntary self-motion that can apply to plants, the *De motu* also must go downwards from the previous treatises on perception.

14 The traditional place of the *De motu* within the *PN* after *De div*. is increasingly accepted, e.g., Nussbaum 1985, 3-12, Rashed 2004, Rapp and Primavesi edd. 2020, and Bolotin 2021.

15 Douglas 2007 supports an author's very careful contrivance in composition of a ring. Douglas says, "The minimum criterion for a ring composition is for the ending to join up with the beginning..." (1-2) and "the simple chiastic pattern...is AB C BA" (6) and "A well-crafted composition is its own authentication" (27-28) and "A major ring is a triumph of chiastic ordering... The other prime test of a well-turned ring is the loading of meaning in the center and the connection made between the center and the beginning; in other words, the center of a polished ring integrates the whole". With its arrangement, the *DA* surrounds the "perception" powers, sense perception and intellection, with the "motion" powers, nutrition and locomotion, while the *PN* treats perception prior to self-motion and nutrition. Another way to see the basic ring structure of these treatises is that the *DA* covers:

(A) Nutritive self-motion,

(B) Perceptive self-motion, including sensation, thinking, and progressive motion.

The *PN* treats:

(B*) Perceptive self-motion,

(A*) Nutritive self-motion.

strategically devotes the *De anima* to the main powers of the soul, with only limited attention to body, while the *Parva naturalia* concentrates on the soul's working in common with the body. The *Parva naturalia* then offers additional accounts of the causes of perception and motion, and it shows in more detail the difficulties and impossibility of the predecessors' accounts. Returning to what initiated Aristotle's whole investigation of soul in the *De anima*, the *Parva naturalia* confirms his account of soul and what is said of its principal powers. The ring composition is more than merely the up and down direction of the treatments of the soul powers, but the completion of the entire project set out in the *De anima* regarding the soul's principal powers and its whole approach, i.e., the determination of what is most characteristic of the ensouled, and how motion and perception that distinguish ensouled mortal living beings are causally explained. Further indicative of the careful connection of body and soul and perception and motion in the *Parva naturalia* is having its treatises manage to argue that the soul's principal powers other than mind, i.e., the perceptive, locomotive, and nutritive power, come unified and centralized in the heart or some analogous part in animals, with the nutritive analogously centered in plants, though more loosely (cf. *PA* ii 1.647a24-33).[16]

We have yet to mention that along with the principal powers of soul, the *De anima* also investigates *phantasia*, which is not on the level of the nutritive, perceptive, intellective, and locomotive powers. *Phantasia* is a presentational rather than a critical and discriminative capacity, as are perception and intellection, for in operation it presents a *phantasma* deriving from sense perceiving. Since

16 To reinforce the overall ring of the *De anima* and the *Parva naturalia*, we point out within the *Parva naturalia* smaller rings. Aristotle early on discusses the extinguishing of fire with reference to vision (*DS* 437b14-23), and at the end he reconsiders how life ends when its needed fire is extinguished (*De juv*. 479a32-b7), thus refining the Heraclitean and Democritean emphases upon fire as key to life. Aristotle also mentions medicine at the beginning (*DS* 436a17-b1) and at the very end (*De juv*. 480b21-30). And we shall find rings in individual treatises. Regarding Aristotle's further care in structural design, we find that adding the six Bekker pages of the *De motu* (698-704) to the seventy-eight combined pages for the *De anima* and *Parva naturalia* (402-480) makes the division of the *De anima* and the *Parva naturalia* a "golden section". And the very middle of all these treatises is about *DS* 444b, discussing the two sorts of odors of the middle sense of smell, between distance and contact senses, available to humans through respiration, which pulls together much of the composition, only humans smelling odors pleasant in virtue of themselves. If we just consider the *PN*, the center is about *De div*. 464a-b, on the interpretation of extravagant dreams. We very much agree with Eijk 2005, 31 that "however impersonal the tone of his [Aristotle's] works may be and however careless the structure of his argument may appear, his writings nonetheless contain a hidden but undeniable rhetoric aimed at making the reader agree with his conclusions" (cf. Wians and Polansky edd. 2017 introduction).

perceiving activity gives rise to *phantasia*, not all perception and cognition *appears* (*phainetai*) or is *appearance* (*phainomenon*), as it is for Democritus (see 404a27-31). *Phantasia* must nevertheless receive its major treatment in *De anima* iii 3 for at least three key reasons, which accord with what we have said regarding ordering the series of treatises: (a) Since *phantasia* comes from perceiving in activity, and *phantasia* is what initiates thinking, in thus standing between perceiving and thinking, *phantasia* distinguishes and separates sense perception and intellection.[17] (b) While *phantasia* can develop from perceiving proper sensible objects—color, sound, odor, flavor, tangibles—it enters the perception of most common sensible objects. For instance, to perceive locomotion the animal projects and expects where the object will be going, which likely involves *phantasia*. And *phantasia* enters perception of shape, size, distance, speed, time, and even number.[18] As crucial for common perception, which is the sort of perception most vulnerable to error, Aristotle has *phantasia* to account for error. And this account of error helps distinguish perception from thought, since perception of proper sensible objects is *true*, whereas thinking can be true or false (see *DA* iii 3.427a17-b17; on error, see 428b18-25 and 442b4-10). (c) In addition, *phantasia* enters memory, desire, inquiry, deliberation, and locomotion. Consequently, the *De anima* must treat *phantasia* in preparation for its prominence in the *Parva naturalia* in accounting for memory, recollection, time sense, dreaming, desire, and animal motion. Thus, inquiry into *phantasia* belongs in the *De anima*, while preparing for vital employment in the *Parva naturalia*.

The *Parva naturalia* treatises, then, fit tightly together and closely with the project of the *De anima*. The whole series is a ring composition explicating the main powers of the soul in the *De anima* and continuing in the *Parva naturalia* with what needs additional explication and what applies generally to mortal

17 *Phantasia* can be used both for the power of presentation and the presentations (*phantasmata* or *phantasiai*) of this power. It initiates intellection both by enabling memory that leads to our apprehending universal notions, and by its presentations activating universals for thinking. Universal notions occupy the soul of the learner (see *DA* ii 5.417a21-b28), and they remain there dispositionally (as first level actuality), but to provoke thinking (second level actuality) by their means, some *phantasma* must put thinking into activity. While we can think of the universal as universal, by its means we primarily think of things in their essence, for these are the truest objects of thought (see *DA* iii 4.429b18-430a5 and iii 6). Having intellection initiated by *phantasia* prevents needing, e.g., to perceive a lion to think a lion; the *phantasma* presentation in our soul can lead to thinking the lion.

18 For some evidence of Aristotle's awareness of this role of *phantasia* in perceiving common sensible objects and what is closely connected with these, such as distance, speed, and time, see *DA* iii 3.428b2-30, *DS* 6.446b10-17, *De mem*. 2.452b7-22, and *De som*. 2.460b18-27.

living beings when the relation of the soul with the body is more fully considered. Aristotle scientifically treats the ways soul and body as he understands them account for "motion" and "perception" of ensouled beings to counter his predecessors' approaches.

B Compositional techniques

To enhance our case for the careful composition of the treatises—methodological and literary—we note their frequent use of a remarkable feature, beyond the ring arrangement, which aims to draw the reader into direct confrontation with the topic at issue, thus provoking learning by "recollection". Aristotle often manages to make his discussions an instance of the very topic under discussion, humans often being the most obvious exemplars of what he considers so that access to the subject matter entails enhanced self-understanding. He thereby enlists a Platonic technique of having the dramatic action of the dialogue parallel and mirror what the interlocutors discuss.[19] For example, Plato's *Apology of Socrates* has Socrates claim that unfamiliarity with the courtroom makes him speak in just the way that gets him into trouble, so if those in the court, and perhaps the reader, become annoyed by his kind of cross-examining, and Plato has Socrates several times ask the court not to make outbursts, the rhetorical strategy of the defense confronts the court and readers with the very life in question and its usual refutative activity, so that they can judge it for themselves. In Plato's *Meno*, the slave's coming to "recollect" how to double the square displays by its actuality the very possibility and potentiality of learning that Meno has denied, and it also mirrors for Meno the good cooperation that might lead to genuine learning, in contrast to his own self-satisfied uncooperativeness. Plato's *Gorgias* depicts Socrates unfairly refuting Polus to establish that it is better to suffer than to do injustice. If we disapprove of Socrates' unfair argumentation, however, we ironically confirm his defense of the superiority of suffering to doing injustice, and his holding out for Polus this better situation in the interchange. Such wonderful reflexivity, unifying word and deed by their mirroring each other, enhances the directness and comprehensiveness of treatment. This careful contrivance should have the

19 Myles Burnyeat in his introduction to Williams 2006, xii states, "Bernard [Williams] regarded Plato as the greatest philosopher of all time. His admiration and, I would like to say, love come through on every page of *Plato: The Invention of Philosophy*... For Aristotle, by contrast, whose philosophy has reached us solely in the form of treatises (because his published dialogues, much admired in antiquity, are lost), he professed dislike." Burnyeat thus affirms Williams's distaste for Aristotle based on a writing style differing greatly from Plato's. We challenge this quite questionable reading of Aristotle.

interlocutor and reader learning by direct involvement with the very being itself at issue.[20]

We shall frequently point out Aristotle's employment of this extraordinary pedagogical technique within the *Parva naturalia*. For example, he early on surprisingly elevates hearing to the supreme position among the senses, for its contribution to intelligence, as we readers or listeners "hear" this very argumentation. In his treatment of memory and recollection, he repeatedly inserts "as has been said before", in order to have the reader engage in remembering or recalling, when this is just what is being investigated; the treatise's final word is "has been said" (εἴρηται, 453b11). Prefacing the inquiry into sleep, he also speaks of dreams and prophecy by them as coming attractions, as if by this announcement, he alerts us to be very awake as he deals with sleep and dreaming, and he tantalizes us with the possibility of interpreting our dreams as windows to the future. This gives merely some hint of what we shall find Aristotle contriving for his readers.

Other rhetorical features of Aristotle's compositions are employing examples to illuminate his points and facilitate generalization, along with enthymematic arguments, the former a kind of induction and the latter a kind of syllogism, as involved in gaining knowledge (see *Post. An.* i 1.71a9-11 and *Rhet.* ii 20.1393a23-25). He sometimes utilizes the first-person plural, e.g., "we say", either to emphasize his own expertise in contrast with others or to include others, such as his

20 Plato's entire *Theaetetus* dialogue illustrates this mirroring of word and deed, such that Polansky 1992 claims the "definitive interpretation of the work", which Myles Burnyeat and Bernard Williams intended to write, but "Somehow, this never came about" (see Williams 2006, xxi). The *Theaetetus* seeks knowledge of knowledge with four attempted accounts of knowledge: the various arts and sciences, perception, true opinion, and true opinion with an account. Then the dialogue at its end offers four accounts of account, which Polansky argues parallel the four accounts of knowledge in one-to-one relationship. Since the four accounts of knowledge are *all* knowledge's likely accounts, the dialogue thus deals comprehensively and self-reflectively with knowledge, by its final review of all the accounts, thus perhaps overcoming the key problem for knowledge, getting beyond mere opinion. Self-reflectively reviewing of all knowledge's likely accounts goes beyond simply adding another opinion as justification to a true opinion, by instead reflectively "squaring" true opinion to achieve commensurability with knowledge. Theaetetus' dealing with "powers" prefigures what is needed, for it shows that "squaring" makes the sides of squares of oblong-integer area, e.g., 2, 3, 5, 6, 7, 8, 10..., commensurable with the sides of square-number (n^2) area squares, e.g., 1, 4, 9, 16... The two kinds of sides represent respectively true opinion and knowledge, which become commensurable in the soul that squares them by thinking self-reflectively about them. The entire dialogue therefore offers human knowledge of knowledge, by depicting this comprehensive and self-reflective "squaring" that raises true opinion to knowledge, at least so far as humans can. Perhaps "cubing" would get even more fully to the ultimate dimension of depth.

readers, along with him in the inquiry. He also summarizes, reviews, and refers to other of his texts as ways to get readers to recall what should already be familiar to them to prepare them to work out along with Aristotle and so to progress to what is more knowable by nature (see *Post. An.* i 2.71b33-72a5).[21]

Our display of Aristotle's careful arrangement of the *De anima* and *Parva naturalia* in dealing with perception and motion for the ensouled, their ring compositional ordering, and his employing mirroring of word and deed, inviting the reader's close involvement in the discussion, demonstrates the *Parva naturalia*'s extremely meticulous literary and pedagogical construction, its intended unity, and its constant attention to its own scientific approach to inquiry.[22]

C Manners of treatment

The *Parva naturalia* completes the *De anima* by its reversal of direction, and it does so to an extent by imitating that work's procedure for analysis of the powers. The *De anima* uses the peculiar object of each power of soul to determine the operation of the faculty in relation to its object, with the power the potentiality for this operation. In this way, he goes from actuality to potentiality, from object to operation to power, and this discloses what the power is (formal cause), what the end is, the operation of the power in relation to its object (final cause), the object in connection with soul is the moving cause, and the living body and pertinent bodily organs are substratum and material cause. Thus, his investigation

21 Korobili 2022, ch. 11 discusses these compositional techniques of Aristotle, and she suggests that these techniques steer the reader to undergo a learning process much as a researcher might, "the investigative procedure that a researcher follows when looking for ways to explain things turns out to be parallel to the educational procedure of his student in his attempt to understand his teacher's manner of thinking" (208). For additional discussion of Aristotle's style of writing, see Eijk 2017 and Asper 2013, 2016, and 2019.

22 The ordering within the *Parva naturalia* is based on the introduction to the collection in the *De sensu*, as well as opening and closing remarks in subsequent treatises. Apart from the inclusion of the *De motu*, this order has been commonly accepted. Nonetheless, questions about the collection's unity were raised by twentieth-century notions about Aristotle's development (see Ross 1955, 1-18, and Wiesner 1978, 242 claims, "It may be regarded as fairly certain that the opening treatises of the *Parva naturalia* belong to a different period from the final sections, since scholars who hold quite divergent views about Aristotle's production in general are unanimous on this"). Such efforts to arrange the treatises chronologically propose that Aristotle was more physiologically based in an earlier period, but more psychologically based subsequently. We reject all such chronological interpretation, for we substitute scientific and pedagogical concerns to explain the arrangement.

eventuates in the four causes pertinent to natural science. This pattern of treatment can extend into the *Parva naturalia* when the investigated power has a clear object and operation, such as for memory. But where there is no such object or operation, such as with sleep or death, there must be a modified approach.[23]

For all of the topics treated in the *Parva naturalia*, whether there is an object or not, causes are sought in accord with the demands of science. Aristotle soon introduces a *tripartite* analysis that can apply to any feature or power of a living being. This tripartite scheme aims to ascertain what the feature or capacity is, to what part or parts it belongs ("part or parts" in the soul or body or composite being), and on account of what it belongs. This means that the approach should disclose: the definition of what is investigated, what is its substratum, and what gives rise to it as its moving cause and/or its final cause. We can see this in the passage that introduces the tripartite approach:

> Concerning memory and remembering one ought to say what it is (τί ἐστι), on account of what cause it arises (διὰ τίν' αἰτίαν γίγνεται), and to which of the parts of the soul this affection happens (τίνι τῶν τῆς ψυχῆς μορίων συμβαίνει τοῦτο τὸ πάθος), and also recollecting.[24] (*De mem*. 449b4-6; cf. *De somno* 453b11-17 and *De insom*. 458a33-b3)

The tripartite scheme can involve all four of the causes, for "on account of what it arises" covers both final and moving causes. When Aristotle deals with a definite power of the soul with an object and operation, such as memory, this tripartite scheme ties in directly with the four causes, since there will clearly be a final cause for the power. But even when he deals with what lacks a clear object, as in

23 Treatment of *phantasia* in *DA* iii 3 also confronted the difficulty that there is not such an obvious special object. Whereas for perception (*aisthêsis*), there is both *aisthêton* and *aisthêma*, for *phantasia* there is a power, the *phantastikon*, but is there also the *phantaston*, or only the *phantasma*?

24 We suggest that Aristotle introduces the tripartite scheme with memory and recollection because, even though memory has a definite object, recollection does not. In this way he prepares to apply this scheme in subsequent treatises. Corcilius and Gregoric 2010, as noted, argues that a soul part can differ from a soul power or capacity, every part being a power but not every power a part. Parts are what are separable in definition, so memory is a capacity of soul but not a part since it depends upon the perceptive part. Recollection depends upon both the perceptive and intellective parts. Of the four main powers of soul, the locomotive power is not a part as depending on the perceptive and/or intellective parts. But the nutritive, perceptive, and intellective powers of soul are truly definitionally separable *parts* (see also Gregoric 2018, 92n1). Aristotle's terms for "part" are μόριον and μέρος. *Morion* seems used for part as a definite form, whereas *meros* seems a less clear and determinate portion (cf. Plato's *Statesman* 261e8-262c1 and the distinction of cutting at the form or making less distinct cuts, though Aristotle seems to reverse Plato's usage of the terms).

the case of sleep or death, these being conditions or possibilities for the living being, he can still determine what sleep or death is, to what it pertains, i.e., body, soul, or composite, and what gives rise to it, both as moving cause and also as final cause.[25] The tripartite scheme applies whether there is or is not an object for an operation or condition, and it ties to the four sorts of causes.

The securing of causes should be constantly attentive to relevant phenomena. The *De anima* often appeals to such possible observations as dividing plants and animals to determine their kinds of unity, or the placing of sensible objects right upon the sense organ to show the role for sense media in sense perception. This effort to motivate and justify his conclusions continues with even more emphasis in the *Parva naturalia*. There will be discussions of divisions of living organisms, observations regarding looking at and then turning from bright objects, the effects of wine drinking, much evidence from dissections, and so forth. Of course, this ancient observation will tend either to be centered on humans or surely on what is observable by humans. Since his predecessors also made observations and offered accounts of many of the matters that Aristotle treats, some of his investigation must be utilizing and criticizing predecessors' accounts.[26] As the *De anima* begins with an extended treatment of predecessors and returns to their views repeatedly, the *Parva naturalia* is often examining what leading theorists have proposed. The criticism of predecessors regarding sense perception occupies the *Parva naturalia*'s opening treatise, *De sensu*, and the final treatise,

25 When Aristotle adds a fourth question to his tripartite scheme, e.g., regarding recollection, sleep, gills, and respiration he asks how widely these extend among the beings, this question about extension helps with the tripartite analysis, which confirms the comprehensiveness of the tripartite scheme. Also, the question about extension recognizes the phenomenon's extension beyond humans. Though he criticizes his predecessors' exclusive focus on human soul (see *DA* i 1.402b3-5), in his careful methodology he may devote special attention to the most complex human case, and most intelligible case to us, to cover the simpler cases.

26 Lennox 2021, 3 states that Aristotle's inquiries "often begin by reviewing previous research on the subject and the puzzles that emerge from subjecting that previous research to critical scrutiny. Aristotle's own considered answers are typically only presented late in the narrative, and are often presented in preliminary ways first—after which he will often declare that it is time for a fresh start! I suspect that this mode of presentation is pedagogical in intent—but the primary focus is not on teaching scientific *content*, but on providing object lessons in *the methods and norms appropriate to scientific inquiries*. And…the lessons will vary from one domain of investigation to the next." We largely agree, while holding that Aristotle seeks comprehensive understanding, and so must be concerned with manner of inquiry to establish the content as demonstrably as the content permits. Does Aristotle employ experimentation? If we mean observation of phenomena, then he surely does. If we mean testing whether he gets bodily motions in close accord some mathematical calculations, then this sort of experiment is much less evident.

De juventute, has a strikingly lengthy consideration of and criticism of predecessors regarding the function of gills and respiration. When there is much treatment of predecessors, this suggests that causal understanding is difficult, and it requires scrupulous marshalling of evidence.[27] Thus, the sequence from *De anima* through the *Parva naturalia* opens and ends with the most thorough reflection upon what can and cannot be taken over from the predecessors.

Sometimes Aristotle's criticism of his predecessors and defense of his own principles and understanding of phenomena involve many lines of argument and much observation. When many arguments and observations must be employed, one suspects that none is fully demonstrative. Accordingly, he often suggests that a defended view is reasonable (*eulogos*, e.g., 439b32, 452b8, 463a6). This is his admission that he does not have conclusive arguments and evidence for the view, though it fits with various plausible assumptions and data and coheres with the rest of his accounts. In this way he attempts to be as reflective, consistent, and comprehensive as he can with the causal explanations he introduces, while also acknowledging the level of evidence available. Whereas in practical science only limited precision is possible, and many or most of the arguments can be no more than reasonable due to the tremendous variety of circumstances, even in theoretical science some of the argumentation can only seek to be reasonable, since our human access through observation confronts limits on our ability to arrive with assurance at the only possible causes. Nonetheless, the continuing reflection upon the empirical evidence and cogency of the reasoning aspires to comprehensive scientific understanding. Aristotle will embrace what others have reasonably said, and he attempts to do better where they have spoken less convincingly.

While seeking causes by dealing with observations and with predecessors, Aristotle arranges for his auditors or readers to follow his presentation. We should hardly assume, then, that his own route toward discovering principles is just the route that these treatises devise for pedagogical purposes. He definitely aims for comprehensive understanding based on principles and causes, but by an order that can best display and support his position.

27 Lennox 2021 aims to show how Aristotle's process of scientific inquiry regarding gills and respiration in *De juv*. accords with *Posterior Analytics* ii (see p. 268). Lennox says, "Aristotle is not satisfied with *imagining* or *supposing* that fish accomplish this [cooling of the heart region] by mean of gills—he makes his case based on a comparative anatomical study of the vascular connections between the heart and lungs and those between heart and gills, and finds that, superficial appearances notwithstanding, they have much in common [as to function]" (p. 287).

D Tripartite analysis, actuality, and activity

Besides its accord with the four causes, Aristotle's tripartite analysis connects closely with his understanding of actuality (*energeia*/*entelecheia*) and potentiality (*dunamis*).[28] We offer some clarification of potentiality and actuality in relation to living beings.

De anima ii 1.412a27 classifies the soul as a "first actuality" (ἡ ψυχή ἐστιν ἐντελέχεια ἡ πρώτη), since the soul is the nature of the natural living being, and the nature has readiness for further operations. While asleep the animal has a functional soul, though generally not sense-perceiving, for the senses are largely though not completely deactivated. Yet, the nutritive capacity in plants and animals must constantly be in operation as their living activity. The dispositional and ready state of soul is "first actuality", but its activity commentators call "second actuality". While animals typically can perceive very early in their lives, such potentialities as for flying and speaking, belong initially only in an undeveloped condition, and require developing the potentiality for use, and even plants may only reproduce as they complete their growth. There can then be undeveloped potentiality, developed potentiality, and usage of the potentiality. Aristotle's explication of these distinctions focuses on human learning (in *DA* ii 5). Humans at birth have undeveloped potentiality to know. Through their ability to perceive and remember, they develop their potentiality by learning and attaining knowledge. Having attained knowledge, they can utilize it in making, doing, or theorizing, depending upon whether their knowledge is productive, practical, or theoretical science. Commentators speak of innate but undeveloped potentiality as "first potentiality" and developed potentiality as either "second potentiality" or "first actuality", which is ready to be exercised as "second actuality". Aristotle only ever applies this three-level analysis—(1) first potentiality, (2) second potentiality/first actuality, (3) second actuality—to the life of mortal living beings.[29]

28 The two words for actuality are perhaps Aristotle's innovations. *Energeia* derives from *energos*, meaning busy or at work, while *entelecheia* joins together *entelês*, meaning complete and perfect, with *echein* meaning holding or keeping, so keeping complete. With *entelecheia* Aristotle plays on its similarity to the term *endelecheia*, which means continuing and continuation. His two coinages have different semantic links, *energeia* with motion and *entelecheia* with fulfillment. Yet, Aristotle can exploit their different possibilities while also using them nearly interchangeably. The term, *dunamis*, by contrast, was already in common usage.

29 That the analysis of the three levels applies only to mortal living beings is not always appreciated (e.g., Caston 2018, 51-58 speaks of "first actuality" color and "first actuality perceptible objects"). Non-living beings may have features in a somewhat analogous way, e.g., a wall only in potentiality blue, when painted is in actuality blue, and when being seen is perceived blue in

The three-level analysis can apply to the *motion* of living beings, such as walking, swimming, and flying—as the infant has potentiality for walking prior to learning to walk, then develops the walking ability, and then readily walks. Aristotle can make a further distinction in the way living beings have actuality (*energeia*): motion (*kinêsis*) vs. activity (*energeia* in a more complete meaning). This is the distinction between what Aristotle calls "complete" and "incomplete activity".[30] While motion is an actuality and activity, it is still on its way to its end, and so incomplete throughout the process, until the motion reaches its termination. The definition of motion in *Physics* iii 1, as the actuality of the being in potentiality as such, shows that motion is actuality or activity, but incomplete, for during the motion there is still potentiality remaining to come into actuality. The end and termination of the motion is outside itself. When the potentiality to be in the place, quality, or quantity has become full actuality, the motion is completed, at its end, and finished.[31] Because motion is on the way to its end, motion takes

actuality, or sand is glass in potentiality, glass is breakable, and glass that is shattering is breaking in actuality. But Aristotle speaks of non-living things in quite different contexts from the tri-level distinction. Caston aims to show that Aristotle believes perceptible objects have the very features that they cause to be perceived in sentient beings. Caston states, "So even though the agent's [sensible object's] power to initiate change will only be exercised in the change, it still *actually possesses* that power prior to the change. This power is therefore *not* a mere potentiality of the sort the patient [the perceiver] has beforehand, but a *first actuality*, an active quality that the patient too will come to possess afterwards as a result of the change" (p. 55). We object to speaking of color as first actuality, and we see absurdity in claiming that the perceiver/patient "will come to possess afterwards" the agent's/sensible object's very power to initiate change, for this would mean that by seeing a color, the perceiver is thereby empowered to have the seen color further acting on a sense medium to cause perceiving in another perceiver, which is hardly the case. The sensible object's power to cause perceiving is not simply what the sentient being takes on in perceiving, any more than the builder's art causes the house to gain that art.

30 The distinction appears quite prominently in the ethical treatises, for action (*praxis*), pleasure, and happiness (*eudaimonia*) are complete activities, and in *Meta*. xii 9, the highest being's thinking thinking of thinking, is pure activity. Aristotle typically makes the contrast between *kinêsis* and *energeia*, rather than *entelecheia*, since *energeia* links more with motion and activity, and better permits him to say that motion (*kinêsis*) is activity (*energeia*), but incomplete (ἀτελής, see *Phys*. 201b31-33, *DA* iii 7.431a4-7, *Meta*. ix 6.1048b18-35). *De sensu* 1.436a1-5 indicates that the treatises of the *Parva naturalia* investigate the proper and common actions (*praxeis*) of living beings, covering both motions and activities.

31 Aristotle's account of motion has motion as the actuality of the potentiality to *be* in some new place, quality, or quantity, when such potentiality remains. Motion cannot be merely the actuality of the potentiality to be some place, quality, or quantity, or it would *be in actuality* in the place, quality, or quantity, and so the motion would be terminated. And if the motion stops along the way to its end, there is only the potentiality to be in the place, quality, or quantity toward which the motion was heading. When there is motion, this is the actuality of the potentiality to

time, and for Aristotle time is a measure of motion (see *Physics* iv 11). In contrast, activity is always complete, having its end always within itself.[32] Aristotle inspires understanding the distinction by stating that with activities we can simultaneously use the present and perfect tenses. We say, for example, that we are living and have lived, or we are seeing and have seen (see, e.g., *Meta*. ix 6.1048b18-35 and *DS* 6.446b2-13). This verbal point is *not* the decisive criterion; it emphasizes the completeness throughout its duration of any activity and hence also its continuability.[33] As always complete, activity does not come into being and need not terminate upon reaching some external end, as does motion. Sublunary motion for Aristotle is always "suicidal", being in process of terminating itself, but activity, as being happy, may continue during much of a life.

We may wonder how activity can be always complete, if it can have a temporally extended object, such as a song or a walk. The activity of living beings is of just four different kinds. (1) The most basic activity is living itself, the nutritive activity of plants or animals. Then for animals there is (2) cognitive living, i.e., sense-perceiving or thinking. From having this cognition, animals gain (3) affective activity: enjoying, being pained, desiring, and having emotions (see *Meta*. ix 8.1050a30-b1). Deriving from cognition along with affectivity, humans have (4) choice (*proairesis*), action (*praxis*), and happiness (*eudaimonia*). Affectivity (3) and action (4) must then have cognition (2) as their basis. Since cognition occurs for Aristotle by apprehending the form, the sensible or intelligible form, which is simple, whole, and complete (see *DA* ii 12.424a17-19 and iii 6), any activity based on cognition, even with a temporally extended object, has its end always complete in its cognition, and so is continuable as complete. Nutritive activity, living

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be in some place, quality, or quantity *as such*, i.e., as the incomplete actuality of the potentiality to be in one of these termini. It is also quite true to say that motion is the actuality of the potentiality for locomotion, alteration, or growth or diminution (or actuality of the movable, alterable, or growable as such), but this is quite circular, and so not such a good account.

32 Gonzalez 2019, 137-146 argues that Aristotle's distinction appears in *Physics* iii and viii, and *DA* ii 5 and iii 7, that is, in all those places in which Aristotle defines motion and/or indicates that it is incomplete activity (*energeia*). Gonzalez (esp. 138-142) makes the case that activity is not exactly the genus dividing into complete and incomplete activity, but that in fact motion is only activity in a limited and deficient way: Aristotle uses *energeia* equivocally, for its primary meaning should be complete activity. And we contend that all that has complete activity is a living being, mortal or eternal, for living is activity.

33 It is not the criterion of activity, for activities may have temporally extended objects, as hearing a song or enjoying a walk, and so we might say we have heard the song or enjoyed the walk only at its conclusion. The object takes time, but the activity cognizing it is complete, and in this way does not take time.

itself (1), being the living activity of the entire ensouled composite plant or animal, is always complete and must continue so long as the plant or animal lives.[34]

The completeness and continuability of activity marvelously explain much in Aristotle's thought. For instance, they allow for many activities to be simultaneous, unlike the case for some motions. While the same body can be in different sorts of motions at the same time, e.g., in locomotion and in alteration, or different parts of the body can be in opposed motions, the same body in the same respect cannot be in opposed motions of the same sort at the same time. A perceiving animal, however, can be perceiving opposed sensible affections in the same genus, e.g., the sweet and the bitter, even at the same moment (see *De sensu* 7). This possibility for simultaneous cognitive awareness is vital for discriminative perceptive activity generally and particularly for memory, remembering, and recollection, which require an accompanying time sense (see *De memoria* 1).

Since activity, unlike motion, is complete at every moment, (i) activity dubiously fits within physics or natural science, (ii) activity questionably has a substratum or location as does motion, and (iii) activity has a more unusual relationship with temporality than does motion.

i Activity and natural science

For Aristotle the study of nature (φύσις, *phusis*), is the study of the inner principle of motion and rest of natural beings and what follows from this principle. The nature and inner principle of motion and rest of mortal living beings is their soul. In *Metaphysics* ix 8 Aristotle argues that actuality is prior to potentiality, and this applies not merely to the potentiality that is a principle of change in another or as other, "but generally of every principle generative of motion or rest" (1049b5-8). He further states, "For indeed the nature arises in the same; for it is in the same [class] as potentiality; for it is a principle productive of motion, but not in another but in itself as itself" (καὶ γὰρ ἡ φύσις ἐν ταὐτῷ γίγνεται· ἐν ταὐτῷ γὰρ γένει τῇ δυνάμει· ἀρχὴ γὰρ κινητική, ἀλλ᾽ οὐκ ἐν ἄλλῳ ἀλλ᾽ ἐν αὐτῷ ᾗ αὐτό, b8-10). We see, then, that the nature within a natural being is a potentiality as a principle

34 The plant or animal, rather than its body or body part, engages in activity. Passages of Plato, e.g., *Tht*. 196d-198b, may lead Aristotle to the motion-activity distinction. The aviary image, likening knowledge to the situation of birds, distinguishes between birds in the wild, birds already within the aviary, and birds that one has in one's hand. And the distinction is in play in the "craft analogy" to virtue. A craft allows for making a good product or deliberately ruining it, but choice as activity deriving from character governs the making.

productive of its motion or rest. Strictly, therefore, natural science should have the nature and soul as principle of motion or rest, rather than activity complete at every moment. Yet, in fact, the most important natural operations of living beings are activities, e.g., living itself, perceiving, and thinking. Moreover, for Aristotle all motions, whether of living or non-living beings, ultimately derive from such activity, since every motion requires a cause, and the cause of any motion is the activity of a self-moving living being, either a mortal or an eternal heavenly living being. For treating the soul within natural science as principle of activity, rather than simply motion, Aristotle speaks of activity as "motion of a sort" or "alteration of a sort" (κίνησίς τις or ἀλλοίωσίς τις), thus apparently maintaining the nature as principle for a certain sort of motion or rest.[35]

As significant as his concept of activity in contrast with motion is for Aristotle, he resists being too explicit about complete activity in the *De anima* and *Parva naturalia*, because he wishes, in studying mortal living beings, to remain as straightforwardly within natural science as he can. Motion for Aristotle always involves some underlying substratum or matter taking on a new form, the composite bodily being undergoing the motion. Complete activity, however, need not involve matter, for at least in the case of the prime mover, which is thinking thinking itself, it is without any potentiality or matter. Natural science does not focus on activity in contrast with motion, since concentrating on this distinction would complicate the understanding of causes and principles and get outside of physics. Hence, Aristotle only occasionally alludes to the distinction in these works (see, e.g., *De anima* ii 5, iii 7 and *De sensu* 4.441b22-23 and ch. 6), so it remains in the background for natural philosophy, though it appears openly in first philosophy and practical philosophy.[36]

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35 Burnyeat 2002 says that *kinêsis tis* or *alloiôsis tis* is to be understood in an "etiolated sense", which we understand to mean *not really* motion or alteration at all, but truly activity as opposed to any motion. A standard alteration is a destruction or replacement of the privative affective quality or sensible affection, e.g., heat is destroyed as something becomes cold. But with alteration of a sort, as the activity of perceiving heat or cold, there is no destruction or replacement at all, but the completion or perfection of the capability (see *DA* ii 5.417b2-7).

36 Yet, we suggest that when Aristotle speaks of "safety" or "saving", even regarding saving the body or the living being, this alludes to preserving life activity complete at every moment, though explicitly about motion. Thus, talk of "safety" is itself a way to keep things safe for natural science. Burnyeat 2008 argues that the key passage, *Meta*. ix 6.1048b18-35, does not really belong in its location, yet he acknowledges that the distinction is in *Meta*. ix 8. So, the distinction clearly applies in first philosophy. Even Burnyeat's denial that the distinction pertains to natural philosophy is only true in the limited sense that we are explaining, which is that Aristotle, to remain within natural science, avoids much explicit appeal to the distinction. As noted previously, Gonzalez 2019, 144-146 argues that the distinction appears in *Physics* iii 2.201b28-29, when

When Aristotle refers in the psychological works to some operation of a soul power as motion *of a sort* or alteration *of a sort*, he means for us to recognize that this is questionably motion of an ordinary sort. And he has another way as well to suggest that the operation of some psychical faculty is complete activity, when he speaks of the living being as engaged in saving itself (σωζεῖν or σωτηρία). Such self-saving can be the very living that is the operation of one of the life functions of the soul, e.g., perceiving, for such living is complete activity, fulfilment rather than change, replacement, or destruction. We see this way of speaking of saving prominently in *De anima* ii 4 and ii 5, and we shall observe it, along with motion of a sort, in the *Parva naturalia*.

ii Activity's substratum or location?

Only living beings can engage in activity, complete and continuable; non-living bodies just have motion and change, as the body takes on a new form. Does activity in living beings, then, pertain to their body, soul, or something else? Body as body need not be living, so perhaps activity belongs merely to soul. Yet, this seems unlikely, since the soul as unmoved mover moves the body, so should the soul then have its own activity? Aristotle instead indicates in *De anima* i 4.408a34-b18 that it is the animal rather than the soul that is pleased or pained, bold or fearful, angry, perceiving, or thinking, and it seems as well that a plant is living not just its soul. Activity properly belongs to the composite living being, the plant or animal is activity's proper substratum. It may be surprising to have the living being as substratum for its own activities, yet it is most itself in its living activity. We may just say the plant or animal engages in activity, much as we say the plant or animal is in motion, though bodies as bodies are most properly what is in motion. Speaking of activity, living, and the soul as in a location or having a substratum seems metaphorical, for bodies are strictly what is in a place and accidental features are in a substratum.[37]

With the distinction of complete activity and motion, and activity's pertaining to the composite living being, we can answer a question that has challenged interpreters but that Aristotle himself does not raise: What does it mean to be a self-mover? This question arises because in *Physics* viii Aristotle distinguishes the

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Aristotle states that motion is incomplete activity: "and motion seems to be activity of a sort, but incomplete" (ἥ τε κίνησις ἐνέργεια μὲν εἶναί τις δοκεῖ, ἀτελὴς δέ).

37 Life's highest activity, the prime mover's thinking thinking of thinking, is being simply (ἁπλῶς, *Meta.* xii 7.1072b10-14 and 9.1074b38-1075a10), with no further substratum.

elemental bodies, which are not self-movers (though they have a nature tending to move them to their own places), from self-moving animals (even though an external object of desire is needed to get the animal into motion). We suggest that for Aristotle self-movers are all and only the embodied living beings, including the heavens, mortal animals, and plants. These are self-movers, since the living being's own activity initiates its motion, which is then self-motion. The one or more eternal, unmoved movers are alive and have eternal activity as their very being, but without bodies, they do not have any motion, and therefore are not self-movers.[38]

iii Tripartite analysis and activity's temporality

Since the explicit distinction of activity and motion appears infrequently in the natural philosophical treatises, it might seem inappropriate to make much of it within natural philosophy. Yet, we think that the tripartite analysis (see section C above), often employed in the *Parva naturalia*, has special pertinence for activity. When Aristotle deals with an activity, he typically utilizes something along the lines of the tripartite analysis, since he seeks its object, what the activity is, and on account of what condition(s) it emerges.

Such a tripartite scheme is appealed to in the account of the passions in *Rhetoric* ii 1.1378a19-26 (cf. *Politics* v 2.1302a16-22 for analogous principles of political change):

38 On the issue of self-movers, see Hankinson 2020, 400-415 and the texts to which this refers. Whereas Plato has the soul as self-mover, Aristotle takes the composite living being to be the self-mover. Plants and the heavens are self-movers, and not just mortal animals, so our treatment goes differently from Hankinson's and others. Elemental bodies need to be freed by some self-mover from the impediments preventing their motion, and then their nature initiates their single motion to their own place. The self-mover is not the elemental body itself, the motion not coming from self-activity and being merely unidirectional. An animal is moved by its cognition of objects of desire, even external objects, but this cognitive activity leads to the self-activity of desire, so that animals have wider possibilities of motion (or activity) than the elemental bodies (Hankinson calls this "plasticity"), making them obviously self-movers, especially when they have progressive motion. (This "plasticity" argument resembles Descartes' distinguishing humans from automata by the unlimitedness of what humans can do and say, see *Discourse on Method* v.) Plants too are self-movers, despite more limited possible motions, because they are alive and initiate their own motion, as in multi-directional growth, by their nutritive activity, though without desire and consciousness (see *DA* iii 9.432b7-13). Each heavenly sphere, in regular, eternal rotational motion, must for Aristotle be a self-mover since it causes this regular motion by its activity in relation to its unmoved mover.

> The passions are those things on account of which people, changing, differ in their judgments, and from which pain and pleasure follow, for instance anger, pity, fear and so many others of such a sort, and the contraries to these. One ought to distinguish concerning each into three, I mean for instance concerning anger how the angry are disposed, and with what things/at whom they are accustomed to be angry, and in what sorts of conditions; for if we might have one or two of these, but not all, there would be incapacity to engender anger; similarly in the case of the others.
> ἔστι δὲ τὰ πάθη δι' ὅσα μεταβάλλοντες διαφέρουσι πρὸς τὰς κρίσεις οἷς ἕπεται λύπη καὶ ἡδονή, οἷον ὀργὴ ἔλεος φόβος καὶ ὅσα ἄλλα τοιαῦτα, καὶ τὰ τούτοις ἐναντία. δεῖ δὲ διαιρεῖν περὶ ἕκαστον εἰς τρία, λέγω δ' οἷον περὶ ὀργῆς πῶς τε διακείμενοι ὀργίλοι εἰσί, καὶ τίσιν εἰώθασιν ὀργίζεσθαι, καὶ ἐπὶ ποίοις· εἰ γὰρ τὸ μὲν ἓν ἢ τὰ δύο ἔχοιμεν τούτων, ἅπαντα δὲ μή, ἀδύνατον ἂν εἴη τὴν ὀργὴν ἐμποιεῖν· ὁμοίως δὲ καὶ ἐπὶ τῶν ἄλλων.[39]

Passions or emotions are activities, while leading to changes in the rhetorician's audience's judgment. The analysis involves the three factors: (1) how those in the passion are disposed, (2) the sort of object involved with the passion, and (3) what conditions prepare someone to undergo the passion. For instance, anger is pain at the appearance of a slight giving rise to desire for revenge against the perpetrator, with conditions such as self-doubt or being hot making one prone to anger. The tripartite analysis discloses what the passion is (pain at apparent slight), its moving cause and aim (what slights and revenge), and what background conditions, usually bodily or psychical conditions, prepare one to undergo such a passion. The tripartite analysis here much resembles that in the *Parva naturalia*, and like it pertains to the four causes.

Also, in *Nicomachean Ethics* iii 6.1115a4-5, before undertaking his accounts of the virtues and vices, Aristotle presents a comparable three-factor analysis:

> Taking up concerning each [virtue], let us say what they are and concerning what things and how; it will be clear at the same time how many they are.
> ἀναλαβόντες δὲ περὶ ἑκάστης εἴπωμεν τίνες εἰσὶ καὶ περὶ ποῖα καὶ πῶς· ἅμα δ' ἔσται δῆλον καὶ πόσαι εἰσίν.

Though virtues and vices are dispositions toward actions and passions, rather than actions and passions, they still work with a tripartite analysis. We should wish to know what the virtue is, what its object is, and how persons are suited to the virtue. Therefore, actions or passions according to virtue, that is, activities, have some end and object and motivation due to the virtue. The action or passion

39 We shall attempt to translate ἀδύνατον as consistently as we can as "incapable" or "incapacity" rather than "impossible", and δυνατόν as "capable" rather than "possible" (cf. Gonzalez 2022). Such translation, at the risk of some awkwardness, conforms to Aristotle's usage of the related verb forms. His more usual way to speak of what is "possible" are forms of ἐνδέχεται.

is activity aimed at this object, with action moved by deliberation and choice, and the action or passion pertaining to the sort of person disposed to it. Again, this seems well in line with the tripartite analytical scheme of the *Parva naturalia*.

Even the most basic activity, non-cognitive nutritive living, has an object (e.g., nutriment), an end (living itself), and bodily instruments (e.g., heat). The rest of the activities, being cognitive, affective, or pragmatic (action), get their direction toward their object by way of cognition. Thus, all the higher activities are cognition or based in cognition. Now cognition surely lends itself to the tripartite analysis, since cognition has an object, is a certain cognitive engagement with the object by which its possessor in activity somehow becomes one with its object, and it arises under certain conditions in the living being, as being awake, sober, or angry. The sorts of activities that are based on cognitive activities, such as affective responses and actions, therefore also lend themselves to the tripartite analysis.

What underlies Aristotle's attachment to the tripartite sort of analysis, beyond its general connection with actuality and potentiality and its accord with causal analysis, is his conviction that in their way of being tripartite, activities have completeness. In *De caelo* i 1.268a4-20 Aristotle says:

> Of the things constituted by nature, some are bodies and magnitudes, some have a body and magnitude, and some are principles of what has these. What is divisible into ever divisible things is continuous, and body is what is in every way divisible. Of magnitude, that in one [direction] is a line, that in two [directions] is a plane, and that in three is a body. Indeed, besides these there is no other magnitude on account of the three being all and the three ways in every way. Just as the Pythagoreans say the sum and the all are delimited by the three; for terminus, middle, and beginning has the number of the all, and these are the triad. That is why, having taken it from nature, as though its law, we use this number even for the worship of the gods. We apply modes of address in the same manner: for we speak of two things as "both", and two people as "both", and we do not say "all", but we first utter this mode of address of three things. In these things, as has been said, we are following on account of nature itself so leading.

For Aristotle bodily magnitude is divisible in three ways, and three fits being whole and complete, for with three there is beginning, middle, and end. Now a motion also when complete, has had a beginning, middle, and end, and the time of the motion has beginning, middle, and end. Time as ongoing, rather than merely the measure of a completed motion, has past, present, and future aspects.[40]

40 In *GA* i 1.715b14-16 Aristotle says, "Nature flees the infinite, the infinite is incomplete, but nature always seeks an end". On Aristotle's embrace of the tradition of "trinitarianism", see Marré 2021, 109n15.

In dealing with the operations of living beings, Aristotle suggests that their magnitude has "six intervals grouped in three pairs" (εἰσὶ γὰρ διαστάσεις μὲν ἕξ, συζυγίαι δὲ τρεῖς, *De incessu animalium* 2.704b19-22; cf. *DC* ii 2.284b30-285a1). These are up-down, before-behind, and right-left. He holds, "Generally always the better and more honorable, where nothing other greater impedes, of the up and down it is rather the up, of the before and behind the before, of the right and left in the right" (*PA* iii 3.665a22-26). For living beings, the up and down pertain to the orientation of the living being and to the way food enters and exits the being, i.e., nutritive operation. Humans are the most upright mortal living being, with plants being reversed since food comes through their roots and growth starts there. Before and behind relate to sense perception, the primary direction for perception usually being frontwards. And right and left are the directions from which progressive animal motion arises, Aristotle holding that the right is naturally the direction beginning the motion (see *De incessu* 4-5). The heart in sanguineous animals, or its analogue in the bloodless, is for Aristotle the centralized principle of three fundamental powers: nutrition, perception, and locomotion.

Any operations of living beings that are motions, since time for Aristotle is a number or measure of motion, have obvious temporality. With life operations that are activities, however, which have their end always in themselves, the temporality is less clear. Yet, since the activity of mortal living beings lends itself to the tripartite analysis, and all motion derives from activity, there is a more fundamental kind of temporality built right into the engagement in activity. The tripartite analysis will have: (i) some object of the activity, (ii) the activity being in relation to the object, (iii) the living being's condition as engaging in the activity. We can then view the object giving the aim and end of the activity as its futural dimension, the activity in relation to the object as the present dimension, and the condition of the living being as suited for the activity as the past dimension.

This temporality can be seen in the tripartite analysis of passion proposed in *Rhetoric* ii 1. The object of the passion leads to its aim and futural aspect, e.g., the angry person pleasantly thinks about revenge upon the disrespectful person; how those being in the passionate activity are affected is the present aspect of the passion, i.e., pain at the apparent slight; and what conditions have made the person liable to the passion is the past aspect, as persons especially warm, feeling insecure, or having strong desire are prone to anger. We suggest that activity in its tripartite configuration in mortal living beings forms their most fundamental temporality. They have more ordinary temporality as bodily

beings in motion, but their temporal life as living beings originates in the deeper temporality of activity.[41]

Motion as incomplete actuality, as actuality of the being in potentiality as such, has ordinary temporality, since it is what is numbered or measured by time. Such motion, as we have indicated, depends for Aristotle on activity, the activity of mortal living beings or eternal living beings. And we can recognize that motion as incomplete, as activity of a sort (*energeia tis*), is in the image of activity as complete, for motion's heading toward its termination is its futural aspect, i.e., its direction toward what is still merely in potentiality; the motion as actuality is its present aspect; and the contrary or privation of the motion's termination, what the motion is leaving, is the past aspect.[42] There are these temporal aspects of motion due to the very being of motion as deriving from activity. The temporality of activity does not take time but causes time by giving rise to motion, which is the substratum for time, with the time of motion measured by ensouled beings.

We have pointed out that Aristotle's way to speak of psychical faculties' operations in the *De anima* and the *Parva naturalia*, to keep them so far as possible within natural science, is to speak of complete activities as "motions of a sort". In addition, he tends to speak of saving the life, i.e., the sort of living of the living being, whether nutritive, perceptive, or intellective living, as saving (see *DA* ii 4.416b14-17, 5.417b2-7). Engaging in living, perceiving, or thinking is a perfecting and completion rather than destruction or replacement of a previous condition. We can see that such talk of "motion of a sort" and "saving" fits well with our emphasis on the deep temporality of the living of mortal living beings. Saving prepares for future being of the sort of present life continuing from its previous living.

Since activity may be involved with motion and give rise to motion, we find no conflict with our account of activity when Aristotle says in *De memoria* 1.449b25-28 that remembering pertains to past cognition, perception to the

41 In Harry and Polansky 2015 this deeper temporality is spoken of as accidental, which it is in the way it is treated there, as measured by the temporality of motion. But in the way we are now thinking of activity as having the tripartite structure in mortal living beings, it is their basic temporality. Hence, Aristotle is rightly concerned in *Phys*. iv 14.223a16-29 with the question whether time exists without soul.

42 The definition of motion as actuality of the being in potentiality as such points to these temporal dimensions of motion, whereas the principles of motion—form, matter, and privation of form—are as principles fixed. The regular eternal rotational motion of the heaven comes as close to being complete as motion can be. While any heavenly bodily motion has temporality, its regularity and eternality allow it to serve as standard of measure of the temporality of sublunary bodies.

present, and hope, expectation, or desire to the future. Activity remains the fundamental temporality underlying all of these. Remembering, perceiving, hoping, expecting, and desiring are one and all present, occurrent activities, and hence they have the fundamental temporality that we have been explicating, though as present cognitional activities they can relate to their objects as past, present, or future, and form the basis for these temporal dimensions of the living being. Speaking of cognitive activities as "motions or alterations of a sort", allows having the ordinary temporal life of mortal living beings derive from the "temporality" of these activities, or motions of a sort. The time sense that is so crucial for remembering becomes understandable when the cognitive acts that are the primary objects of remembering are implicated in the motions of the animal and are themselves viewed as motions of a sort.

E Aristotle's division of the sciences

Dividing the sciences is not itself a part of any science for Aristotle. In several contexts, however, he makes explicit divisions or assumes such division of the sciences (e.g., *Phys*. ii 2). Prominently in *Metaphysics* vi 1 he divides the sciences into theoretical, practical, and productive, based on where their principles are located. The theoretical sciences have their principles in the matters themselves, and therefore they have more precision, and seem to have more objectivity, than the other sciences, which have their principles in humans.[43] Practical sciences—political science, ethics, and household management—have their principles in humans, as *doers* of action, while productive sciences, all the productive arts, have their principles in humans, as *makers* of the products. The distinction of doing (*praxis*) and making (*poiêsis*) derives from Aristotle's distinction of activity and motion (see, e.g., *NE* i 1, ii 4.1105a26-b5, vi 2.1139a31-b5, and 4.1140a10-17). Doing or action has its end always in itself, insofar as it is activity, while making involves change or motion to generate its product, and therefore has its end outside itself. Yet, the distinction is complicated, since some of the productive arts, such as music performance, dancing, rhetoric, and poetry, have an unusual sort of "product", quite close to human action, and most human action also involves

43 For Aristotle the three theoretical sciences are first philosophy (theology), natural science (physics), and mathematics (see *Meta*. vi 1.1025b-1026a23). Natural science deals with form with the addition of matter, mathematics deals with quantitative being with the abstraction or subtraction of the matter, while first philosophy deals with being in virtue of itself, neither adding nor subtracting the matter. Being in virtue of itself means the essence of a being and the highest being.

engaging in various motions, e.g., choosing to make a house or to do a brave action or enjoying walking can involve many motions.

Not only is the distinction of the practical and the productive sciences often rather tricky, but also, their distinction from the theoretical sciences can sometimes be problematic. The productive sciences, such as farming, medicine, fishing, and caring for herds, sometimes border on the theoretical sciences, for such productive arts share some understanding of what they treat with natural science. Moreover, the practical sciences resemble natural science insofar as the statesperson works on both the person's or community's "form" and "matter", just as nature generates the form and matter of what it produces, as in reproduction. An individual's matter, for practical concern, includes desires and passions, with the form given to this matter being the shaping of desire, i.e., character, virtue or vice arranging the matter, while the community's matter is particularly its population, with its form the *politeia* (constitution), i.e., the distribution and arrangement of the offices in the community. In contrast with practical science's dealing with both matter and form, the productive sciences usually merely take over some matter, perhaps from another art, and attempt some change in its form. Thus, Aristotle divides the sciences, while recognizing that they can have significant connections.[44]

The *De anima*, which investigates the soul, and the treatises of the *Parva naturalia*, which analyze what is common to soul and body, largely belong within natural science. The soul is the very nature, or internal principle of motion and rest, for the ensouled mortal living beings, plants and animals. Mortal animals all have sense perception, which is strictly activity rather than motion, and hence only fits problematically within natural science; humans, among the animals, are enabled by sense perception and intellectual capacity, to obtain knowledge and to exercise it in thinking, i.e., intellectual activity. Such activity, involved in writing and thinking through the *Parva naturalia*, fits even more problematically within natural science (see *PA* i 1.641a32-b4).

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44 Polansky 2017 defends the claim that while Aristotle's ethics may always have his theoretical notions in its background, yet these notions are withheld from explicit employment in the practical context. A reason for this is that practical science is crucial for all humans, though practitioners cannot be expected to embrace theoretical notions. Also, the principles for sciences may differ, e.g., physics only has humans utilizing everything *as if* intended for their use, whereas politics holds that everything *is* for our use, meaning that nature is sufficiently generous that humans need not be in competition and justice is natural (cf. *Phys.* ii 2.194a33-36 vs. *Pol.* i 8.1256b15-26). One should be able to live a happy life without being a theoretician. Hence, practical science's independence from his theoretical science, which science we may suppose out of date, keeps Aristotle's ethics and politics likely always still applicable.

We emphasize this problematic fit of the *De anima* and the *Parva naturalia* within natural science, though Aristotle endeavors to keep them within the fold, because it helps explain his acceptance of complications and incongruities. This contrasts with post-Newtonian thinking, which views the heavens as adhering to universal laws of nature applying also to the earth. And modern thinking often entertains the hope that we might eventually have "a science of everything", bringing together all of physics, chemistry, biology, and even all the human sciences.[45] Aristotle accepts a clear division of the sciences and subject matters. The heavens greatly differ from and have different principles from the sublunary realm, and mathematics deals with natural beings only as having quantity, not as (natural) beings capable of motion. First philosophy, natural science, and mathematics, then, have different subject matters, different principles, and different manners of inquiry.

Yet, Aristotle also has sciences straddling the division of natural science and mathematics. He recognizes four "mixed" or "intermediate" sciences: astronomy, optics, harmonics, and mechanics. These sciences apply mathematics to natural entities. Now when he deals in the *De anima* and *De sensu* with vision and hearing, their respective objects, and how vision and hearing occur, should we then expect that his accounts will be fully in line with what emerges in the study of optics and harmonic science, the mathematical treatments? Or does he intend to remain strictly or mostly within natural science? Some of the prominent ancient commentators on Aristotle, such as Alexander of Aphrodisias (and maybe John Philoponus following him), seem to expect compatibility with the mixed sciences and struggle with making his accounts in the *De anima* and the *De sensu* accord with results in optics and harmonics. Does Aristotle himself, however, view this as an urgent problem? Living beings are central to his natural science, but sense perception is ultimately activity rather than motion. While motion surely fits with natural science and also the mixed sciences, need activity and life, whether the life of mortal beings or even that of the heavenly bodies, be in perfect alignment with the results of these mixed sciences?[46] We shall find that

45 Antiquity had a vision of the science of everything in Plato's *Republic*'s Idea of the Good as the non-hypothetized ultimate principle beyond being, the principle from which everything else could be derived. Yet, Plato's dialogue indicates the dubiousness of this enterprise for humans.

46 See, e.g., Berryman 2012 for consideration of the difficulty that the science of optics presents for Aristotle's account of vision. She says pp. 17-18, "It seems, then, that in late antiquity, all four of Aristotle's key examples of intermediate sciences [astronomy, optics, harmonics, mechanics] were in some kind of tension with received natural philosophy… Changing views about the perceived relationship of the intermediate sciences to natural philosophy was evidently a major factor in the emergence of a new, unified mathematized physics in the 17th century." In treating the

not even the way that sensible objects act on the sense medium and sense organ to cause perceiving can be spoken about quite as ordinary or standard alterations are treated in the *Physics*. Suitable inquiry into living beings demands Aristotle's theoretical flexibility and care.

There was in classical antiquity a genre dealing with whether some field might be considered an art or a science. We see such attention in, for instance, the Hippocratic treatise *The Art* [of Medicine], in Plato's *Gorgias* and *Protagoras* regarding rhetoric and sophistry, and Aristotle's *Metaphysics* with respect to a first philosophy, and the *Rhetoric* and even ethics and poetics about their own standing as art or science. We shall be finding inquiry regarding status as art in *On Prophecy on account of Sleep* and elsewhere in the *Parva naturalia*.

F Overview of the *Parva naturalia*

The *De anima* twice attempts accounts of sense power. The first is prior to dealing with each of the five senses.

> What is perceptive is in potentiality of the sort that the perceptible/perceived thing already is in actuality, as has been stated. It is affected, then, when it is not similar, but, having been affected, it has become similar and is such as that is. (*DA* ii 5.418a3-6)
> τὸ δ' αἰσθητικὸν δυνάμει ἐστὶν οἷον τὸ αἰσθητὸν ἤδη ἐντελεχείᾳ, καθάπερ εἴρηται. πάσχει μὲν οὖν οὐχ ὅμοιον ὄν, πεπονθὸς δ' ὡμοίωται καὶ ἔστιν οἷον ἐκεῖνο.

This definitional account has what is capable of sense as that which becomes assimilated to the sensible object through being affected by it. Initially unlike what it perceives, the perceptive power becomes likened to its object. The sense, or the perceiving animal, in perceiving its object becomes the sort of thing the sensible object is already, but not exactly what it is, for the perceiving is not itself a sensible object causing further sense perception, as touching wet paint can spread the paint.

The second account of sense follows his discussions of each of the five proper senses.

> Concerning every sense universally, one must grasp that, on the one hand, the sense is what's receptive of the perceived things' forms without their material, e.g., in the sort of way the wax receives the ring's signet without its iron or its gold: it takes on the golden or

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De sensu and the rest, we shall be constantly cognizant of the significance of Aristotle's keeping different sciences apart. The distinction of motion and activity, and their different but related temporality, are here an important insight.

> the brazen signet, but not insofar as it's gold or bronze; in a similar way, the sense too, of each thing, is affected by what has color or flavor or sound, but not insofar as it is spoken of as each of those things, but insofar as it is this *sort* of a thing, i.e., by virtue of the *logos*. On the other hand, a perceptual organ is, first of all, that in which there is this sort of capacity. It is, then, the same thing, yet different with respect to being. For what is perceiving would be a certain magnitude, but of course the being for the perceptive thing is not, nor is sense perception, a magnitude, but a certain *logos* and capacity of that [perceiving] thing. (ii 12.424a17-28)
>
> καθόλου δὲ περὶ πάσης αἰσθήσεως δεῖ λαβεῖν ὅτι ἡ μὲν αἴσθησίς ἐστι τὸ δεκτικὸν τῶν αἰσθητῶν εἰδῶν ἄνευ τῆς ὕλης, οἷον ὁ κηρὸς τοῦ δακτυλίου ἄνευ τοῦ σιδήρου καὶ τοῦ χρυσοῦ δέχεται τὸ σημεῖον, λαμβάνει δὲ τὸ χρυσοῦν ἢ τὸ χαλκοῦν σημεῖον, ἀλλ' οὐχ ᾗ χρυσὸς ἢ χαλκός· ὁμοίως δὲ καὶ ἡ αἴσθησις ἑκάστου ὑπὸ τοῦ ἔχοντος χρῶμα ἢ χυμὸν ἢ ψόφον πάσχει, ἀλλ' οὐχ ᾗ ἕκαστον ἐκείνων λέγεται, ἀλλ' ᾗ τοιονδί, καὶ κατὰ τὸν λόγον. αἰσθητήριον δὲ πρῶτον ἐν ᾧ ἡ τοιαύτη δύναμις. ἔστι μὲν οὖν ταὐτόν, τὸ δ' εἶναι ἕτερον· μέγεθος μὲν γὰρ ἄν τι εἴη τὸ αἰσθανόμενον, οὐ μὴν τό γε αἰσθητικῷ εἶναι οὐδ' ἡ αἴσθησις μέγεθός ἐστιν, ἀλλὰ λόγος τις καὶ δύναμις ἐκείνου.

This has sense receptive to sensible forms, e.g., colors or odors, but neither is the sense acted upon by the substratum in which the sensible form inheres nor does the sense get any such substratum into any matter of its own. When a knife cuts an apple, the apple receives the action of the knife's form and matter, thereby getting cut. Yet, when a hot object approaches and heats an animal's flesh without touching it, the animal receives the sensible form heat from the hot object into its own flesh's matter, but not the hot object's matter. This is receptivity of the form without the matter, i.e., the matter from the object, though the heated flesh has taken the heat into its own matter, so that it might in turn heat something else that were to approach the warmed flesh. In contrast, when the sentient animal perceives the heating of its flesh, though the flesh has heat in its matter, the sense only *perceives* the heat. The sense receives the form heat immaterially, for the sense as soul power has no matter whatsoever. The sense cannot transfer the heat it perceives to a body external to the animal, as can the flesh, for the sense's activity is just perceiving.[47]

In the *De anima*'s accounting for sense perception, Aristotle designates for each of the five senses its own kind of proper sensible object that moves the sense to perceive it, i.e., color, sound, odor, flavor, and tangibles. What the *De sensu* does beyond this is provide accounts of the sensible object as capable of acting on the sense medium, sense organ, and sense. It only must do this for color, flavor, and odor since sound is already treated in *De anima* ii 8 and the tangibles in

47 The *De motu* will contend, however, that perception of some objects leads to heating or cooling of small *internal* parts of the animal, the consequent expansion or contraction of these parts can result in large-scale animal motion.

On Generation and Corruption and *Meteorology*. Further issues requiring attention in the *De sensu* include: (a) how the five sense organs relate to the four sublunary elemental bodies, (b) how the genera color, flavor, and odor give rise to a limited variety of sensible forms, e.g., the colors besides white and black; (c) whether sensible objects and the substrata in which they inhere are unlimitedly divisible; and (d) whether perceiving is limited to but one sensible object at a time. By thus inquiring into sense organs and their objects along with the limited or unlimited divisibility in perceptible magnitude and time, Aristotle reinforces the *De anima*'s account of sense perception through greatly expanding his attack on competing effluence theories of predecessors, such as Empedocles, Democritus, and Plato.

The treatise on memory and recollection (and on dreams) makes good use of the *De anima*'s account of *phantasia*. *Phantasia* gives rise to *phantasmata*, presentations, enabling animals to access their own past awareness, thereby permitting some beasts to learn and humans to gain speech and thought and to recall previous perceiving and thinking. The *De memoria*'s elucidation of animal retention and recall of its past is the first extended scientific treatment of memory and recollection. Aristotle's causal analysis distinguishes different functions of *phantasmata* to locate that enabling memory, explores the trains of presentations permitting recollection, and considers time sense. The *De sensu* and *De memoria* thus fill out accounts of animals' cognitive operations and capacities during waking life.

From awake cognitive life, the next three treatises, consider sleep, dreaming, and prophecy by dreams, and so shift to the binding of perception in sleep when there may still be some dreamy version of cognitive life. Each work provides a scientific causal account of its topic; while dealing with the condition of impeded and cloudy cognition, they support, perhaps surprisingly, the previous accounts of the waking cognition. Since sleep requires that the senses together become largely inoperative, this supports holding that *all* sense perception is centralized. The animal may have multiple sense organs, but for sleep to deactivate sense-perceiving, as well as for animals to discriminate what they perceive through different senses, all perception must come together in a common power for sense. Moreover, the role of *phantasmata* to initiate thinking is illustrated by the way *phantasmata* forming dreams can provoke thinking during sleep, while the senses are deactivated. The treatise on prophecy by dreams defends a disputed practice as genuine, a science divining the future by dreams. Thus, the sequence from the *De anima* through these several treatises of the *Parva naturalia* enriches the account of perception and intellection by tracing the kinds of cognition deriving from sense power, both while the animal is awake and when it enters the deficient condition sleep.

Following these treatises on cognition comes the *De motu*, for voluntary animal locomotion originates from the cognitive capabilities in combination with desire. The *De motu* then completes consideration of specifically *animal* capacities, clarifying the animal soul's role in causing voluntary locomotion by cognition and desire in conjunction with bodily intermediaries. Observable voluntary animal motions result from unobservable not-voluntary motions involved with perception and desire: heating and cooling and expansion and contraction of small body parts. Explaining voluntary motion introduces the not-voluntary motion that gives rise to it. Plants also have their observable self-motion, growth, provoked by environmental warmth and moisture and responded to by not-voluntary nutritive motion. While then concentrating on the locomotion of animals, the *De motu* more widely reflects on the self-motion belonging to all mortal living beings, both plants and animals. Accounting for all self-motion of mortal living beings, the *De motu* continues and finishes the previous reflection upon what gives rise to and follows from the self-motion of perception, and it prepares for the subsequent works on self-motion in nutritive life. The treatise thus secures the ring of the *De anima* and *Parva naturalia*, by ensuring that self-motion and perception distinguish the ensouled plants and animals.

The final two treatises in the series discuss the causation for life length in plants and animals, and the ways such mortal living beings safeguard their lives by heat and moisture maintenance. Quality and quantity of moisture in plants and animals impacts on the moisture's endurance; heat maintenance for plants and animals depends on working with external environmental conditions. Life's *genesis* comes with heat enabling soul's causing self-motion and continuing this heating safeguards life. Many living beings need do little more to maintain heat than take in nutriment, yet the demanding life of the complete animals entails complicated heat maintenance, for these animals must do more to moderate their heat by additional cooling, thereby preventing heat's premature exhaustion. For Aristotle, respiration or gills further utilize the elemental environment of the animal, taking in and expelling air or water for cooling and moderating vital heat. Explicating ways to maintain heat, Aristotle methodically investigates life's safeguarding, and in the most complex cases, ways most difficult for us to understand. Thus, the route of the *De anima* and *Parva naturalia* begins with the nutritive power, which initially seems intelligible to us, and moves toward what is ultimately more intelligible, the cognitive powers and motive power. The *Parva naturalia* continues with the cognitive and motive powers, that are most intelligible for us, to come back to the nutritive power, which in its upholding life by such efforts as respiration and gills, is intelligible to us only through all the previous inquiry.

In traversing the course through nutritive, cognitive, self-motive, and nutritive functioning, Aristotle's scientific inquiry attends to arrangement and methodology. The collection supports the unification of the mortal living being, for he shows that sense perceptive, locomotive, and nutritive powers share a centralized location for soul and body coordination. The sequencing of treatises and their involving the reader or auditor in acquiring deepening natural knowledge and self-knowledge display definite design.

The *De anima* and *Parva naturalia* pertain to motion, both motion of a sort and the standard motions, so motion applies to treatises on cognitive motion and nutritive motion, all the self-motion of mortal living beings. From beginning to end the series concentrates on self-motions depending upon a conjunction of soul and body. The *De anima* surrounds the cognitive powers, involving motion of a sort, perception, *phantasia*, and intellection, with the powers for more direct motion, the nutritive and locomotive capacities; the *Parva naturalia* begins with cognitive powers to get to the *De motu* and nutritive power, the powers of the more observable motion. The entire sequence of the *De anima* and *Parva naturalia*, then, alternates the motive and perceptive powers: motive power (nutritive), cognitive powers (perceptive, *phantasia*, intellective), motive power (locomotive), cognitive powers (perceptive, memory, recollection, dream), motive powers (locomotive and nutritive).

Some of the *Parva naturalia*'s treatises deal with topics about which our time has developed accounts differing from and going beyond Aristotle's. This is most the case where the attention is to the bodily correlate of motions and operations involving bodies, whether non-living bodies or the bodies of plants or animals, including humans. Modern instruments and experiments concerning these enable observations, and in some cases theories, unlike those of which Aristotle was capable. Nonetheless, his treatment even of these topics holds great interest. There is interest in what he says of his predecessors, his methods of arriving at his results, the way he presents his theories, and the historical significance of his views. He enables us to observe the emergence of compelling scientific investigation of an integrated set of topics. Since the topics concern psychology, cognitive science, anatomy, physiology, biology, zoology, and medicine, what he considers displays the beginnings of these fields. Aristotle not only himself observed and investigated widely, but he also amassed evidence from collaborators and wide reading.[48] His treatises can therefore shed significant light on the history of

48 Of the value of considering Aristotle's relation to various fields, Eijk 2005, 16 for instance says, "the subject of Aristotle's relationship to medicine is a vast area, and the study of the role of Aristotelianism in the development of ancient medicine is still in its infancy".

medicine and such fields in which physical, chemical, and biological knowledge play an important part.

Moreover, these treatises often deal with topics about which physical knowledge plays a lesser or less clear role, so that it is debatable whether we know more on these subjects than Aristotle, at the level at which he is discussing them. Such topics, on which his views still retain strength, include memory, recollection, dreams, divination by dreams, life, and death. What Aristotle says about these may not run afoul of what our sciences hold, and therefore might to some extent be embraced today. Our physiological knowledge need hardly much detract from what he has developed in such domains.

G About the texts

The oldest manuscripts that include the treatises of the *Parva naturalia* date from the ninth century CE. This applies as well to other texts in the corpus. Ancient stories about the early transmission of the corpus lead many scholars to suppose that the arrangement of the works as preserved in our manuscripts is the result of editorial efforts by Andronicus of Rhodes and others. But Menn 1995 and Barnes 1997 vigorously attack this supposition, and there is an additional argument against overmuch editorial intervention. Those works of Aristotle that are over six-books long, generally designate the sixth book (or the seventh in the case of the *Metaphysics* because of book little α) by Z (*Zeta*). But the sixth book of most other ancient authors is designated by ϛ′. Burnyeat 2004, 178n3 says, "the Aristotelian corpus is exceptional in sharing with the *Iliad* and *Odyssey*, Herodotus, Theophrastus and the poems of Sappho, the honor (if such it was) of being ordered alphabetically by a system of 24 plain letters, not by the 27-symbol system of letter numerals which became the reigning style of book division already in the third century BC." Hence, we have reasonably good grounds for some confidence that the book arrangements of Aristotle's lengthier texts go back to Aristotle himself. Thus, Burnyeat claims, perhaps overstating, "Andronicus wrote a wide-ranging study of the Aristotelian corpus, but the simple fact that no scholar of the first century BC would have adopted the 24-letter system shows that he came much too late to determine the shape or size of its constituent treatises." Furthermore, Burnyeat says that unlike the case with the exoteric works, which were fixed once sent to the booksellers, the treatises that we have remained with Aristotle so that he could revise them as he wished, and consequently they can all be considered "contemporaneous" works with respect to Aristotle's thought. Burnyeat adds,

> We speak aptly of the Aristotelian corpus, for it is conceived as a whole of many parts, each with its proper place in the overall system, the whole joined together by a vast network of cross-references. What we learn from the blank cross-references... [i.e., cross-references that are unfulfilled] is that the system evolved over time. We do not have to choose between system and development, as scholars have so often thought. Aristotle's was an evolving system.

Our reservation about this is just our conviction that Aristotle writes his treatises only after becoming confident of his command of the field, and therefore they little involved any or much revision. Also, we propose that many or most of the "blank cross-references" are not so blank as Burnyeat supposes, for identifiable passages in and existing texts are often those to which Aristotle refers.

We believe that suggested conflicts in the corpus are in fact when properly interpreted compatible and consistent. They often reflect different contexts of scientific investigation, which require somewhat varied accounts. As ichthyologists and anglers speak rather differently about fish, so the subjects Aristotle treats, such as memory, sleep, dreams, digestion, and respiration, allow for somewhat divergent approaches in different contexts, such as practical, theoretical, and mixed sciences. Along with these different contexts, as explanation for apparently inconsistent accounts, we must always appreciate that Aristotle is very attentive to the ambiguity and equivocality in common usage of terms. Consider how Aristotle often indicates that some term is said in many ways and demarcates these. For example, he specifies four sorts of causes. The equivocality often arises less from the confusion of speakers or writers than from the complexity of the notions under consideration. The pregnancy of terms sometimes points to an explicable and important set of related meanings, so that by his careful statements he manages to be deliberately and helpfully ambiguous, and thus to make more than a single claim at once. Also, in the investigative and pedagogical arrangement of treatises, he may initially state things that subsequently receive further clarification and refinement.

About what manuscripts should be utilized, we try to be textually conservative, and very much in sympathy with the argument in Eijk 2005, 248n31 that when we use a text edited to agree with some interpretation, we lose much ability to test the success of the interpretation. We aim as much as possible to defend the text based on the best-attested manuscripts. For much of the *Parva naturalia* this is the E manuscript, which goes back to the ninth century CE. If we can often defend manuscript readings that editors have marked as problematic, a side feature of our commentary will be resistance to many editorial interventions regarding the text.

While much of the division of treatises and the books within them may originate with Aristotle, chapter divisions in common usage typically derive from the period of the Renaissance. They were made, however, by a good interpreter or interpreters of Aristotle, and they usually prove helpful in organizing the text. Yet, some of the divisions can be questionable (see, e.g., Gregoric 2020, 418n3 for questioning some divisions of *De motu* chapters).

The *De anima* is one of the most frequently commented upon works of Aristotle, whereas the treatises of the *Parva naturalia* have many fewer commentaries. This is likely because the work on the soul was expected to lead to self-understanding and to surpass natural science and take us to the divine study, first philosophy, whereas the treatises of the *Parva naturalia* were supposed merely to investigate diverse topics belonging exclusively within natural philosophy.[49] We have utilized literature on the treatises of the *Parva naturalia* from antiquity to the present. Our aim is to explicate their place within Aristotle's corpus, the overall design of these treatises and their particular arguments, and to elucidate difficult passages and terms. We could wish, if possible, to leave nothing of the whole or its parts uninvestigated. The task of clarifying everything in such works as these, however, is endless, but we hope that the length and strength of our efforts will seem welcome and worthwhile. Aristotle himself, we

49 About ancient and medieval commentary on the *Parva naturalia*, Bydén 2018, 12-16 says, "Apart from Alexander of Aphrodisias' extant commentary on the *De sensu*...and Aspasius' lost commentary on the same work (referred to by Alexander, *In De sensu* 101-2), there is no evidence that any ancient commentary was ever written on any of the treatises included in the collection... For the Neoplatonists...the *De anima* is a transitional work. It represents the beginning of the ascent from the study of the natural world to that of the divine realm. To say that it would have been awkward for them to continue their natural philosophy courses by expatiating on the attributes of animals and plants rather than proceed to mathematics and metaphysics is probably an understatement. In so far as they wished to lecture on zoology and botany they would have had to do so before the *De anima*. But the *Parva naturalia*, as we have seen, presuppose the *De anima*. Easier, then, perhaps, to dispense with them altogether... The first proper commentaries on most of the *Parva naturalia* and the 'zoological' treatises were written only in the early twelfth century, when—apparently at the behest of the princess and historian Anna Komnene—various gaps in the Greek secondary literature on Aristotle were filled, in this case as in several others by Michael of Ephesus. The only work in the collection not to be attended to by Michael was the *De sensu*, obviously because Alexander's commentary was still available...the influence of Michael's commentaries on the later Byzantine tradition is pervasive" (cf. also Trizio 2018, 157). There were discussions of material of the *Parva naturalia* among the Islamic and Jewish philosophers, but this seems to have been based on the *Kitāb al-Ḥiss wa-l-maḥsūs* ("Book on sense perception and the perceived"), a ninth-century Arabic adaptation of much of the *Parva naturalia*, claiming to be a translation, but with major Neoplatonic and Galenic intrusions.

surmise, took these treatises to contribute significantly to our self-understanding along with the advancement of natural science.

While various editions have been consulted, we have especially used the text in Ross 1955 and Siwek 1963, except for the *De motu*, where we have primarily used Primavesi 2020. Departures from the texts of Ross and Primavesi have been noted.

On Sense and Sensible Objects (*De sensu et sensibilibus*) περὶ αἰσθήσεως καὶ αἰσθητῶν

The treatise's title varies in its Latin versions, with "sense" and "sensible object" in the singular in some, in others with plurals, and in others with a combination of singular and plural. Such variation in the title suggests that Aristotle did not himself assign a title to the treatise, as seems also the case with many parts of the corpus, but others added a title to keep track of the scroll in which it was transcribed. All the titles offer a good notion of its topic, yet perhaps the title with the plural for "sensible objects" works best. While the *De anima* presents the common or universal account of sense perception (see 416b32-33 and 424a17-19), the *De sensu*, with its dealing with sense organs and sense media, along with sensible objects and their divisibility, clarifies much about sense. The *De sensu* makes the major case against effluence theories of perception, the main opponent of Aristotle's approach. Thus, this work defends the *De anima*'s account of sense perception. When he elsewhere refers to the *De sensu*, he often does so as ἐν τοῖς περὶ αἰσθήσεως ("in the things concerning perception", *GA* 781a21, 786b25, 788b1, *Meteor.* 341a14, *PA* 653a20, 656a29), whereas he refers to the *De anima* as "in the things concerning soul" (see 436b10, b14-15, 439a8, a16, 440b28). Hence, the *De anima* gives the general account of perception, but it is more broadly the work on the soul, with the *De sensu* focused strictly on sense perception.

Many of Aristotle's predecessors discuss sense perception and sensible objects. The tendency of the predecessors, Aristotle claims, is to explain sense perception as arising through like by the like (see *DA* i 2.404b8-405b30 and 5.409b23-411a22).[1] For some predecessors, it could mean that if the sense organ is composed of a certain elemental body, it should be sensitive to similarly composed objects. This might seem inevitable for a material monist predecessor, as were some Presocratic thinkers, though their fragments may give little evidence. If everything is ultimately one sort of stuff, such stuff should be able to perceive what

1 According to Aristotle and Theophrastus, many of the predecessors have a like-by-like account of sense perception. Theophrasus' *De sensibus* provides our general background for what came before (the case can be made that Aristotle himself used the work). Theophrastus distinguishes two main groups, the "by-likeness" theorists (Empedocles being the primary example), and the "by-contrary" group (Anaxagoras being the main adherent). Others (including Democritus) are not strictly members of either group. For skepticism regarding their account of these thinkers, see Sedley 1992, 26-31.

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is akin to it just as it is. Among pluralist thinkers, like-by-like theories of perceptual awareness would be in more developed forms.[2] These theories typically have perception occurring through effluences, aggregations of particles, coming off bodies and traveling to the perceiver. The particles or minuscule corpuscles emerging from bodies, being pieces of the bodies, are like them, and they are like the composition of animal bodies and sense organs. Aristotle denies, however, that like can simply act on its like, for what is quite like causes no change to another like it (see *De gen. et corr.* i 7); were the like simply to act on the like, the perceiver might just perceive itself, even its own sense organ (see *DA* ii 5.416b35-417a6). The pluralist, effluence theorists, perhaps also appreciating this, refined their account of perception.

With some facetiousness, Aristotle still calls these predecessors' views like-by-like accounts of perception. While this label might apply directly for monists, pluralists have the effluences giving only representational access to sensible objects. Effluence clouds emitted by bodies form in their aggregation an image, representation, or simulacrum of the body's configuration, magnitude, and motion. The simulacrum can simulate the sizes, shapes, motions, rests, and numbers of bodies to enable perceiving these. For explaining perception of colors, sounds, odors, flavors, and tangible features of a body, however, the effluences work differently. Not looking to aggregations of corpuscles, but instead to the size, shape, and motion of individual particles, they can account for sensible features by the way the individual corpuscles fit into commensurable pores or channels in sense organs.[3] As the corpuscle's size, shape, and motion accord with the pores, the body appears to have the perceived color and so on. Thus, such features not truly in the body, appear due to conformable quantitative features of individual corpuscles. The effluence theories attribute *all* perception to effluences, for perception of large-scale *quantitative* features of perceived bodies, i.e., magnitude, configuration, motion, and number, images are formed by aggregations of effluences, and for the *qualitative* features of bodies, color, odor, etc., by

2 Empedocles, says,

> For by earth we see earth, by water, water,
> By Aither divine Aither, and by fire, destructive fire,
> Yearning by yearning [Love] and strife by mournful strife. (DK 31B109, McKirahan trans.; see *DA* 404b13-15)

He also states that blood is thought (DK 31B105), probably because blood blends the elements, and he means blood enables perception and cognition of everything. Yet Empedocles has a still more complicated view, as suggested in Plato's *Meno* 76c-e.

3 Sound might be the exception, for this special sensible qualitative feature is due to the motions of aggregates of effluences. Yet, see Plato's *Meno* 76d8-e1.

appearances resulting from correspondence of the size, shape, and motion of individual corpuscles to pores in sense organs. The like-by-like account by effluences becomes a scheme of two patterns of representational appearances.

Aristotle develops his story of perception to salvage what he can from the like-by-like theories while overcoming their difficulties, especially dependence upon representation. In avoiding having like simply act on its like, he still strives for perceiving's getting to the sensible object just as it is. He accomplishes this by having the sensible object acting upon an unlike intermediary sense medium. This action imparts the sensible form to the sense medium. By the sense medium's taking on the sensible form of the sensible object, it in turn informs the sense organ and sense to move the sense to perceiving the object as it is. On this account, the unlike acts on what is initially unlike it, though like it in potentiality, to change it to be in actuality such as it is to cause perceiving (418a3-6). The sense becomes likened to the sensible object, taking on its form cognitionally to perceive it as it is. Thus, Aristotle has a more elegant way than the monists' way of having like perceive its like, for the like neither acts directly on its like, nor is there resort to representation by effluences, but he has the action of the sensible object's form upon the sense medium getting to the common sense power and soul as the cause for all perceiving.

In his account in *De anima* ii 6, Aristotle distinguishes sensible objects into proper, common, and accidental sensible objects. He focuses primarily upon the proper sensible object perceived in virtue of itself and uniquely by each of the five senses: color for vision, sound for hearing, odor for smell, flavor for taste, and tangible objects, such as hot, cold, wet, dry, hard, and soft, for touch. Common sensible objects—motion, rest, figure, magnitude, number—perceptible by multiple senses, are also perceptible in virtue of themselves. Nonetheless, they depend upon perception of proper sensible objects, since the common sensible objects accompany the proper sensible objects, as what is colored also has magnitude. Accidental sensible objects, that is, sensible bodies and their attributes other than their proper and common sensible objects, for instance, the person riding a larger horse than another person's horse, are only perceived by means of the proper and common sensible objects.

For Aristotle, perceivers perceive sensible objects as they are, because a sense medium conveys to the sense organ the action received from the sensible object, so that the sense power becomes just what sort the sensible object is by taking on its sensible form.[4] The sense medium, for all senses but touch, is

4 In *DA* i 5.409b23-410a26 Aristotle raises questions about all the variety of perceptible and knowable objects, and how the soul could be constructed of all these to be like all these to

primarily air or water unlike the sensible object. Air and water are initially unlike other bodies since they have no color, sound, odor, or flavor of their own, and usually only moderate and hardly perceptible tangible affections, especially for animals aways living within them. Moreover, the sense organs for the distance senses, the eye, ear, and nose, are also largely composed of air or water, yet with more complex composition than the sense medium (see *DA* iii 13).[5] As initially unlike the sensible object, the sense medium and sense organ are receptive to the action of sensible objects.[6] The medium and organ receive into their own matter the sensible form of the sensible object.[7] Yet, this material reception of the sensible form into the sense medium and organ is a non-standard alteration, for the medium and organ mostly lacking sensible affections of their own, do not have the previous sensible affection destroyed and replaced, as in a standard alteration (see *DA* ii 5.417b2-418a6). This non-standard alteration permits the action to be conveyed quite directly to the sense power residing in the central part of the animal and such that the sense power receives the sensible form without re-enmattering it, so that the sense power and soul, or more properly the animal, receptive to the sort of thing the sensible object is in actuality, is assimilated to it. Hence, the animal perceives the object truly.

Sense power is thus "that which is receptive to the sensible forms without the matter" (ἡ μὲν αἴσθησίς ἐστι τὸ δεκτικὸν τῶν αἰσθητῶν εἰδῶν ἄνευ τῆς ὕλης,

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perceive and know them on the effluence sorts of theories. Aristotle's alternative resort to sensible forms acting upon the sense apparatus gives the needed access to all that is perceptible to sense and knowable by mind's access to intelligible forms.

5 *De gen. et. corr.* ii 3.330b21-25 is clear that no sublunary body is purely of a single element. Hence, neither the medium nor the sense organ can be simply elemental. Yet, Corcilius and Gregoric 2013, 58 misleadingly say, "The peripheral sense organs of distance senses are homoiomerous parts made of a single element, such as water or air."

6 Most bodies undergoing qualitative change from a sensible affection have some quality already, e.g., some color or heat, and they have that color or heat replaced or altered in the process of change. But the sense medium and organ, largely air or water with limited sensible affections of their own, undergo non-standard alteration as they rapidly take on and convey what they take on, and then are similarly ready for rapidly undergoing further non-standard alterations. Such non-standard alteration permits them to pass on the sensible form to be perceived just as it is. We shall have much to say about non-standard alterations.

7 Though Plato coins the term for quality (ποιότης) and speaks of alteration in *Theaetetus* 181c-182e, in *De gen. et corr.* i 2.315a32-35 Aristotle says, "nor again did he [Plato] examine the conditions under which alteration or growth are attributable to things. In general, no one except Democritus has applied himself to any of these matters in a more than superficial way." Thus, alteration, crucial for the account of sense perception, has not been adequately discussed by any previous thinker, for Aristotle rejects Democritus' effluence theory. Aristotle's own strict account of alteration (ἀλλοίωσις), as motion in a sensible affection, see *Physics* vii 2-3.

DA ii 12.424a17-19) and perceives the sensible object. For this to occur, the sense medium and sense organ are also receptive to the sensible form without the matter, but in another way, for they receive the sensible form into their own matter. Aristotle states, "for the sense organ each is receptive to the sensible object without the matter; whence even the sensible objects having departed there are perceptions and *phantasiai* in the sense organs" (τὸ γὰρ αἰσθητήριον δεκτικὸν τοῦ αἰσθητοῦ ἄνευ τῆς ὕλης ἕκαστον· διὸ καὶ ἀπελθόντων τῶν αἰσθητῶν ἔνεισιν αἰσθήσεις καὶ φαντασίαι ἐν τοῖς αἰσθητηρίοις, *DA* iii 2.425b23-25). This explains that "perceptions and *phantasiai*" persist in the sense organs when the sensible objects no longer are present, for the sense medium and organ get the sensible form into their *own* matter. Their receptivity "without the matter" means without the matter or substratum in which the sensible form inheres, but they are receiving the sensible form into their own matter. Their reception is a material reception that may involve motion (*kinêsis*), namely, alteration, but as alteration of a non-standard sort. Their own matter having only limited quality or sensible affection of its own, they undergo non-standard alteration, which allows both for subsequent retention of sensible form and motion in the organ for *phantasia* and memory, and for rapidly undergoing further actions of other sensible forms.[8] In contrast with the sense medium and organ, the soul power perceiving is receptive to the sensible form without any re-enmattering of it whatsoever. This taking on of the sensible form cognitively without enmattering it is "alteration of a sort" (ἀλλοίωσίς τις, see *DA* ii 5.416b34-35), not strictly motion or alteration at all, but activity (*energeia*) always having its end in itself and complete at every moment. Perceiving is in fact activity.

When perceiving, taking on the sensible form, the animal perceives differences from itself and differences among its various sensible objects. Thus, sense is a critical and discriminative faculty with respect to its objects, not merely a presentational faculty as is *phantasia*.[9] By being likened to its sensible object in taking on its sensible form, the perceiving animal is also secondarily aware of

8 Aristotle does not have perceiving in virtue of itself by representation, but he does have the generation of perception set up motions in the sense organ that can be retained in potentiality to enable *phantasia*, which comes into play for memory, remembering, learning, dreaming, and so on. Thus, Aristotle maintains an important role for representational awareness.

9 Since sense power discriminates differences, the sense may not perceive what is too like it, as heat too close to the heat of the flesh—this is the "blindspot view" (see esp. *DA* ii 11.423b30-424a10). Flesh, which is the primary sense medium for touch—the sense organ being further within, i.e., the flesh and heart or its analogue—has more quality of its own than other sense media, which makes for the possibility of the "blindspot" to what has the same temperature or hardness as the flesh.

itself perceiving this object, having somehow become it perceptively or cognitively (see *DA* iii 2). Perceiving sensible differences without also attaining this accompanying awareness of its own perceiving, the animal's perceiving would do it little good, for it would be as if any other animal were perceiving rather than it itself. Any perception and discrimination that can serve the animal must also include this accompanying awareness of the animal's own perceiving. Of course, as there are different levels of focus on what is being perceived, e.g., the primary focus may be on one tree or one squirrel in the woods, so there will be different levels of awareness of the perceiving of the objects. With presentation by *phantasia* there is also self-awareness, but when sense perception is also in operation, a human can usually distinguish the presentation from perceiving.

Aristotle's emphasis on sense media's role in conveying to the sense the sensible object as it is, the perceptual discrimination of sensible differences, and the accompanying awareness of the perceiver's perceiving, all coheres with perceiving's being activity (*energeia*) always complete rather than merely motion (*kinêsis*). While in the sense organ there may be non-standard alteration involved in taking on the sensible form materially and its proceeding to the central and common sensorium, the heart or its analogue, sense-perceiving itself is activity of the animal discriminating perceptible objects, also with awareness of the perceiving of these objects. *All* perception occurs centrally by a common sense power, i.e., the soul—as first set forth in Plato's *Theaetetus* 184-186, the origin of all later discussion of central consciousness. This is clear in the *De anima* (especially iii 2) and in the *De sensu*, and subsequently in *De somno* 2.[10] Only if all sense perception occurs by a common sense capacity, which enters into complete activity at each moment when perceiving, can there be discrimination of multiple sensible objects at once and awareness of it, along with the deactivation of all the senses simultaneously together in sleep.

The *De anima*'s demarcation of the sensible objects perceived exclusively by each of the five senses and the common sensible objects derives from observation and reflection (*DA* ii 6). The *De anima* defends the sense media's role by using observable phenomena, such as bringing an object right up to the sense organ, the occlusion of the sense medium canceling any possible perception. It also

10 Feola 2018, esp. 51-53 supposes that *De anima* iii 2 has each proper sense perceiving its object and aware of itself, rather than all perceiving, discriminating, and self-awareness occurring together in a common and central sensorium, which is an innovation of the *Parva naturalia* (see also Gregoric 2007 and 2020b, 4-5). We disagree with some of this, for we hold that discrimination of sensible objects in *DA* iii 2 requires the point-like unified sense power proposed there, and so Aristotle's understanding of sense perception in the *DA* and *PN* undergoes no doctrinal change.

employs imagined phenomena, such as an ant in heaven that should supposedly be visible were effluences unobstructed by the void reaching the eye (see 419a15-17). Initial explication and justification of the sense medium can utilize observation and reasoning. Yet determining just what each sensible object is for having the power to act on the sense, as his account of the audible in the *De anima*, cannot be directly observed. Aristotle has spoken of sound as motions set up in the air, a friable yet unifiable medium (see *DA* ii 8.419b34-420a5 and 420a21-b4). When the *De sensu* undertakes the task for other sensible objects, he will similarly have to go beyond direct and simple observation. By elaboration on the sense medium, he determines what power the sensible object needs to act upon the medium. This emphasis on sense media and sensible objects capable to move them defends his approach to sense perception and attacks effluences favored by predecessors. Whereas the effluence theories have traveling corpuscles as simulacra of quantitative features of bodies, i.e., representations, and representational fitting of shapes, sizes, and motions in openings to explain qualitative features, Aristotle ascertains the sensible object's power by considering what it must be to act upon the sense medium and organ to cause the object to be perceived as it is.

When in chapters 3-5 Aristotle discusses color, flavor, and odor, what gives the power to the sensible object to move the sense medium and sense organ is that the sensible object is just the sensible form, which in some cases is a mixture with the sense medium, in something rather like the sense medium. For instance, he thinks all body is more-or-less transparent. Color, then, is the limit or form a bounded body takes on of its greater-or-lesser transparency. Hence, the color, as a form inhering in more-or-less transparent body, is ready to act upon an illumined transparent expanse, the sense medium. For flavor, a body's nutritious dryness washed off by moisture, i.e., the sense medium, as an animal's saliva, mixes with the moisture to form the sensible object flavor ready to act upon the moistened tongue. Odor results when a body's enflavored dryness washed off by air or moisture mixes with the fluid to form the sensible object odor, which then acts upon the sense medium to convey odor to the animal. And *De anima* ii 8 has already explained sound as arising from collisions of bodies in air or water, setting up motions for sound in the air or water, which then acts on air or water holding together adequately to convey sound through the medium to the sense organ for perception.[11] The tangible objects hot or cold and wet or dry are already

11 He likely in *DA* ii 8 gives special treatment for audibles since they arise by collision of bodies rather than being in a single body, and hence they may seem to be the result of effluences and not perceived truly as the other proper sensible objects. For Aristotle sound is a kind of motion in air or water, thus also a formation involving the sense medium, which then further acts for its

involved in constituting fire, air, water, earth, and any bodies derived from these, so that tangible affections can well act on the flesh as sense medium. That *all* the proper sensible objects have their sense medium in their very formation, while also unlike it, explains for Aristotle why the sensible form can then act upon the sense medium and sense organ. Rather than effluences wafting through void or an indifferent intermediary, he has a quite receptive sense medium doing significant work in constituting and then conveying the sensible object. Perception derives not entirely as representation, then, but by the sensible form acting on the sense medium and organ, so that they take on the form materially, with their passing along the form immaterially to the sense to cause the animal's perceiving the sensible object as it is.

De sensu 1 introduces the project of the entire series of treatises of the *Parva naturalia* and starts to speak of perception's purposes, pointing to some differences among the senses, the key role of the soul and sense medium in perception, and nature's working for an end, all conflicting with materialist effluence theories. Chapter 2 rejects the way predecessors assign the four elemental bodies to the sense organs for the five senses, which would favor the effluence theories, like-by-like thinking, and remove the need for a sense medium. Aristotle declines this approach to defend his view of sense media. Chapters 3-5 work out what the sensible objects, color, flavor, and odor, are. These objects' formations involve their very sense medium, so that they can in turn move the sense medium and animal to perceive them as they are, no effluences needed. Chapters 6-7 support the unlimited divisibility of both the sensible objects themselves and of their perceptions, to counter effluence theories' indivisible minuscule corpuscles and temporal units, strongly debunking effluences and maintaining the soul's role in the discriminative and self-aware activity of perceiving. The *De sensu* maintains a consistent and comprehensive attack on effluence theories.

The care Aristotle takes with the variety of arguments about sensible objects and effluence theories prevents our supposing him so locked into theories, that he has not closely considered how he can make the most compelling case possible for the positions he develops. If some of his arguments can seem to us questionable or unsatisfactory, they are quite strong against his opponents. This may occur more here than in the *De anima* because Aristotle gets more specific, makes more inferences, and appeals to his views on the elemental bodies, which we

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transmittal on the sense medium and sense organ. Sound's account prefigures the accounts of the other proper sensible objects in *De sensu* 3-5. The sensible object acts on the medium, since to an extent unlike it, yet the object has the medium in its very formation, so the medium is quite prepared to receive the action of the sensible object.

have in our time greatly complicated. Yet perhaps his arguments, generally effective against his predecessors while seeming problematic to us, may still have some lessons for us in accounting for sense perception. The way he insists that sense-perceiving is discriminative activity and self-aware seems important for any adequate understanding of sense perception. His sophistication can be seen in the distinctions he makes between arguments that he considers decisive and those he presents merely as reasonable. He acknowledges, by his offering multiple arguments, that none by itself makes a fully demonstrative case, though each by itself is compelling and in conjunction with all the others the position becomes upheld, which he often points out is reasonable (*eulogon*) and hence extremely convincing.

Chapter 1

The *De sensu* opens by positioning itself in relation to the *De anima* and preparing the trajectory that will carry through this treatise and then the rest of the *Parva naturalia* (436a1-6). As with many of his treatises' introductions, however, he speaks quite succinctly. This seems a strategy to entice through provoking some perplexity.

> Since it has been determined previously concerning soul in virtue of itself and concerning each of its parts' powers, continuing is to make the investigation concerning the living beings, i.e., all the things that have life, which of their actions are proper and which are common.[12] Let the things having been said concerning soul be assumed, and let us speak concerning what remains, and first concerning the first things. (436a1-6)

436a1 ἐπεὶ δὲ περὶ ψυχῆς καθ' αὐτὴν διώρισται πρότερον καὶ περὶ τῶν δυνάμεων ἑκάστης κατὰ μόριον αὐτῆς, ἐχόμενόν ἐστι ποιήσασθαι τὴν ἐπίσκεψιν περὶ τῶν ζῴων καὶ τῶν ζωὴν ἐχόντων ἁπάντων, τίνες εἰσὶν ἴδιαι καὶ τίνες κοιναὶ πράξεις αὐ-
a5 τῶν. τὰ μὲν οὖν εἰρημένα περὶ ψυχῆς ὑποκείσθω, περὶ δὲ τῶν λοιπῶν λέγωμεν, καὶ πρῶτον περὶ τῶν πρώτων.

12 We have translated περὶ τῶν ζῴων καὶ τῶν ζωὴν ἐχόντων ἁπάντων as "concerning the living beings, i.e., all the things that have life", but also quite possible is this translation, "concerning animals and all of the things having life". *Zôon* can mean 'living being' generally or more narrowly 'animal', and the *kai* can be 'and' or be used epexegetically. On either translation, this introduction to the series of treatises of the *Parva naturalia* prepares us to consider what pertains to animals, while also getting to plants, though "living beings" may include plants, animals, heavens, and gods.

That the *De anima* considered the soul "previously" (πρότερον) means little for the actual order of composition of the treatises but points to the obvious order of dependence. The treatises following the *De anima* will depend on what is determined there. The *De anima* concerns soul, so the subsequent treatises will probably be limited to ensouled beings, i.e., excluding heavens and gods. Without nutritive power and alteration, since not needing these, the heavens and divine beings are not ensouled. The *De anima* has explicated soul *in virtue of itself*, i.e., the essence of soul, and the powers of the soul according to each of its own parts. The soul's *parts* are at least the nutritive, perceptive, and intellective parts. Deriving from these are all other *powers* of the soul.[13] The *De anima*, after defining the soul, deals with nutrition, perception, *phantasia*, intellection, and progressive motion. The soul's parts—nutritive, perceptive, and intellective—account for the power of *phantasia* and progressive motion, and any other possible soul powers. Were the concern with all living beings, and not just ensouled beings, intellection and progressive motion may extend to the heavenly beings, but these lack the nutritive part needed by ensouled beings. Regarding the ensouled beings, some soul parts and powers may be proper only to some ensouled beings, e.g., perception and maybe *phantasia* to all animals, and intellection proper to humans, while nutrition is common to all ensouled beings. A further way in which the *De anima* explores the soul in virtue of itself is only attending to the body where this is inescapable, and therefore to the extent possible only dealing with the soul in virtue of itself. The following treatises, however, bring the body more prominently into consideration, thus adding to what is covered in the *De anima*.[14]

Since, the *De anima* treats the parts and major powers of the soul, what remains for the *Parva naturalia*? He indicates that what remains are whatever powers these parts enable and the "actions" (πράξεις) of the various powers, some

13 Corcilius and Gregoric 2010 explain that the four principal powers are the nutritive, sensitive, intellective, and locomotive powers. The nutritive, sensitive, and intellective powers are the three *parts* of soul separable in definition, since each can be defined without dependence on any other part, whereas accounting for the locomotive power must bring in desire, and consequently both perception and intellection. As indefinable without these other parts, the locomotive power is not a distinct part of the soul. (We agree with them about this, but not with their supposing that eternal living beings have a soul.) While the nutritive, sensitive, and intellective parts are separable in definition, the nutritive, sensitive, and locomotive powers are inseparable in magnitude, because located in the heart or its analogue, but the intellective part has no such connection with a body part.

14 The clear dependence of the *PN* on the *DA* in investigating what is "common to soul and body" (436a7-8) was unwelcome to interpreters in late antiquity, see 37n49 above.

proper and some common.[15] Actions are presumably the utilizations of one or another of the powers. Some of these actions will be proper, as respiration applies to only a certain group of animals, while some nutritive actions apply in common to all ensouled beings. It might also be the case that some actions are proper only to the soul, whereas others are common to soul and body.[16]

Having set up the contrast of what is proper or peculiar and what is common, Aristotle indicates that the continuing investigation should first deal with what is first. Since there are many senses of "first", he must specify which he means. We expect that what is common takes priority over what is proper merely to some living beings. What is most common to mortal living beings, is nutritive power. Nevertheless, what Aristotle aims to begin exploring is what follows from the perceptive power. Hence, he perhaps said that the continuation investigates concerning the *animals* and all things having life. He still may have us wondering whether he first speaks of animals or all living beings, but it soon becomes clear that he begins with animals, and only in subsequent treatises considers mortal living beings more widely. This accords with our account of the entire chiastic, ring trajectory of investigation in the *De anima* and the *Parva naturalia*.

The continuation indicates that what he takes to be "first" pertains most obviously to animals, for every action that he initially lists as shared by both soul and body, concerns sense perception; yet, among the four pairs subsequently mentioned some also apply to plants (436a6-12).

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15 Though in the context of practical science only humans have choice and action (*praxis*, see *NE* iii 2), in various theoretical contexts action is extended much more widely, see, e.g., *DC* 292b1-2, *DA* 415a16-20, *Meta.* ix 6.1048b18-23, and frequently in the works on animals.

16 Thinking might be proper merely to soul, while perception pertains in common to soul and body. In addition, *common* (κοινόν) tends to mean, for Aristotle, on the same level through an entire genus, whereas *universal* (καθόλου) may mean on any level and perhaps for more than a single genus. What applies to all living beings rather than just ensouled beings, e.g., having life, might then be universal, while perception is *common* to the entire mortal animal genus. What is *proper* (ἴδιον) may be for some subset of a genus, e.g., recollection is proper to human animals. Or proper can mean what is done by some part of the soul itself without the body, as intellect may operate without a bodily organ. Aristotle also speaks of what is *common* to soul and body, which indicates that he treats soul and body as closely unified. Hence "common" might mean doing things cooperatively, as Morel 2005, 122 says, "*koinos* can also mean a state or a movement which implies correlatively to the two entities…an operation that they perform together."

> The greatest, whether common to all or proper to some of the living beings (τῶν ζῴων), are manifestly things common to soul and body, e.g., perception and memory and spiritedness and appetite and generally desire, and in addition to these pleasure and pain; for indeed these belong to nearly all the animals (τοῖς ζῴοις). And there are in addition to these certain others, of which some are common to all things participating in life, while others are common to some of the living beings/animals (τῶν ζῴων). (436a6-12)

436a6 φαίνεται δὲ τὰ μέγιστα, καὶ τὰ κοινὰ καὶ τὰ ἴδια τῶν ζῴων, κοινὰ τῆς τε ψυχῆς ὄντα καὶ τοῦ σώματος, οἷον αἴσθησις καὶ μνήμη καὶ θυμὸς καὶ ἐπιθυμία καὶ ὅλως ὄρεξις, καὶ πρὸς a10 τούτοις ἡδονὴ καὶ λύπη·καὶ γὰρ ταῦτα σχεδὸν ὑπάρχει πᾶσι τοῖς ζῴοις. πρὸς δὲ τούτοις τὰ μὲν πάντων ἐστὶ τῶν μετεχόντων ζωῆς κοινά, τὰ δὲ τῶν ζῴων ἐνίοις.

The "greatest", whether powers or their operations, seem greatest as involving soul and body, which sense perception surely does.[17] The items initially mentioned, "perception and memory and spiritedness and appetite and generally desire, and in addition to these pleasure and pain", besides being readily agreed to be common to soul and body, summarize the opening treatises of the *Parva naturalia*, including the *De motu*.[18] Memory and spiritedness, among these, are perhaps proper to some animals rather than common to all (see *Meta.* i 1.980a29 for the suggestion that not all animals have memory). Nonetheless, these can all be included among the

17 Since the soul is an *unmoved mover*, only moved accidentally along with the body when an animal engages in some motion or a plant grows, what being "common to soul and body" means is that a power or operation strictly belongs to the plant or animal rather than its soul. The soul is an unmoved mover or principle, for the plant or animal performs any action or operation caused by the soul. The actions of a mortal living being *as a mortal living being* will be common to soul and body (see *DA* i 4.408b11-18). Hence, "greatest" need not be restricted to animals, but pertains rather to what is common to soul and body, for soon Aristotle includes youth and agedness and life and death among the greatest. "Greatest" must then be common to body and soul, and somehow first. We shall see that they are "first" and "greatest" in following from the main powers, i.e., nutrition and perception, and being most revealing about what is common to soul and body. We might have expected the "greatest" capacity to be the intellective. But "greatest" can mean widest in extension, as may "belong to nearly all the animals".

18 His overall list interestingly has perception, pertaining to the present, memory to the past, and desire to the future, with pleasure and pain perhaps involved in any of these. Moreover, the order partly reflects the order of treatment of the *Parva naturalia*, for his first two, perception and then memory, relate to the sensitive part, followed by anger, appetite, and desire, which relate to the locomotive part, pertinent to the *De motu* (cf. Aquinas 2005, 18-19 and Bolotin 2021, 141n39). Two of the sorts of desires Aristotle recognizes, appetite (*epithumia*) and spiritedness (anger, *thumos*), are here mentioned, with wish (*boulêsis*) belonging peculiarly to humans deliberately excluded (see the full list in *DA* 414b1-6). Appetite and spiritedness are borrowed from Plato.

greatest capacities and operations pertinent to animals, since they either are sense perception or direct results of it, while sense perception is essential for being an animal. Aristotle interestingly juxtaposes meanings of "common": common meaning shared by all animals or mortal living beings (in contrast with what belongs properly only to some) and common in the sense of shared by soul and body (rather than proper to either body or soul alone).[19]

One reason for this wordplay with "common" and "greatest" is Aristotle's hinting that he will not be focusing within the rest of the treatises on the human intellectual capacity, which is questionably common to body and soul. Intellection may be the one power that is either proper to soul apart from body, or perhaps intellect is not even a power of soul.[20] Of course intellection only takes place in humans in conjunction with *phantasia*, and therefore has connection with and presupposes the body. Yet thinking in virtue of itself does not have such connection, for instance the thinking of thinking of the prime mover has no bodily connection. Thus, no additional treatises in the *Parva naturalia* are required to work out further faculties following from intellection, as the treatises work out further faculties following from sense perception. Two exceptions appear, however, the treatment of recollection and of divination by dreams. Only humans can recollect, and only they can attempt to foretell the future from dreams; yet each of these merely applies intellect to what the perceptive part delivers. Hence, by starting with the greatest things *in common to body and soul in animals*, the *Parva naturalia* begins with the powers following from sense perception.

Another reason for the juxtaposition of common to body and soul with common to all animals or mortal living beings in contrast with proper to some, is that the two senses of common permit Aristotle to hint at the fuller field of this series of treatises. There are capacities and operations in addition to those mentioned as belonging to animals, which by being common to soul and body, are broadly common to all mortal living beings, that is, both plants and animals.

Now Aristotle specifies four pairs, which cover what enters the entirety of the *Parva naturalia* (436a12-b1; cf. *DA* iii 9.432b7-13). When we shall have gone through the treatises, we can retrospectively recognize how these four pairs govern his coming treatment, though his initial announcement should provoke

19 There is some connection of these meanings of "common": actions not so obviously common to soul and body, e.g., thinking, are not common to many animals. There will be a further use of "common" in 1.437a8-9 to refer to the "common sensible objects".

20 The phrasing in *DA* 413b24-27 opens the possibility that mind is not strictly a power or part of the soul (cf. 402b1-3, 411a26-b19, 432a15-b7). Regarding wordplay, Aristotle, while indicating the contents of the coming series of treatises, speaks somewhat confusingly to perplex the auditor or reader to provoke interest, open-mindedness, and close attention.

perplexity about the way these are "greatest" and why just these four. His previous summary left being awake or asleep (and dreaming) unmentioned to save them for "the greatest…four pairs", where they can cover everything deriving from perception, so that the greatest four pairs, "waking and sleeping, youth and old age, inhalation and exhalation, and life and death", encompass all that is investigated in the *Parva naturalia* (*DA* iii 9.432b11-13 explicitly mentions the pairs inhalation-exhalation and sleeping-waking for subsequent treatment).

> The greatest of these occur in four pairs, viz., waking and sleeping, and youth and old age, and inhalation and exhalation, and life and death; one ought to consider concerning them, both what each of them is, and on account of causes they happen. And it belongs to the natural scientist to see the first principles of health and disease; for neither health nor disease can arise for things deprived of life. Hence, most of the students of nature, and the more philosophical physicians pursuing their art, some complete their work going into things concerning medicine, the others begin from things concerning nature. (436a12-b1)

436a12 τυγχάνουσι δὲ τούτων τὰ μέγιστα τέτταρες οὖσαι συζυγίαι τὸν ἀριθμόν, οἷον ἐγρήγορσις καὶ ὕπνος, καὶ νεότης καὶ γῆρας, καὶ ἀναπνοὴ καὶ ἐκπνοή, καὶ ζωὴ καὶ θάνατος· περὶ ὧν θεωρητέον, τί τε ἕκαστον αὐτῶν, καὶ διὰ τίνας αἰτίας συμβαίνει. φυσικοῦ δὲ καὶ περὶ ὑγιείας καὶ νόσου τὰς πρώτας ἰδεῖν ἀρχάς· οὔτε γὰρ ὑγίειαν οὔτε νόσον οἷόν τε γίγνεσθαι τοῖς ἐστερημένοις ζωῆς. διὸ σχεδὸν τῶν περὶ φύσεως οἱ πλεῖστοι καὶ τῶν ἰατρῶν οἱ φιλοσοφωτέρως τὴν τέχνην μετιόντες, οἱ μὲν τελευτῶσιν εἰς τὰ περὶ ἰατρικῆς, 436b1 οἱ δ' ἐκ τῶν περὶ φύσεως ἄρχονται [περὶ τῆς ἰατρικῆς].

The greatest four pairs are common to body and soul, and they are perhaps greatest for our understanding of what is thus common (cf. *PA* i 1.639a15-23). Waking and sleeping pertain to soul and body, and these can cover all that he previously mentioned, if they derive from animal perception. Bringing up sleep points to this remarkable consequence of perception, and some of the treatises will be devoted to sleep and the striking phenomenon of dreaming. Youth and old age are clearly pairs common to body and soul, but in *all* mortal living beings including plants as well as animals (and obviously not eternal living beings). Inhalation and exhalation, again common to soul and body, may pertain just to animals, but in fact these apply only to some of the animals, though Aristotle's predecessors were hardly clear about this (see, e.g., *DA* 410b27-411a2). He could speak collectively of respiration (ἀναπνοή), but he instead refers to both inhalation and exhalation (καὶ ἀναπνοὴ καὶ ἐκπνοή) to have a pair, and so his four pairs. With life and death, he arrives at the most encompassing and greatest pair, those common to body

and soul of all mortal living beings (surely not eternal living beings), for they are the action or lack of action of the nutritive power.

The order of presentation of the four pairs is telling for the coming treatises. Waking and sleeping, actions sense perception entails for animals, dominate the initial treatises. The *De sensu*, *De memoria*, *De somno*, *De insomniis*, *De divinatione*, and *De motu* all deal with operations and capacities deriving from sense perception. Inhalation and exhalation are also among the animal motions mentioned in the *De motu* (see 4.700a21-24 and 11.703b8-11). The *De motu* may in fact deal with the self-motion of all ensouled beings including plants, in this way illuminating the motion both of cognitive operations and of nutritive life. This would then prepare for turning to nutritive life common to all mortal living beings. Three of the four pairs may refer to the final treatises in the series. Nutritive life has a youthful stage, and if things go well, advanced age, so Aristotle will examine youth and age in *De longitudine*. Since this mortal life requires maintenance of vital heat, death occurring with heat cessation, some animals sustain heat with respiration, and Aristotle considers inhalation and exhalation and life and death in *De juventute*. Respiration receives special attention, because the most honorable animals have this, and this rhythmic, perpetual action that his predecessors have such difficulty explaining, is perhaps surprisingly most revealing about nutritive life generally and emphasizes his own scientific achievement and reliability.[21] This fills in much with regard to the digestive part of nutrition and the action of the most crucial bodily organ of all, the heart.[22] If he can explain the really hard case of respiration, the accounts of nutritive life for the other animals and plants can be supplied by analogy. He consequently has an adequate and compelling account of life and death.

The four pairs are greatest, then, as we may appreciate retrospectively, in following from two of the soul's parts, perception and nutrition, and providing the most understanding of what is common to soul and body. This significance of the four pairs and their arrangement being at first unclear, he entices by the initial perplexity. What will eventually be understood is that all the operations he considers, cognition and self-motion and maintaining the nutritive life, are unified in the heart

21 Perplexity regarding the causes of sleeping and waking and dreaming and respiration (see *DA* iii 9.432b12-13 regarding the *aporia* they foster) has Aristotle tending to focus upon humans as the hardest cases, with the others being explicable by analogy. Thus, he takes us to what is most intelligible for us and contributes most to self-knowledge, and about what is otherwise difficult for us to understand.

22 Since for Aristotle the mind has no bodily organ or definite location, Eijk 2005, 130 claims, "For this reason it is, strictly speaking, not correct to attribute a cardiocentric view on the mind to Aristotle, as has frequently been done both in antiquity and in modern literature."

or its analogue in animals or the nodes of plants. The soul may have parts and various powers, but these tend to come together in a centralized location to coordinate actions. Moreover, in clarifying these four pairs, he elucidates fully the criteria of ensouled beings specified in *De anima* i 2, perception and motion.

Concerning his greatest four pairs, Aristotle says one ought to consider what each of them is and on account of what causes they occur (436a16-17). This is an abbreviated suggestion of the several kinds of causes that he seeks. What each is gives its definition and form, while on account of what causes can include the underlying matter or substratum, moving cause, and that for the sake of which they occur. Thus, all four causes may enter into the coming investigations. Since he studies actions common to soul and body, the *Parva naturalia* stays within natural science even more consistently than the *De anima*, where investigation of thinking and intellect may go beyond what strictly has bodily organ and involves some motion.

Though the four pairs keep the investigation within natural science, the natural scientist studying these might well also touch on some of the principles of health and disease, which pertain to medical science. The physicist does not inquire into these to produce cures, however, as does the doctor, for theoretical science pursues knowledge for its own sake. But insofar as nature is a principle of mortal life, and only such living beings have health and disease, the principles of health and disease will enter the study of nature (436a17-b1; cf. 464b32-33 and 480b22-30). Consequently, Aristotle observes that most of the natural scientists and the doctors more philosophically pursuing their art get into each other's terrain. We should hardly be surprised, then, that he will occasionally refer to matters of concern to physicians and even sometimes appeal to medical theories in developing his investigations, since the more sophisticated physicians have utilized natural principles in their causal accounts. Clearly, Aristotle is attentive to medical investigation and literature of his time and borrowing from it, and also likely having some influence on it.

Yet, if Aristotle uses some results from contemporaries in the medical tradition, need this involve a problematic breakdown of the division of the sciences, such that productive science and theoretical science become indistinguishable? It is unlikely that the most fundamental principles of physics, e.g., nature, motion, place, and the infinite, come directly into play in the science of medicine, but perhaps some natural principles, such as about kinds of motion and about heat and cold serve as causes of health, disease, life, and death, important for the medical art.[23] Medicine might just take such natural principles as assumptions

23 Ross 1955, 184 instead proposes that what Aristotle has in mind for the connection of the sciences is the way that *Post. An.* 79a13-16 exemplifies geometry helping solve the medical

from which they derive medical results. Medicine thereby remains a productive art, aiming to produce health. Aristotle's defense here of mutual borrowing may be a reply to the attack on the use of philosophy in medicine in the Hippocratic *On Ancient Medicine*.[24]

Need all the notions that Aristotle has mentioned involve both soul and body (436b1-8). For example, does memory or respiration or death? Whichever connects closely enough with sense perception, which requires soul and body, will involve both. All the notions mentioned, perception, memory, desire, pleasure, pain, waking, sleep, youth, age, inhalation, exhalation, life, death, health, and disease, can be linked with perception in various possible ways to associate them with soul and body. Youth, agedness, health, disease, and death, however, also belong to plants, lacking perception, as well as animals. Still, anything connecting with nutrition will also involve soul and body.

> That all the things having been said are common to both the soul and the body is not unclear. For they all happen, some with perception and some through perception, some being affections of this, some states, some safeguards and savings, some destructions and privations; that perception arises through the body to the soul is clear both through argument and apart from argument. (436b1-8)

436b1 ὅτι
δὲ πάντα τὰ λεχθέντα κοινὰ τῆς τε ψυχῆς ἐστὶ καὶ τοῦ σώματος, οὐκ ἄδηλον. πάντα γὰρ τὰ μὲν μετ' αἰσθήσεως συμβαίνει, τὰ δὲ δι' αἰσθήσεως, ἔνια δὲ τὰ μὲν πάθη ταύτης
b5 ὄντα τυγχάνει, τὰ δ' ἕξεις, τὰ δὲ φυλακαὶ καὶ σωτη-

question why circular wounds heal slowest. But Aristotle envisions here in the *De sensu* a more direct and broad way in which medicine employs some results of natural science, though without jeopardizing the distinction of the sciences. On the connection of Aristotle with the medical tradition, see Eijk 2005, 8: "Indeed, my own interests in ancient medicine were first raised when I was studying Aristotle's *Parva naturalia* and came to realize that our understanding of his treatment of phenomena such as sleep, dreams, memory and respiration can be significantly enhanced when placing it against the background of medical literature of the fifth and fourth centuries. Fifteen years later the relevance of Greek medicine to the study of ancient philosophy is much more widely appreciated, not only by historians of science and medicine but also by students of philosophy in a more narrow sense." We observe that the connection of natural science and medicine enters early in this treatise and returns at the end of the whole series of treatises, a nice instance of a deliberate ring.

24 The issue of the possible overlapping of sciences goes beyond medicine in these treatises. He will at times refer to mirrors and possible motions of light. Is he then dealing with the science of optics, what Aristotle calls a "mixed science", in which natural phenomena get treated as mathematical entities? He also explores whether there can be a science of divination. When he deals with practical syllogisms and voluntary motion in the *De motu* need he be turning to ethics?

436b6 ρίαι, τὰ δὲ φθοραὶ καὶ στερήσεις· ἡ δ' αἴσθησις ὅτι διὰ σώματος γίγνεται τῇ ψυχῇ, δῆλον καὶ διὰ τοῦ λόγου καὶ
b8 τοῦ λόγου χωρίς.

Perception, waking, pleasure, and pain are obviously "with sense perception" (μετ' αἰσθήσεως) because they coincide with it, while health and disease may be with perception as impacting upon it, and youth and age are perhaps "with perception" since the condition of sense perception determines youth and age, e.g., the elderly animal may lose significant sense power. Sleep is one of the "affections" (πάθη) of perception and maybe also a state or disposition (ἕξις) of perceptive power. Safeguards (φυλακαί) and savings (σωτηρίαι) of sense can be memory, and in another way sleep, respiration, and health. Also memory and desire can be "through perception" (δι' αἰσθήσεως). Destructions (φθοραί) and privations (στερήσεις) of sense are death, disease, and sleep.[25] What matters for the argument, more than the exact allocation, is that these all closely connect with sensitive life, at least for animals, and that perception arises by some conjunction and cooperation of soul and body.

That perception arises to the soul through the body is said to be clear "through argument and apart from argument". We shall see reason to suppose that "through the body" does not mean as a fluid goes through a pipe leaving the pipe unaffected, for Aristotle will be arguing that the sense organs are affected by sensible objects. The argumentative case, as in *De anima* ii 7, will look to the role of the sense medium as required to move the sense organ to cause perception, and that the sense must lie in a mean unavailable to non-ensouled bodies or even plants (*DA* ii 11-12). Also, there will be appeal to motions in the sense organs, such as afterimages. Nevertheless, it is the animal, the composite being, that perceives, rather than just the soul (i 4.408a34-b18). Even without argument, we readily observe that closing off a bodily sense organ, such as holding our breath, prevents perception by smell. The senses of vision and smell have natural "coverings" in some animals, eyelids and respiration (421b13-422a6), so perception definitely and manifestly involves the body along with soul.

Besides preparing for all the subsequent treatises that consider what is "common to both the soul and the body", Aristotle's case that perception includes

25 Alexander of Aphrodisias *In de sensu* 7.17-8.4 allocates these thus: waking, pleasure, pain, health, and disease are with perception; youth and age are through perception; sleep is a *pathos* of perception; perception is the having of the senses; memories and recollections are safeguardings and savings of perception; forgetting and death are destructions and privations of perception. For a fuller account of the allocation, see Morel 2005, 126-130, 133, and Roreitner forthcoming.

both, and therefore definitely the soul, starts to pose difficulties for like-by-like effluence theories, for their tendency is to leave soul's participation in perception unclarified. Such theories aim to account for perception in terms of images of effluences and the mobile, corpuscles from which they are composed fitting into commensurable pores in the perceiver, minimizing much else in play, except perhaps a corpuscular soul somehow acting as a homunculus. Directing attention to soul challenges the opponents' representational, materialist, physicalist, and reductionist accounts. The treatise emphasizes the soul in chapter 1 (436a1, a5, a8, b2, b7), chapter 2 (438b8), and chapter 7 (447b7, b24, 448b21, b27, 449a6, a9, a14, a17), while also referring to the *De anima* as "in the things concerning the soul" (ἐν τοῖς περὶ ψυχῆς, 436b10, b14-15, 439a8, a16, 440b28). Thus, the soul's role is stressed in the treatise's beginning and end, along with the references to the *De anima*, and in chapter 2's mention, which contends that perception occurs within rather than on the sense organ's surface. This all fits with this treatise's own ring composition, along with the occlusion of soul in the effluence theories' reductive accounts of perception, in their concentration on traveling corpuscles and sense organs. The opening and closing sections of the treatise, with their frequent references to the *De anima*, remind us of the place of soul in any adequate account of perception, despite its seeming dismissal by those favoring effluences.

Having introduced the entire series of treatises of the *Parva naturalia*, the *De sensu* begins to focus on its own concerns (436b8-10). The rest of chapter 1 considers the contributions of the senses to animal life.[26] The *De anima* has already explained what sense perception is through its causal account, some of which has regard for the purpose of perception in animal life, and here Aristotle will restate and expand some of this. Taking natural purpose seriously may discomfort materialist theories.

> But concerning perception and perceiving, what it is and on account of what this affection happens for the animals has been said before in the discourses concerning the soul. (436b8-10)

436b8 ἀλλὰ περὶ μὲν αἰσθήσεως καὶ τοῦ αἰσθά-
νεσθαι, τί ἐστι καὶ διὰ τί συμβαίνει τοῖς ζῴοις τοῦτο τὸ
b10 πάθος, εἴρηται πρότερον ἐν τοῖς περὶ ψυχῆς.

The "discourses concerning the soul" are clearly the *De anima*. The power of sense perception is there defined twice, first in ii 5.418a3-6: "What is perceptive is in

26 Though current chapter divisions in Aristotle only go back to the Renaissance or Middle Ages, they are generally helpful in grouping parts of the text.

potentiality of the sort that the perceptible thing already is in actuality, as has been stated. It is affected, then, when it is not like, but, having been affected, it has become likened and is what sort that is." (τὸ δ' αἰσθητικὸν δυνάμει ἐστὶν οἷον τὸ αἰσθητὸν ἤδη ἐντελεχείᾳ, καθάπερ εἴρηται. πάσχει μὲν οὖν οὐχ ὅμοιον ὄν, πεπονθὸς δ' ὡμοίωται καὶ ἔστιν οἷον ἐκεῖνο.) The second account is ii 12.424a17-19: "Universally concerning every sense, one ought to grasp that sense is what is receptive to sensible forms without the matter" (καθόλου δὲ περὶ πάσης αἰσθήσεως δεῖ λαβεῖν ὅτι ἡ μὲν αἴσθησίς ἐστι τὸ δεκτικὸν τῶν αἰσθητῶν εἰδῶν ἄνευ τῆς ὕλης).[27] These definitions say "what" sense is and "on account of what" sense occurs (cf. 436a16-17). It occurs on account of the sensible object and the sensory apparatus.[28] The sensible object moves the animal to perceive it, by way of medium and organ, because the sense can become what sort of thing the sensible object is, that is, the sensible form without reenmattering it. The formal cause is the receptivity to the sensible object, the moving cause is the sensible object, the sense organ is the soul's material instrument, with the final cause of perception being the very discriminative activity itself, which provides awareness, directs animal locomotion, secures nourishment, and so on. *De anima* iii 13.435b17-25 has the contact senses supporting life itself, while the distance senses are for safety and living well. Perceiving is called an *affection* (πάθος), for it is passive insofar as the sensible object moves the animal to perceive, but active insofar as sensing is discriminative and requires being awake and attentive (cf. Miller 1999, esp. 203-204).

Why does Aristotle now spend time on the purposes of the senses, since it partly repeats what was said in the *De anima*? As indicated, emphasizing perception's involving soul along with body sets up difficulty for effluence theories. And concern with purpose reinforces the importance of soul, the soul being the very nature of the mortal living being, which employs the natural purposes of the senses. We further suggest that stressing significant differences in the senses contrasts with the like-by-like theories, which have all the senses functioning quite similarly through configurations of effluences and their minuscule corpuscles. This beginning chapter, then, prepares for the entire treatise's attack on effluence theories.

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27 See on these, Polansky 2007, 246-249 and 338-349. The account of sense power in *DA* ii 5 is "common" since it applies to each of the five senses, while that in *DA* ii 12 is "universal" since it might apply to the various meanings of *aisthêsis*, including sense power and the sense organ.

28 Ross 1955, 185 unnecessarily restricts the "account of what" of 436b9 to final cause. Though Aristotle clearly discusses the ends of the various senses, *dia ti* may refer to any of the four sorts of causes.

All animals as animals have perception, which distinguishes animals among mortal living beings (436b10-18).

> For the animals in which way each is an animal, it is necessary that perception belongs; for by this we distinguish the animal and not-animal. To all [being animals] it follows already from necessity proper to each touch and taste, touch on account of the cause said in the *De anima*, and taste on account of nutrition; for it discriminates the pleasant and the painful concerning its nutriment, so that it flees the one and pursues the other, and generally flavor is an affection of the nutritive power. (436b10-18)

436b10 τοῖς δὲ ζῴοις,
ᾗ μὲν ζῷον ἕκαστον, ἀνάγκη ὑπάρχειν αἴσθησιν· τούτῳ γὰρ
τὸ ζῷον εἶναι καὶ μὴ ζῷον διορίζομεν. ἰδίᾳ δ' ἤδη καθ'
ἕκαστον ἡ μὲν ἁφὴ καὶ γεῦσις ἀκολουθεῖ πᾶσιν ἐξ ἀνάγ-
κης, ἡ μὲν ἁφὴ διὰ τὴν εἰρημένην αἰτίαν ἐν τοῖς περὶ ψυ-
b15 χῆς, ἡ δὲ γεῦσις διὰ τὴν τροφήν· τὸ γὰρ ἡδὺ διακρίνει καὶ
τὸ λυπηρὸν αὐτῇ περὶ τὴν τροφήν, ὥστε τὸ μὲν φεύγειν τὸ
δὲ διώκειν, καὶ ὅλως ὁ χυμός ἐστι τοῦ θρεπτικοῦ
b18 πάθος.

This demarcation of animals and plants by perception has emerged in *De anima* ii 2.413a20-b10. Every animal minimally has the contact senses, touch and taste. An animal must have touch to apprehend food by the tangibles—hot, cold, wet, dry—and to avoid the dangers posed to the animal body by certain tangible features of other bodies (see 414b3-11 and 434b9-24; cf. 436b18-437a1). By taste the animal discriminates (διακρίνει) the pleasant and painful in food, the painful to avoid and the other to pursue. Here Aristotle employs chiastic structure, a literary device from which ring structure arises or follows. Mention of discrimination (436b15), and the distance senses as announcing differences (in 437a2), accords with the *De anima*'s important view of sense power as a discriminative and critical power, not merely presentational (see, e.g., 418a14, 424a5, 426b10, b14, 427a20, 432a15-16).

Flavor is said to be "an affection of the nutritive power", or of that which is capable of nourishing (τοῦ θρεπτικοῦ πάθος). *Threptikos* can refer to the nutritive part of soul, but it can more generally include the body parts engaged in nutrition, the entire animal, and even the nutriment, insofar as any of these is capable of nourishing. Surely flavor is an affection of tasteable and flavorful things, and due to the action of the tasteable on the sense of taste, also an affection of the sense. Since flavor and taste contribute to nutrition, flavor can be called an

affection of the nutritive power.[29] Yet, *De anima* 414b6-14 casts doubt that flavor is itself nourishing, for flavor connects only accidentally to what nourishes. So, when 4.441b27-442a2, and *GA* 762a12-13 and 776a28-29, say that flavor and the tasteable nourish, this just means that what *has* the flavor, what is sweet nourishes, since sweet things burn readily. Flavor *as sensible affection* is not what is nourishing; the combustible sweet body nourishes, its flavor attracting the animal, and thus flavor is an affection of the nutritive capacity.

All animals have the contact senses touch and taste, and some animals have merely these senses. Since different kinds of animals take pleasure and pain in different tangibles and flavors, likely due to the rest of their body types, habits, and living conditions, even these most widely shared senses allow for diversity of animals, much as plants display great variety with but one sort of soul power, nutritive power. Again, difference and diversity, especially of the senses, work against effluence theories.

Those animals capable of progressive motion (τοῖς πορευτικοῖς) must additionally possess the distance senses, smell, hearing, and sight, allowing further diversity of these animals (436b18-437a3).

> The senses through the external things are for the ones [animals] capable of progressive motion, for instance smell and hearing and vision, to all those having them they belong for the sake of safety, how they might both pursue pre-sensing the nutriment and flee the base and destructive things, and also to those obtaining intelligence for the sake of [living] well; for [these distance senses] announce many differences, from which arises intelligence both of intelligible notions and of the practical things. (436b18-437a3)

436b18 αἱ δὲ διὰ τῶν ἔξωθεν αἰσθήσεις τοῖς πορευτικοῖς
αὐτῶν, οἷον ὄσφρησις καὶ ἀκοὴ καὶ ὄψις, πᾶσι μὲν τοῖς
b20 ἔχουσι σωτηρίας ἕνεκεν ὑπάρχουσιν, ὅπως διώκωσί τε προ-
αισθανόμενα τὴν τροφὴν καὶ τὰ φαῦλα καὶ τὰ φθαρτικὰ
437a1 φεύγωσι, τοῖς δὲ καὶ φρονήσεως τυγχάνουσι τοῦ εὖ ἕνεκα·
πολλὰς γὰρ εἰσαγγέλλουσι διαφοράς, ἐξ ὧν ἥ τε τῶν νοη-
a3 τῶν ἐγγίνεται φρόνησις καὶ ἡ τῶν πρακτῶν.

29 Ross 1955, 185 too narrowly says that flavor is strictly an affection of food rather than of the faculty of taste or nutrition. Flavor, whether in potentiality or actuality, is an affection of what has flavor, while tasting the flavor in actuality is also an affection of the faculty of taste, and thereby nutritive faculty as well. Coates and Lennox 2020, n20 observe the ambiguity of *trophê* and *threptikon* in the *DA* and *De sensu* 1.436b17-18, 5.443b21, 445a8-9, and a30-31, which can refer to a capacity of soul or nutriment, and our suggestion of bodily organs and the living being goes somewhat beyond theirs (see Roreitner forthcoming, appendix for a defense of the text).

Aristotle refers to the distance senses as "the senses through the external things". He must mean senses that operate through *external sense media*, especially air and water, since every sense, even contact sense, can be moved by external sensible objects. And though touch and taste have a sense medium, the animal's its own flesh or what is analogous, it belongs to the animal rather than being external. Without yet explicit mention, he alludes to sense media, which set his account of perception apart from effluence theories. Smell, hearing, and vision, by way of their sense media, permit all the animals having these senses to perceive food and dangers at a distance, i.e., prior to any direct contact, thus engaging in pre- or fore-sensing (προαισθανόμενα).[30] Such distance sensing readies the animals capable of progressive motion to pursue what is beneficial or avoid the harmful, for the sake of their safety (σωτηρίας ἕνεκεν).

Safety (σωτηρία) is Aristotle's repeated way of referring to sustaining life. There is of course safety of bodily being and safety of the kind through reproduction. Yet, since life is activity (*energeia*) complete at every moment rather than merely motion (*kinêsis*), when "safety" appears, as in *De anima* ii 4 and 5, it is a valuable means in natural science to point toward activity in contrast with motion, activity of any form of life operations. Thus, by speaking of "safety" and "saving", Aristotle has a "safe" way to "save" his approach to natural science by careful elocution, which in fact suggests going beyond mere motion appropriate within natural science. All activity of mortal living beings, as the perfection and fulfilment of a dispositional capacity and always complete, is saving itself by its very activity, whereas motion, with its end beyond itself, is in the process of terminating itself as motion (see esp. *DA* ii 5.417b2-16). The life saved by the distance senses is perceptive life itself, along with nutritive life.

The account so far of the reasons animals possess contact and distance senses, for nutrition and safety, has largely reviewed his results in *De anima* iii 12-13. Yet, he further states in 437a1-3 that the distance senses, by the access they provide *some animals* to the wealth of sensible differences, enable them to gain intelligence (φρόνησις), at least practical intelligence, so that these animals live especially well, i.e., they are saving even their superior sorts of life activity. With multiple senses animals may better observe "common" and "accidental" sensible

30 The order of the listing of the senses, smell, hearing, vision, probably reflects getting further from corporeality with perception at greater and greater distance. And in 436b13-19 Aristotle has set out the five senses in reverse order from his treatment in *DA* ii 7-11, which fits with the reversing of direction of the *DA* with the entire *PN*. Discussion here in the *De sensu* of the uses of the senses connects with *DA* iii 12-13. That every sense discloses differences fits with the *De anima*'s emphasis upon sense as critical and discriminative rather than merely presentational, as is *phantasia*.

objects, and some have more capacity for memory. Animals other than humans can then share in practical intelligence and capacity for living well (see *Meta*. i 1.980b21-28 and *DA* iii 12.434b24-25 and iii 13.435b19-25), since dealing with actions in particular circumstances need not require universal notions.

Humans, having mind, go beyond the beasts in developing from perceived differences universal and intelligible notions (τῶν νοητῶν), rather than remaining merely with perception of individual items (cf. *Post*. *An*. ii 19 and *Meta*. 980a21-27).[31] Speech makes this possible since speech enables thinking in universal terms and about intelligible essences. Human intelligence (*phronêsis*) can take two major forms, theoretical science and regarding practical matters (τῶν πρακτῶν), i.e., practical or productive science.[32] Beasts have their practical intelligence apart from universal notions and speech. The distance senses, along with the contact senses, serve for the sake of life, though ultimately for living well. Deriving speaking and thinking from perception, humans gain science, theoretical, practical, and productive. Even the basic contact senses, besides contributing more differences, lead to human desires for pleasant flavors and sensations going well beyond simple need. They, along with the distance senses allow comparisons and expand human desire for necessities and for luxuries and foster the productive arts. The discussion of distance senses contributing to intelligence, and other senses, challenges the effluence thinkers who hardly distinguish sense perception and mind, and who limitedly mark various roles for the different senses.

Expanding his observations about the senses' roles in animal life and especially distance senses for intelligence, Aristotle proceeds to a novel consideration of the relative importance for humans of two of the distance senses—sight and hearing (437a3-17).[33] Hearing is the distance sense that does not have a "covering", as the eyes in higher animals have lids and respiring animals only smell odor when they inhale. Sight far surpasses hearing in disclosing differences,

31 *Meta*. i 1.980a21-27 considers vision to reveal the most differences and hence desired just for itself, but he goes on in 980a27-b29 to relate hearing to learning and likely the development of the arts and sciences.

32 Though *phronêsis* is given a rather narrow meaning in *NE* vi, Aristotle can here use the term more widely to include theoretical, practical, and productive sciences. It seems that use of this term only arises in the Classical period. It is found in the tragedians and then 4th century thinkers. *Phronein*, which is used in *DA* iii 3 apparently to refer to even more ancient thinkers, applies to truthful thinking and perhaps both theoretical and practical thinking.

33 In ch. 4 he indicates that smell is an inferior sense in humans, inferior to the other distance and even contact senses (440b30-441a3). In *De div*. 461b3-7 there is the suggestion that usually vision is the authoritative sense and more than touch.

since color is so pervasively manifest, and since common sensible objects are most prominently discerned by sight, and so too all the accidental sensible objects, e.g., rocks, houses, plants, and animals. Nonetheless, surprisingly, vision does not ultimately contribute the most to intelligence![34] Thus, starts a pattern that the most necessary is not necessarily highest, and the less necessary, due to its availability, may make the highest contribution (except in the case of God). This unusual argumentation may appear here near the beginning of the series of treatises, since Aristotle intends to prepare us for some unexpected results of his coming investigations and to appreciate that nature has done what is for the best, even when it may initially look otherwise. Intelligence is natural for humans rather than merely a conventional product.

Despite disclosing the most differences, vision turns out less crucial for human intelligence than hearing, for hearing crucially detects differences in the voice (437a3-17).

> Of these [senses] themselves, regarding the necessary things, vision in virtue of itself is superior, but with respect to mind, according to accident, hearing is. Many differences, and of all sorts, the power of vision announces, since all bodies partake of colors, so that also through this we especially perceive the common sensible objects (I mean common sensible objects, magnitude, figure, motion, number), but hearing [perceives] only the differences of sound, and to a few also those of voice; according to accident, however, hearing contributes the greatest part toward intelligence. For speech being audible is a cause of learning, not in virtue of itself, but according to accident; for from names it is composed, of the names each is a symbol. Hence, more intelligent are those from birth deprived of perception, the blind than the deaf and dumb. (437a3-17)

437a3 αὐτῶν δὲ τούτων πρὸς μὲν τὰ ἀναγκαῖα κρείττων ἡ ὄψις καθ' αὐτήν, a5 πρὸς δὲ νοῦν κατὰ συμβεβηκὸς ἡ ἀκοή. διαφορὰς μὲν γὰρ πολλὰς καὶ παντοδαπὰς ἡ τῆς ὄψεως εἰσαγγέλλει δύναμις διὰ τὸ πάντα τὰ σώματα μετέχειν χρώματος, ὥστε καὶ τὰ κοινὰ διὰ ταύτης αἰσθάνεσθαι μάλιστα (λέγω a9 δὲ κοινὰ μέγεθος, σχῆμα, κίνησιν, ἀριθμόν), ἡ δ' ἀκοὴ

34 In Plato's *Timaeus* 46e-47c, Timaeus says that due to our vision of the heavens we develop astronomy, mathematics, and philosophy. In *Meta.* vii 16.1040b34-1041a5 Aristotle says that even if we had not seen the stars, we could recognize that there are divine beings. (The suggestion of never seeing the stars recalls Aristotle's *De philosophia* [Cicero *DND* ii 37.95-96], which relates to the cave allegory, since those in the cave have never seen the real stars.) He seems there and here in *De sensu* to be attacking expectations about vision's contribution to intelligence. Lindberg 1976, x states, "All early natural philosophers acknowledged that vision is man's most noble and dependable sense". Effluence theories seem most devoted to vision, likely due to their limited concern for the role of different senses.

437a10 τὰς τοῦ ψόφου διαφορὰς μόνον, ὀλίγοις δὲ καὶ τὰς τῆς φωνῆς· κατὰ συμβεβηκὸς δὲ πρὸς φρόνησιν ἡ ἀκοὴ πλεῖστον συμβάλλεται μέρος. ὁ γὰρ λόγος αἴτιός ἐστι τῆς μαθήσεως ἀκουστὸς ὤν, οὐ καθ' αὐτὸν ἀλλὰ κατὰ συμβεβηκός· ἐξ ὀνομάτων γὰρ σύγκειται, τῶν δ' ὀνομάτων ἕκαστον
a15 σύμβολόν ἐστιν. διόπερ φρονιμώτεροι τῶν ἐκ γενετῆς ἐστερημένων εἰσὶν ἑκατέρας τῆς αἰσθήσεως οἱ τυφλοὶ τῶν ἐνεῶν
a17 καὶ κωφῶν.

Sight in virtue of itself discloses the most perceptible differences, and therefore it is the superior sense for necessities. But it happens that hearing contributes most to mind's development and operation. In saying that sight pertains to necessities, Aristotle means things necessary for survival rather than theoretical necessities, for sight's disclosure of differences of bodies makes it the most practical of the distance senses. Because all bodies have colors, and even transparent bodies participate in a way in color, and the common sensible objects most evidently and ubiquitously accompany color, sight picks out the most differences and plays the leading role in disclosing and identifying bodies.[35] Hence, sight most advantageously picks out things necessary for us to discern from a distance as helpful or harmful to our safety. By contrast, many fewer bodies make sounds, and those that sound do so much less often, since sound involves one body striking another. Hearing relates, then, mostly to the narrow domain of sounds and limitedly to common sensible objects, with only some hearing for some animals connected with animal voice. Much of the time bodies are making no audible sound, whereas nearly all bodies in light have visible colors, magnitudes, figures, and so on. By claiming hearing is restricted to differences of sound, Aristotle is not denying its perceiving common sensible objects, for by differences in sound hearing can perceive magnitude of a place, direction from which the sound comes, the motion of a sound source, and so on, but he only indicates hearing's much more limited role in such perception.

35 Saying *all* bodies partake of color may cause surprise, since some are transparent, and the list here in 437a9 of common sensible objects has merely magnitude, figure, motion, number, thus leaving out rest as the usual fifth, and unity as the infrequently mentioned sixth (cf. *DA* 425a14-16). The order of the present list is unusual, since motion as the most striking and fundamental of the common sensible objects is frequently listed first (see 418a17-18, 425b15-16). Does motion not direct us to bodies so that we can then appreciate them when they rest in their unity? The order here, with magnitude and figure first, may link to vision and color in discerning the common sensible objects, because magnitude and figure, so prominent for bodies, seem always to go along with color (cf. Plato *Meno* 75b). Putting magnitude first will also be seen important in *De mem.* 450a7-14. Magnitude of place can also be detected by hearing.

Seemingly then by accident, but in fact attributable to the marvelous purposiveness of nature, which prepares some animals for voice and hearing it as speech, hearing contributes most to intelligence.[36] Humans have speech, which goes beyond voice expressing merely immediate passions, for speech permits naming and saying everything that can be thought, so that hearing becomes the most important sense for us. Political and theoretical life of humans is based on speech. Lacking sight, we can substitute other senses to get many of the differences sight discloses, but in antiquity there was hardly substitute for hearing voice and speech.[37] Hearing takes on this prominence because voiced *logos*, so crucial for the development and exercise of mind, is audible. Human thought for Aristotle connects intimately with *logos* (see *DA* 427b11-14 and 428a19-24). Though *logos* can also be written and unvoiced, writing and thinking for humans pertain to what can be said (see *De int*. 1.16a4).[38] *Logos* can be a proposition, though it can also just be a phrase, as in a definition by genus and difference, e.g., "biped animal" (see *De int*. 4.16b26-32).[39] *Logos* is put together from names that are symbols.

In referring to each name as a "symbol" (σύμβολον), Aristotle alludes to his account in *De interpretatione* 1.16a3-9. Names are for him *symbols* because, though conventional rather than natural, since different languages use different names for the same things, the names employed become for speakers of the language so closely related with what they name that the names take them quite transparently to the very things named. Whereas many signs have humans aware

36 Aristotle uses μέρος here for hearing's contributing the greatest portion to intelligence. It seems that *morion* (μόριον) is the preferred term for part when a very distinguishable part or organ is at issue, whereas *meros*, which can also be used for part tends to mean a less distinguishable part or portion.

37 Should we concede, as sometimes urged, that most previous philosophers focus too much on the sense of vision? Is Aristotle not making this complaint of his own predecessors, while he recognizes the greatness of hearing, along with other senses? Plato's *Timaeus* 46e-47e observes the large role of sight in disclosing the heavens, which is supposed to awaken us to philosophy, yet Timaeus also stresses the equal importance of hearing. For Aristotle, elevating hearing above vision, hearing speech perhaps less likely explicable merely by traveling corpuscles, might contribute to blocking effluence theories.

38 Not all thinking need be voiced or relate to *logos*, for the god for Aristotle seems to be thinking without speaking, out loud or silently, though all human thought pertains to *logos*.

39 It may be suggestive that hearing, pertaining to voice and speech, can deal with what is propositional, discursive, narrative, and extended in time, whereas vision pertains to a momentary complete showing, but this can, of course, be exaggerated, since speech and thinking may be the route toward the simple essence that is the supreme thinking, and we can watch things taking time.

of them as merely being signs of something else, we become so familiar with, so at home with names in speech, that our thought passes right through vocalized or written names to what is named (see Kuczewski and Polansky 1990). So, Aristotle calls names symbols. They are peculiar signs that direct us to the very essence of what is named. While names name, *logos* says something. *Logos* may even say the definition of essence, and when propositional, something about something. Though not all saying is making declarative statements, whatever *logos* says, it seems to be disclosing the thought of the speaker.

Yet, to the sense of hearing *as hearing* and to its object sound *as sound* it is accidental that they most contribute to intelligence, since names and *logos* happen to be audible. Sound as such is audible; voice is peculiar, meaningful sound produced by use of respiration and the mouth (see *DA* ii 8.420b5-421a6), with speech as a possibility of voice through assembling symbolic names. That hearing should hear *voice* is accidental to it *as hearing*. Many animals hear without having voice, paying special attention to it, and developing intelligence. Even the animals with voice do not all have *logos*.[40] Since a "name" that composes *logos* is for Aristotle meaningful voice by *convention* (*nomos*, see *De int*. 16a19-22), its meaningfulness can be said to be "accidental" to it as just these particular sounds. Hence, learning by *logos* is accidental inasmuch as *logos* is composed of conventional and accidentally meaningful names (437a13-17).[41] Of course, it is not accidental from the standpoint of human nature that hearing serves a great role, for voice is not accidental in those animals that have it, and neither is intelligence. But Aristotle's insistence upon hearing's accidentally serving the natural end of intelligence (437a5, a11, a13-14), after all most animals hear without being especially intelligent, pertains to nature's utilizing a capacity with an obvious function for further functions.[42] Fitting with intelligence from hearing, he claims

40 When in *Meta*. i 1.980b22-25 Aristotle allows animals with memory to be intelligent (φρόνιμα), but they cannot learn unless they can hear, he may mean learning as responding to vocalized signals from an animal's parent, and even more likely to domesticated animals learning from hearing and responding to the human voice.

41 It is similarly but derivatively accidental to vision that it permits humans to read written words, since reading depends on even more conventional alphabetic letters, which match visible written signs with sounds.

42 In Plato's *Republic* i 352e something's function is what it alone can do or what it does better than other things that can do it, which tends to suggest that there is but a single function for each thing that is capable of a function, though the *Republic* has the best humans as both philosophers and rulers. Aristotle frequently points out that nature in a non-niggardly way has one thing serve more than one function, e.g., the tongue can be an organ for touch, taste, and articulation of speech (see, e.g., *DA* ii 8.420b16-22). Respiration maintains heat and allows for voice.

elsewhere that mind comes to humans from *outside*, for from perception we can develop thought, but intelligence comes especially from hearing speech directed to us by those who are already speakers (see *GA* ii 3.736b27-29). This reflection on nature's wonderful dexterity will figure in Aristotle's dealing with actions common to soul and body; the emphasis on its being accidental has the natural rising above the necessary, challenging effluence accounts of the role of the senses in relation to thought.

Hearing is available for its important relation to voice and speech because hearing is otherwise a limitedly significant sense for humans. Yet hearing cannot easily be closed off, and it is a distant sense precise enough to discern fine articulations, unlike smell.[43] When awake we nearly always engage in distinguishing things by sight, which fits with its practical utility, while hearing remains almost always available to voice and its persuasive possibilities.

Since *logos* relates closely to voice and hearing, in antiquity the non-sighted were better off than the deaf from birth, who would also then be dumb or inarticulate (437a15-17; see *HA* iv 9.536a32-b5). Prior to the development of means for teaching the deaf to speak and to read, the deaf were very severely handicapped. Lack of sight would not be a similarly great impediment to the development of mind. Thus, Aristotle has this argument for claiming that hearing contributes more than vision to intelligence, and if we listen well to this treatise, we should be better off, dissuaded from embracing effluence theories that generally derive from accounting for vision, while leaving us rather blind to understanding perception.

The respective roles of sight and hearing come up because Aristotle asks on account of what the animals have senses, and he explains that hearing fosters mind. But why now compare sight and hearing? The comparison prefigures what will follow. He often has to consider why certain cognitions, for example, remembering or dreaming, will be more or less reliable, or unreliable (see *De insom.* 2.460b21-22 on the superior authority of vision over touch; also 3.461b3-5; cf. Plato *Phaedo* 65b on comparison of accuracy of senses). Comparison displays how we must make discriminations to discern possibilities nature utilizes, as if it were operating by intelligence. He here refers to and utilizes intelligence, which

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Might this initial reference to voice link with the concluding treatise's focus on respiration to suggest a ring?

43 Whereas humans have eyelids and only smell when they breathe in, so these distance senses have a kind of cover, hearing lacks this, and so is conveniently continually available (see 444b21-28 and *DA* 421b26-422a6). *Rhetoric* 1364a37-b1 offers an argument that accuracy in vision is more choiceworthy than in smell, since vision is more choiceworthy than smell.

only appears as a topic sporadically in these treatises, but this can follow from sense perception for those animals with natural readiness for intelligence. Thus, the comparison is topically relevant. And it has clear methodological and pedagogical relevance. If we are listening to and hearing Aristotle, he now illustrates just what he speaks about, since our hearing him discussing differences in sight and hearing enhances intelligence regarding them. Even reading what he says contributes, for writing derives from vocalizing, and we go beyond seeing the marks to interpreting them. We are hearing about hearing, and what we are hearing is hearing's superior support of intelligence. This introductory mirroring for us of what he speaks about may prepare us to look and listen for this repeated method for developing intelligence and self-knowledge about the topic. We have suggested as well, and most pertinently, that our intelligence deriving from hearing and the different roles of different senses may have us agreeing with Aristotle about sense perception's requiring sense media and his account of its operation rather than effluences.

That hearing ends up the most important sense is suggestive for much of the coming treatment of animal and plant life. Nature resourcefully organizes living beings. It well integrates the functional parts to employ capacities for more than a single task, very crucially the heart or its analogue. What may seem the secondary task, as the tongue serves for both tasting and articulating, proves even more important for higher life. Aristotle's discussion here of distinctions leading to intelligence exemplifies what it discusses. His treatment of why animals have sense, and now hearing's most crucial contribution, links to the opening reflection upon which of the common actions is first and greatest. If a main topic of the *De sensu* is sense and the sensible objects, and hearing the greatest sense, because it is greatest for intelligence, which is not a sense, and he has already accounted for the audibles in the *De anima*, this supports his now dealing with the other sensible objects, in chapters 3-5, in light of what he has said of the audibles in *De anima* ii 8. His predecessors tend to concentrate on vision, so he will have to show his success here with this as well. But we can see that he has already done quite great things with sound and hearing (previously in *DA* ii 8 and now in the *De sensu*; most appropriately in 437a9 the first mentioned common sensible object is *megethos*, magnitude or greatness).

Chapter 2

The motivation for this chapter's allocating sense organs to the elemental bodies can be obscure and confusing. The like-by-like account of perception, which Aristotle attacks throughout this treatise, provokes it. These theories have

effluences from bodies flow toward sense organs composed of each of the elemental bodies—fire, air, water, earth (see *PA* ii 1.647a2-24). The effluence of particles from the perceived body impacts the like sense organ, like in composition or in pores, supposedly enabling perceiving the sensible object. Aristotle here strategically simplifies the like-by-like thinking.[44] Their account might receive most significant support from the view that light is traveling fire and that there is fire in the eye. Vision also seems best to support the representational view of perception. To challenge his predecessors, Aristotle assesses their allocation of elemental bodies to the sense organs, especially fire to the eye. His alternative for the sense organs is to have them most like the sense medium rather than the perceived body. As the sense medium, mainly air or water, can be acted upon by the sensible object because the medium is generally free from interfering affective qualities of its own, this also will apply to the sense organ.[45]

While in *De anima* ii 4.415a14-22 Aristotle proposes starting from the object to clarify the power, the *De sensu* reverses this, going in effect from the sense power to the sensible object, but primarily from the sense medium to the sensible object. This reversed investigation well serves his present intention, because he aims not, as in the *De anima*, to illuminate the sense power starting from the actuality of what is perceived, but instead to get at the nature of the sensible object that can move the sense medium and sense organ to cause perception.[46] By this he undermines the opponents' case for traveling effluences, perception by way of representational images, and like perceiving like.

De anima ii 5-12 has explicated sense power generally, along with each of the five possible proper senses; all these accounts Aristotle indicates that he still maintains (437a18-22). His predecessors, instead are claimed to assign each of the four elemental bodies to a different sense organ. Thus, the perceived body, the

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44 Democritus has the effluence produce, in conjunction with light and the air outside the eye, an "air impression", which being rather solid enters the eye (see Baldes 1978, 88-90, Caston 2015, 34-37, and Curd 2019, 54-56, based on Theophrastus *De sens.* 50). A reason for this is that Democritus must explain how the effluence from a large body becomes a suitable size to enter the eye. Again, focusing on elemental bodies and corpuscles, as do effluence theorists, reduces or eliminates the role for soul in perception.

45 Democritus has the effluences traveling through void; Aristotle, rejecting void, has a colorless, soundless, odorless, and flavorless sense medium, and rather similarly constituted sense organ, acted upon by the sensible object to receive its sensible form by non-standard alteration. Yet, as will be seen, the affectionless sense medium enters the sensible object's formation.

46 That his direction of treatment here of sense reverses that in the *De anima* recalls that the entire *Parva naturalia* reverses the direction of the *De anima*'s treatment of the soul's powers. That he can begin from either direction, from the sensible object or from what it can act upon, may display the completeness and coherence of his account of perception.

effluence coming off it, and the sense organ might be like each other for explaining perception, but this runs into insuperable difficulties.

> Now concerning the power, which each of the senses has, previously has been said. But concerning the body in which by nature arise the sense organs, some seek the bodies according to the elements; not proceeding well with respect to assigning four [elements] to five [senses], they struggle concerning the fifth [sense]. (437a18-22)

437a18	περὶ μὲν οὖν τῆς δυνάμεως ἣν ἔχει τῶν αἰσθήσεων ἑκάστη,
	πρότερον εἴρηται. τοῦ δὲ σώματος ἐν οἷς ἐγγίγνεσθαι πέφυκεν
a20	αἰσθητηρίοις, ἔνιοι μὲν ζητοῦσι κατὰ τὰ στοιχεῖα τῶν σωμάτων·
	οὐκ εὐποροῦντες δὲ πρὸς τέτταρα πέντ' οὔσας συνάγειν, γλίχον-
a22	ται περὶ τῆς πέμπτης.

The five senses were treated appropriately in the *De anima*, without overmuch attention to bodily sense organs. Some of the predecessors in their accounts of sense perception allocate the four elemental bodies to the different sense organs, to have them like the perceived bodies, but they are short on elements, assigning only four elemental bodies to five different sense organs.[47] This snide comment begins the explicit criticism of the like-by-like theories. He will be going through the five sense organs in his very own order of treating the senses in *De anima* ii 7-11, but Aristotle will himself have another motivation for assigning elemental bodies to the sense organs (see esp. 438b16-439a5). He finds a way around four elements for five senses by connecting the contact senses (see 438b30-439a1), yet this still seems offered to weaken his opponents' positions and to support his own account of sense media and organs.

Did any of the predecessors in fact allocate each of the elemental bodies to one or another of the five sense organs? Perhaps none did this as directly as Aristotle suggests, though Empedocles DK 31B109 states, "For by earth we see earth, by water, water, by Aither, divine Aither, and by fire, destructive fire, yearning by yearning [Love] and strife by mournful Strife." And we shall see that Plato's *Timaeus* has fire from the eye interacting with fire from objects. If any predecessor did try to make a complete scheme of such assignments, the attempt might have difficulty with allocations, and it leaves no place for a sense medium. Though Aristotle will speak as if he succeeds with the same project as his predecessors, he in fact starts to defend the sense medium. His approach fastens on the sort of sense medium receptive to action by the sensible object, with a sense organ of

47 Cf. *Bhagavad Gita* 13:5 where there are five elements for the five sense organs.

similar composition. This approach suits his subsequent explication in chapters 3-5 of color, flavor, and odor as sensible objects able to move their sense media.

Predecessors' assigning fire to the eye as vision's sense organ first comes under attack (437a22-29). Aristotle challenges Plato's account of vision in the *Timaeus*, along with other effluence views. Plato has fire emerging as light from the eye and interacting with fire from the perceived object. This looks to be a like-by-like account involving effluences or traveling particles, though Plato, unlike others, gives prominence to the soul. Aristotle's attack will proceed somewhat deviously in going between Plato, Empedocles, Democritus, and unnamed predecessors to lessen the appeal of their accounts.[48] This challenge to their confident assigning of fire should diminish the appeal of their view, and he offers a clear alternative composition for the eye. It is watery, since it should be transparent, like the transparent sense medium required for vision.

> All make the vision [or the eye] of fire on account of being ignorant of the cause of a certain affection; for when pressing and moving the eye fire appears to alight from it; this happens in the dark by nature, or when the eyelids are shut; for also then darkness arises. This also has another perplexity. For if perceiving and seeing are not possible to escape notice, it is necessary therefore for the eye to see itself. (437a22-29)

437a22 ποιοῦσι δὲ πάντες τὴν ὄψιν πυρὸς διὰ τὸ πάθους τινὸς ἀγνοεῖν τὴν αἰτίαν· θλιβομένου γὰρ καὶ κινουμένου τοῦ ὀφθαλμοῦ φαίνεται πῦρ ἐκλάμπειν· τοῦτο δ' ἐν a25 τῷ σκότει πέφυκε συμβαίνειν, ἢ τῶν βλεφάρων ἐπικεκα- a26 λυμμένων· γίγνεται γὰρ καὶ τότε σκότος.

a26 ἔχει δ' ἀπορίαν τοῦτο καὶ ἑτέραν. εἰ γὰρ μὴ ἔστι λανθάνειν αἰσθανόμενον καὶ ὁρῶντα, ἀνάγκη ἄρ' αὐτὸν ἑαυτὸν ὁρᾶν a29 τὸν ὀφθαλμόν.

Since flashes appear when the eye is pressed and moved, in darkness or with the eyes shut, the predecessors, in ignorance regarding the phenomenon's real cause, take the eye to be composed of fire.[49] Aristotle might consider two ways to get the flashes: pressing on the eye, whether open or closed, in light or darkness, and motion from standing up quickly from bending over and "seeing stars". Because the flashes prominently occur in the dark and in the darkness of closed

48 In *GC* i 8 Aristotle similarly links Leucippus/Democritus, Empedocles, and Plato.

49 Aristotle says, "*all* make the eye of fire" (437a22), though in 438a5 Democritus is commended for making the eye of water. Presumably we are to suppose that all make the vision yielding part of the eye fire, since even Empedocles, who is prominent in viewing vision as due to fire, recognizes that much of the eye is watery (see 438a2-3).

eyes from pressing, they hold this as indubitable evidence that the eye has its own fire generating vision. Yet, if fire is prominently its composition, there is perplexity as to why the eye does not always see itself since fire enables sight and the perceiver's perceiving does not escape its notice. If we are aware of what we perceive and our perceiving it, the eye having its own fire should no less see itself and its own fire, even when it is not being pressed and moved. A simple like-by-like account immediately raises the question why the eye, and any other such sense organ, does not always mainly perceive itself (cf. *DA* ii 5.417a2-6).

Offering his own explanation why pressing the eye results in flashes, Aristotle resists supposing the eye primarily fire that due to this composition should see itself (437a29-b10). Yet, he acknowledges that the eye in certain rapid motions does in a way see itself.

> And so, on account of what, resting does this [appearance] not happen? The cause of this, and of the perplexity and that fire seems to be the sense, one ought from here to grasp. For the smooth things by nature shine in the dark, yet they do not make light to be sure, but the so-called black and middle of the eye is also smooth. This appears, when the eye is being moved, on account of the happening the one becoming just as two. This the quickness of the motion does, so that that which sees and that being seen seem to be other. Hence indeed it does not arise unless this happens quickly and in darkness; for the smooth in the darkness shines by nature (for instance heads of some fish and the fluid of the cuttlefish), but with the slowly changing of the eye it does not happen so that it is seeming at the same time to be one and two both that which sees and that being seen. Thus, the eye sees itself, just as also in the reflection. (437a29-b10)

437a29 διὰ τί οὖν ἠρεμοῦντι τοῦτ' οὐ συμβαίνει; τὸ
a30 δ' αἴτιον τούτου, καὶ τῆς ἀπορίας καὶ τοῦ δοκεῖν πῦρ εἶναι
τὴν ὄψιν, ἐντεῦθεν ληπτέον. τὰ γὰρ λεῖα πέφυκεν ἐν τῷ
σκότει λάμπειν, οὐ μέντοι φῶς γε ποιεῖν, τοῦ δ' ὀφθαλμοῦ
437b1 τὸ καλούμενον μέλαν καὶ μέσον λεῖον. φαίνεται
δὲ τοῦτο κινουμένου τοῦ ὄμματος διὰ τὸ συμβαίνειν ὥσπερ
δύο γίγνεσθαι τὸ ἔν. τοῦτο δ' ἡ ταχυτὴς ποιεῖ τῆς κινήσεως,
ὥστε δοκεῖν ἕτερον εἶναι τὸ ὁρῶν καὶ τὸ ὁρώμενον. διὸ καὶ
b5 οὐ γίγνεται, ἐὰν μὴ ταχέως καὶ ἐν σκότει τοῦτο συμβῇ· τὸ
γὰρ λεῖον ἐν τῷ σκότει πέφυκε λάμπειν (οἷον κεφαλαὶ
ἰχθύων τινῶν καὶ ὁ τῆς σηπίας θολός), καὶ βραδέως μετα-
βάλλοντος τοῦ ὄμματος οὐ συμβαίνει ὥστε δοκεῖν ἅμα ἓν
καὶ δύο εἶναι τό θ' ὁρῶν καὶ τὸ ὁρώμενον. ἐκείνως δ' αὐτὸς
b10 αὐτὸν ὁρᾷ ὁ ὀφθαλμός, ὥσπερ καὶ ἐν τῇ ἀνακλάσει·

The eye flashes in darkness, Aristotle proposes, because, without making light, smooth surfaces can naturally shine in the dark. The interior wall of the eye is smooth and dark, and "the so-called black and middle" of the eye is smooth. The black might seem to be the pupil, but the word for black also means dark, and

saying it is in the middle and smooth, indicates the interior of the eye. Even though it is dark within the eyes, what he uses to account for the flashing when the eye is pressed is its own luminescence (see 438b2-11). The repeated reference to "by nature" (πέφυκε, 437a25, a31, and b6) is meant to emphasize the naturalness for the brightness of the smooth surface to appear even in the dark, when the pressed eye is moved quickly to reflect itself. This may explain his mentioning "the so-called black", for it is truly luminescent, though the eye's interior is also dark. Smooth surfaces that naturally shine in darkness without making light are phosphorescent, luminescent, or bioluminous. Referring to them in *De anima* 419a2-5, he says, "Some objects of sight that in light are invisible, in darkness stimulate the sense; that is, things that appear fiery or shining. This class of objects has no simple common name, but instances of it are, e.g., fungi, flesh, heads, scales, and eyes of fish" (οἷον μύκης, κρέας, κεφαλαὶ ἰχθύων καὶ λεπίδες καὶ ὀφθαλμοί).[50] Here in the *De sensu* he says that smooth things, as the heads of some fishes and the fluid of the cuttlefish, naturally shine in the dark, clearly indicating luminescence.[51]

The inside back surface of the human eye, then, can become visible to us as luminescent under some conditions, as the fish's eye in darkness. With rapid movement of the eye, as by pressing it, the interior luminescence in darkness can be reflected, so that it becomes visible to us. That this visibility occurs in darkness without producing light explains the flashes appearing when the eye is pressed, and why the eye is not constantly seeing itself. Pressing the eyeball rapidly, rather than pressing gently and hence slowly, makes the eye to be "seeming at the

50 See Renehan 1996, 223-224 for the argument that κρέας rather than κέρας belongs in the text here, since horn is not luminescent, while decaying flesh *is*, due to the growth of luminous bacteria. He states, "Luminescence is the more accurate term, since phosphorescence is luminescence due to the absorption of radiant energy emitted afterwards as light, but the two terms are often interchanged" (223).

51 Alexander 2000, 30-31 and Aquinas 2005, 34, 36, and 40 seem to hold that all smooth bodies naturally shine, though they do not give light. Ross 1955, 189 suggests that Aristotle has "realized that the sheen on the surface of smooth objects was a case of reflection". But Aristotle surely has in mind that some smooth objects are luminescent, including the back surface of the human eye. Hence, he emphasizes that they shine by nature and without making light (see 437a31-32 and b6), and this is confirmed by his reference to the heads of some fish and the dark juice of the cuttlefish (cf. *DA* 419a5). The talk of smooth surface and reflection may have been suggested to Aristotle by what Democritus said (see 438a7-10). Gregoric 2018, 96 suggests, "phosphorescence is an outcome of specific elemental composition, probably one in which the fiery element predominates or enters a special mixture with the other elements". Surprisingly, however, Gregoric (p. 95) asserts that transparency "is an emergent property, because no element is itself transparent".

same time to be one and two". The rapid pressing causes the eye to act as a mirror to its own luminescence, so that what sees is seeing its own luminescent flashes, i.e., the eye becomes one and two, both the seeing and that being seen.[52] The one quickly pressing sees the luminescence of the pressed eye, but this will not be observed by others. Aristotle thus counters fire's composing the eye or emerging from it.

With the phenomenon of flashing in the eyes explicated, which purportedly provokes it, Aristotle attacks the theory of vision based on fiery eyes (437b10-23).

> Since if to be sure it [the eye] was fire, just as Empedocles says and has been written in the *Timaeus*, and the seeing happened by the light going out just as from a lamp, on account of what does the eye not see in the darkness; to say that going out it is extinguished by the darkness, just as the *Timaeus* says, is entirely vacuous; for what extinguishing is there of light? The hot and dry is extinguished either by moisture or cold (for instance it seems in the ashes the fire and the flame), nothing of which manifestly belongs to light. If therefore it belongs but on account of the gentleness escapes us, it ought with day at least that the light to be extinguished more in the water and in the frosts to become darkness; and so truly the flame and the having been burned bodies suffer this; but now [regarding light] nothing of such a sort happens. (437b10-23)

437b10 ἐπεὶ
εἴ γε πῦρ ἦν, καθάπερ Ἐμπεδοκλῆς φησὶ καὶ ἐν τῷ Τι-
μαίῳ γέγραπται, καὶ συνέβαινε τὸ ὁρᾶν ἐξιόντος ὥσπερ
ἐκ λαμπτῆρος τοῦ φωτός, διὰ τί οὐ καὶ ἐν τῷ σκότει
ἑώρα ἂν ἡ ὄψις; τὸ δ' ἀποσβέννυσθαι φάναι ἐν τῷ σκότει
b15 ἐξιοῦσαν, ὥσπερ ὁ Τίμαιος λέγει, κενόν ἐστι παντελῶς· τίς
γὰρ ἀπόσβεσις φωτός ἐστιν; σβέννυται γὰρ ἢ ὑγρῷ ἢ ψυ-
χρῷ τὸ θερμὸν καὶ ξηρόν (οἷον δοκεῖ τό τ' ἐν τοῖς ἀνθρα-
κώδεσιν εἶναι πῦρ καὶ ἡ φλόξ), ὧν τῷ φωτὶ οὐδέτερον
φαίνεται ὑπάρχον. εἰ δ' ἄρα ὑπάρχει μὲν ἀλλὰ διὰ τὸ
b20 ἠρέμα λανθάνει ἡμᾶς, ἔδει μεθ' ἡμέραν γε καὶ ἐν τῷ
ὕδατι ἀποσβέννυσθαι τὸ φῶς καὶ ἐν τοῖς πάγοις μᾶλλον
γίγνεσθαι σκότον· ἡ γοῦν φλὸξ καὶ τὰ πεπυρωμένα σώ-
b23 ματα πάσχει τοῦτο· νῦν δ' οὐδὲν συμβαίνει τοιοῦτον.

Empedocles says, as will be seen below, and it is written in *Timaeus* 45b-d—does this distinguish Plato from what is written in the dialogue(?)—light emerging

52 Aristotle stresses darkness to emphasize that the eye is not fire or emitting light, but rapidly pressing even open eyes in daylight allows the flashing as mirroring the eye's luminescence to itself in its own darkness. Compare this being one and two in vision to a clasping of the fingers to be perceived as one and two (*De insom.* 460b20-22 and 461b30-462a2) and joints as one and two (*De motu* 698a18-b7).

from the eye as from a lamp explains vision. If the eye could thus supply its own light, why would we not see in the dark? Aristotle is taking the *Timaeus*'s position to derive from Plato's predecessors such as Empedocles and Democritus, so that if Aristotle undermines the clever-sounding offspring, he discredits its parents' reliance upon material composition of the sense organs to explain perception, and in turn by attacking the parents he can get rid of their offspring, the *Timaeus* account.

To explain the obvious failure of vision in complete darkness, the *Timaeus* resorts to darkness extinguishing the light coming from the eye (45b2-e3), and thereby any vision.[53] Aristotle exposes this account's futility, at least on his understanding, for what can extinguish light? Not moisture or cold, which extinguishes instead of light the heat and dryness of fire and the flame of burning coals, since for Aristotle light does not have any heat or dryness, so light is not thus extinguishable. He conjoins fire and flame in 437b18 because for him fire is what is intensely hot and dry, yet it need not show itself in flame (see *Meteor.* i 3.340b21-23 and 4.341b13-24). He means to allow that fire's heat and dryness can be extinguished, as can flame. Yet, for him, light is exclusively a phenomenon connecting with vision and having little other influence (see, e.g., *DA* ii 12.424b9-12), and hence not vulnerable to water, cold, or wind. Light is obstructed, or ended by the absence of its principle, such as fire or the sun, but not extinguished. The *Timaeus* views light as traveling particles of fire, and consequently extinguishable, but *De anima* ii 7 has attacked any such corporeal account of light.

Fire, as principle of light, causes illumination of a transparent expanse, but light is not fire or a body. Light, for Aristotle, is instead the actuality of the transparent body *as transparent*, rather than simply as a body (*DA* ii 7.418b9-10). According to him, light does not travel, but instantly illuminates, not being extinguishable as is fire. To someone maintaining that heat and dryness belong to light, but so gently as to escape notice (437b19-20), he retorts that then rain

53 Broadie 2011, 180-181 suggests that the extinguishing of vision at night without daylight would prevent observation of celestial bodies predominately visible at night, so preventing the role of heavenly observation to awaken humans to mathematics, the notion of time, and philosophy (see *Tim.* 46e7-47c4). Costello 2024, 64-80 answers that Timaeus only means to make daylight primary for vision, rather than to prevent any vision without daylight. Total darkness extinguishes any vision, but the fiery, gentle light from heavenly bodies, local fires, or lamps permits vision of the fiery objects and some muted vision of non-fiery objects. Aristotle's talk here of extinguishing (ἀποσβέννυσθαι) fire prefigures what he returns to toward the conclusion of the entire series of treatises when death of the mortal living being comes with the extinguishing or burning out of the vital fire's warmth.

should extinguish light, and it should be impossible to see through water, with frosty weather bringing on darkness. Though water and ice do extinguish flame and fiery bodies, nothing like this happens to light, but water's transparency permits illumination. The *Timaeus*'s account, depending upon impossible extinguishing of the eye's light by darkness, seems discredited. This case has such importance for Aristotle because his rejection of traveling light corpuscles and affirmation of the transparent sense medium eliminate effluences as causes of color vision.

Prior to the *Timaeus*, Empedocles has the eye containing fire, but he seems to waver between sight resulting from fiery light emanating from the eye as from a lantern and from effluences coming off the objects seen (437b23-438a5).

> Empedocles likely is thinking that there is seeing when the light travels out, just as has been said before; he says in fact thus:
>
> As when someone planning a journey prepares a lantern,
> Through the stormy night, a flame of blazing fire,
> Adjusting to it screens against all sorts of winds,
> Which scatter the breath of the winds as they blow,
> But the more subtle part leaps out of this,
> Shines across the threshold with incessant beams:
> So then in membrane fenced in ancient fire
> Did she [Aphrodite] give birth to the round eye.
> And these held off the deep surrounding flood,
> While letting through the fire, i.e., all its more subtle part.
>
> Sometimes thus he says to see, sometimes by the effluences from that which is seen. (437b23-438a5)

437b23 Ἐμπεδοκλῆς δ' ἔοικε νομίζοντι ὁτὲ μὲν ἐξιόντος τοῦ φωτός, ὥσ-
b25 περ εἴρηται πρότερον, βλέπειν· λέγει γοῦν οὕτως·

ὡς δ' ὅτε τις πρόοδον νοέων ὡπλίσσατο λύχνον
χειμερίην διὰ νύκατα, πυρὸς σέλας αἰθομένοιο,
ἄψας παντοίων ἀνέμων λαμπτῆρας ἀμοργούς,
οἵ τ' ἀνέμων μὲν πνεῦμα διασκιδνᾶσιν ἀέντων,
b30 πῦρ δ' ἔξω διαθρῴσκον, ὅσον ταναώτερον ἦεν,
λάμπεσκεν κατὰ βηλὸν ἀτειρέσιν ἀκτίνεσσιν·
ὣς δὲ τότ' ἐν μήνιγξιν ἐεργμένον ὠγύγιον πῦρ
438a1 λεπτῇσιν τ' ὀθόνῃσι λοχεύσατο κύκλοπα κούρην·
1a <αἳ> χοάνῃσι δίαντα τετρήατο θεσπεσίῃσιν·
αἱ δ' ὕδατος μὲν βένθος ἀπέστεγον ἀμφιναέντος,
πῦρ δ' ἔξω διίεσκον, ὅσον ταναώτερον ἦεν.

ὁτὲ μὲν οὖν οὕτως ὁρᾶν φησίν, ὁτὲ δὲ ταῖς ἀπορροίαις ταῖς
a5 ἀπὸ τῶν ὁρωμένων.

Empedocles surely must have contributed greatly to the *Timaeus*'s account of vision, if the *Timaeus* has vision result from combining light from the eye with light as effluence from objects. Where Aristotle previously said that Empedocles has light coming from the eye, as from a lamp, is 437b10-13. Aristotle now quotes Empedocles' lines (DK 31B84) to confirm that he does have light emerging from the eye as precursor to the *Timaeus*.[54] Empedocles compares the eye to an oil lamp that at night has its flame protected by screens from the wintry winds. The screens scatter the winds, while permitting the finer, fiery light to emerge through them, such that the fire within the eye, shielded from the eye's own watery composition and external moisture, can emit light fine enough to emerge. Love (Aphrodite) has made the eye with membranes doing the work of the lantern's screens and possibly protecting the eye's fire from the eye's own moisture, while allowing the subtle fire to pass out from the eye through the membrane.[55]

Reference to Empedocles' lantern-like eye in a stormy night discloses that this image also suggests Aristotle's previous attack on the *Timaeus*; moreover, the image ironically might allow Timaeus to defend against Aristotle's objection.[56] Empedocles has not sought like Timaeus to explain why with lantern-like eyes we do not see in the dark, but Empedocles protects the fiery light from wind and rain, i.e., he shows why storm does not counter sight and possibly why the water in the eye does not endanger its own fire and light. The fineness and subtlety of the particles of light—rather than gentleness—enabling them to penetrate the membrane on the eye's surface and the storm's water can also rescue the

54 Ross 1955, 190 points to a "reminiscence" of Empedocles' ὅσον ταναώτερον ἦεν in *Timaeus* 45b4: τοῦ πυρὸς ὅσον τὸ μὲν κάειν οὐκ ἔσχε, τὸ δὲ παρέχειν φῶς ἥμερον, supporting Plato's indebtedness. Caston 2015, 33 instead suggests Aristotle mistakenly links Empedocles to Plato.

55 Sedley 1992, 22 takes Empedocles' simile to refer only to the "externally visible features" rather than to the eye's internal structure, so the membranes would only parallel the lamp's screens. Rather than also protecting from the deeper moisture of the eye, the cornea shields from external moisture and protects the eye's lachrymal fluid. Sedley (p. 25) has Empedocles, based on Theophrastus' account, taking the fire flowing out from the eye to interact with moisture on the eye's surface, "so that it is the reflective surface of the eye that is responsible for vision…paralleled in Hippocratic writings" (Hipp. *Carn.* xvii 8.606). Fire passages receive light effluences and water passages dark effluences; the effluences fitting into passages "cumulatively build up a picture on the eye's surface" (26). This account discloses "Aristotle's mistake of conflating it [Empedocles' simile] with Plato's visual ray theory in the *Timaeus*". However unfair Aristotle may be, he clearly links Empedocles with Plato, which is what most matters for interpreting Aristotle. Caston 2015, 33 says Empedocles was only using the lantern to deal with night vision.

56 For further irony in all this discussion of rain as possibly extinguishing fire, light, and vision, see the comments below on *De somno* 457b31-458a10, and again this all prefigures the eventual discussion of death as extinguishing of heat in *De juv*.

Timaeus's account from the rain objection. And when the *Timaeus* has external darkness "extinguish" the light emerging from the eye, this might only mean that without any additional external light source, no light comes off objects to mix with light from the eye to cause to vision. Aristotle thus seems to reveal both objections to the *Timaeus* and how to resist them. Nevertheless, he may pressure his opponents to acknowledge that they do not view light as ordinary fire, but most unusual fire. And leaving unexplained the supposed emanations from objects and how this light should fit into vision, they may find this sufficiently troublesome that they might instead accept Aristotle's own account of light, which rejects it as fire and corpuscular. If we wonder how strong Aristotle thinks his case is against light as fiery corpuscles, we find that he must continue the attack against effluence accounts throughout the treatise, and especially in chapters 6-7. Devoting so much argumentation to the case indicates not only its importance, but also lack of a single decisive and devastating argument, with recognition by Aristotle of the difficulty of fully effective counter argumentation.

The primary issue, then, is whether light is corpuscular and travels, or not (438a5-10). Empedocles may combine fiery corpuscles escaping a lantern-like eye with corpuscular effluences (ταῖς ἀπορροίαις) emanating from visible objects. To challenge any such position, Aristotle turns to the atomist Democritus who most insistently has corpuscular atomic films coming off what is visible.

> Democritus says that it [the eye] is water, he speaks well, but that he believes seeing is the reflection, not well; for this [reflection] happens because the eye is smooth, and it is not in that [eye] but in the one seeing [the observer]; for the affection is reflection, but universally concerning mirrors and reflection nothing yet was clear, as is likely. (438a5-10)

438a5 Δημόκριτος δ' ὅτι μὲν ὕδωρ εἶναί φησι, λέγει καλῶς, ὅτι δ' οἴεται τὸ ὁρᾶν εἶναι τὴν ἔμφασιν, οὐ καλῶς· τοῦτο μὲν γὰρ συμβαίνει ὅτι τὸ ὄμμα λεῖον, καὶ ἔστιν οὐκ ἐν ἐκείνῳ ἀλλ' ἐν τῷ ὁρῶντι· ἀνάκλασις γὰρ τὸ πάθος, ἀλλὰ καθόλου περὶ τῶν ἐμφαινομένων καὶ ἀνακλάσεως οὐδέν πω δῆλον ἦν, ὡς ἔοικεν. a10

Aristotle commends Democritus' having the eye mainly water—Empedocles may allow that the eye is moist but most essentially fire—yet Aristotle rejects the account of seeing based on an appearance or reflection (τὴν ἔμφασιν) on the eye's smooth surface. Democritus takes the observable reflection in the pupil of a person's eye, which can be observed by someone else, as disclosing the person's vision and evidence that the vision is due to effluences coming off objects to form an image, e.g., of the one facing the person seeing him (cf. Plato *Alcibiades I* 132d-133b and *MM* ii 15.1213a20-24). The observable reflection in the eye's surface is

assumed an image of what is on the hidden inner surface of the seeing person's eye explaining the eye's seeing, rather than merely an observed reflection being seen, by a further observer. Aristotle is denying the image on the surface of the eye is the eye's seeing, for not the eye but an animal sees, and in this case another person sees the reflection in another's eye.

The image on the eye's surface is just the universal phenomenon of reflection on certain smooth surfaces, about which those in Democritus's time were unclear (cf. on smoothness and reflection, 437a31-b10). Vision hardly consists of any image, or a reflection on the eye's smooth outer or inner surface, but instead occurs in the seeing, ensouled animal. In Democritus's time, a younger contemporary of Socrates, and so back perhaps in the 420s, there was yet little progress in the science of optics about images and reflection, progress that takes place shortly thereafter, and seems celebrated by Plato (*Timaeus* 46a-c). Can any account that relies on corpuscles and effluences to explain vision escape problematic images and representations in the eye? By going back from Plato to Empedocles and Democritus, Aristotle gets Plato's scheme's origins, and the liability of relying on corpuscular fire and light generating images. Such accounts through images likely sneak in a homunculus viewing the images.[57]

Theophrastus's representation of Democritus in *De sensibus* 10.50 indicates that Aristotle over-simplifies the atomist position, for Democritus has the effluence in combination with light impacting on the air in front of the eye to create an "air impression" that in fact enters the seeing eye, where there are vessels with openings congruent with the particles (438a10-15). Nonetheless, Aristotle's simplification gets to the key point that an observing animal rather than any arrangement of corpuscles should account for the seeing.

> Absurd it is indeed that it did not come up for him to be perplexed on account of what the eye alone sees, but none of the others in which images appear. Now that the eye is of water is true, yet it does not happen to see insofar as it is water but as transparent; which is also common to the case of air. (438a10-15)

438a10 ἄτοπον δὲ καὶ τὸ μὴ
ἐπελθεῖν αὐτῷ ἀπορῆσαι διὰ τί ὁ ὀφθαλμὸς ὁρᾷ μόνον,
a12 τῶν δ' ἄλλων οὐδὲν ἐν οἷς ἐμφαίνεται τὰ εἴδωλα. τὸ μὲν

57 Plato's account in the *Timaeus* with minuscule triangles may not explain perception by images. Long after Aristotle, Kepler following the contribution of Alhazen developed the retinal image account of vision (see Lindberg 1976), which employs point-by-point images (perhaps observed by a homunculus?). Descartes and subsequent philosophers take vision to resemble watching images on a screen, somewhat like the situation of the prisoners in Plato's cave allegory in *Republic* vii, rather than the *Timaeus*'s account of vision.

438a13 οὖν τὴν ὄψιν εἶναι ὕδατος ἀληθὲς μέν, οὐ μέντοι συμβαί-
νει τὸ ὁρᾶν ᾗ ὕδωρ ἀλλ' ᾗ διαφανές· ὃ καὶ ἐπὶ τοῦ ἀέ-
a15 ρος κοινόν ἐστιν.

Were effluences arranging corpuscles into images sufficient for seeing, Democritus should be perplexed, Aristotle suggests, that the eye alone sees, rather than everything in which images appear as reflections, e.g., a mirror or a river. Images in a bronze mirror or in water might have the mirror or water seeing what is imaged. Water may well be a material cause of vision, but for Aristotle it is not *as water*, but *as transparent* that such matter as water or air helps with vision. Emphasis on water's transparency as most important for its role in vision fights the significance of reflections, for water simply as transparent might be seen through rather than support reflections. Vision cannot be simply a reproduction or imaging of what is to be seen, for the seeing results from action upon the transparent sense medium and sense organ. Water and air's transparency suits light's role in vision without need for fire in the eye's composition or images developed in or upon the eye.

Looking to transparency rather than elemental water or air, Aristotle's understanding of vision already questions merely assigning elemental bodies to sense organs. For him sense perception depends upon appropriate sense media, rather than elemental bodies as elemental. The eye is watery not to be like its sensible object as elemental, but because transparency of the sense organ is required to be like the sense medium's receptivity. The sensible object's color can act on the transparent sense medium and organ since as colorless they are most receptive to its action.

Though transparency applies to both air and water, due to some other of its features, water better composes the eye (438a15-25).

> But water is more easily guarded and more readily compressed than air; hence indeed the eye jelly and the eye consist of water. This is also clear from the facts themselves; for what flows from eyes when decomposing appears to be water, and this in undeveloped embryos is exceedingly cold and glistening, and the white of the eye in sanguineous animals is fatty and oily; which on account of this the moisture of the eye remains uncongealed, and on account of this the eye is of all parts of the body the least sensitive to cold; for no one ever feels cold inside the eyelids. The eyes of bloodless animals are hard skinned, and this makes their covering. (438a15-25)

438a15 ἀλλ' εὐφυλακτότερον καὶ εὐπιλητότερον τὸ
ὕδωρ τοῦ ἀέρος· διόπερ ἡ κόρη καὶ τὸ ὄμμα ὕδατός ἐστιν.
τοῦτο δὲ καὶ ἐπ' αὐτῶν τῶν ἔργων δῆλον· φαίνεται γὰρ
ὕδωρ τὸ ἐκρέον διαφθειρομένων, καὶ ἔν γε τοῖς πάμπαν
a19 ἐμβρύοις τῇ ψυχρότητι ὑπερβάλλον καὶ τῇ λαμπρότητι,

438a20 καὶ τὸ λευκὸν τοῦ ὄμματος ἐν τοῖς ἔχουσιν αἷμα πῖον καὶ λιπαρόν· ὅπερ διὰ τοῦτ' ἐστί, πρὸς τὸ διαμένειν τὸ ὑγρὸν ἄπηκτον, καὶ διὰ τοῦτο τοῦ σώματος ἀρριγότατον ὁ ὀφθαλμός ἐστιν· οὐδεὶς γάρ πω τὸ ἐντὸς τῶν βλεφάρων ἐρρίγωσεν. τῶν δ' ἀναίμων σκληρόδερμοι οἱ ὀφθαλμοί εἰσι, καὶ
a25 τοῦτο ποιεῖ τὴν σκέπην.

The eye jelly or fluid (ἡ κόρη) and the eye (τὸ ὄμμα), Aristotle says, are suitably composed of water. ἡ κόρη can mean "girl", and it comes to mean the pupil of the eye, as it is generally translated, since it is on the pupil that someone's reflection might be seen. In the context Aristotle has been speaking of reflections on the eye's surface, so κόρη might mean pupil, where such reflections can appear. But the reflection might also be in the inner surface of the eye, and Empedocles had spoken of the κούρη in 438a1 as what is encircled, so Aristotle in the *De anima* and *Parva naturalia* seems to mean by κόρη the eye's fluid as the key part of the eye given its transparency (see 438b16). By conjoining κόρη and eye as he does, then, the *kai* seems to be exegetical, which confirms that the eye generally is water rather than fire.[58]

Having the eye primarily composed of water counters any view that the eye operates by fire, and some facts that Aristotle elicits make evident that water rightly dominates the eye's construction. While both air and water are transparent, water can be better maintained as the eye's compact sphere, for it does not have to be held under pressure, as would air. That the eye is predominately water is manifest, since water flows out of corrupted eyes, even in young embryos there is an excess of cold and bright fluid, and the white of the eyes of blooded animals is fatty and oily (πῖον καὶ λιπαρόν). Some of this comes from medical observation in human diseases and injuries, though the restriction in Aristotle's time of dissection of human corpses means some comes from dissecting other animals.[59]

58 For a source of the use of κόρη, see 438a1. When in 438b16 Aristotle refers to that which is called the *korê* (τὴν καλουμένην κόρην) and links it with the transparent, it is as if to indicate that the term is being used metaphorically to mean the transparent eye jelly. This should be compared to 437a32-b1, where Aristotle refers to "the so-called the black of the eye and its smooth middle (or interior surface)". Sedley 1992, 22 states, "'eye' is in any case the regular poetic use of κόρη in the fifth century", and he refers to Aristophanes *Vesp.* 7; Sophocles fr. 710; Euripides *Ion* 876, *Hec.* 97. We shall frequently in these texts, e.g., 437b1, 438b16, 455a11, 467b30, 468a10, a24, 469b19, 470a9, 471b22, 476a2, a6, a20, b15-16, b32, 477a5, 478a14, 479b21, find Aristotle referring to a term as "so-called" or "being called" (καλούμενον or καλουμένην). He is pointing out the metaphorical derivation of or ambiguous usage of a technical term, possibly recently developed.

59 Sedley 1992, 22 says regarding dissection about Empedocles' time, "As G.E.R. Lloyd has argued, human dissection at this date is out of the question, and one should be extremely cautious

Whiteness and brightness accord with wateriness, as does oilyness (see 441a23-26). Brightness may fit with youthful eyes as opposed to the dimming eyes of the aged. The oilyness of the eye jelly explains its remaining fluid rather than freezing, congealing, and solidifying. He can assert on this basis that the eye is the part of the body least vulnerable to cold, and that no one has yet felt cold inside the eyelids. Since congealing water loses transparency, it is vital to vision that the eye, as sense organ, resist any freezing. Many blooded land animals not only have the white of the eyes fatty and oily to protect from cold and freezing, but they have protective eyelids. Animals lacking eyelids may still have comparable protection from eyes being hard-skinned (σκληρόδερμοι, see *DA* 421b30-31, *DS* 444b23-28, and *PA* ii 13). Why Aristotle refers specifically to the hard-skinned eyes of *bloodless* animals is that unlike many blooded aquatic animals without eyelids and having hard-skinned eyes, which still have fatty and oily eyes, the bloodless animals without eyelids lack fatty and oily eyes.

The eye being predominately water, Aristotle claims the views entirely unreasonable that explain vision by something emerging from the eye, such as effluxes extending to the stars or growing together with some effluence coming from the sensible object (438a25-b2). This may apply to Empedocles and the *Timaeus*, and even to Democritus, who has effluences commensurate with openings, stretching until the stars, and forming images (cf. *DA* 419a15-21).

> It is wholly unreasonable to have seeing by something going out, indeed stretching until the stars, or until in going from to grow together with something, just as some say. For it is better than this that the growing together is in a beginning of the eye. But even this is simple-minded; for that which grows together is light with respect to light, or how is it able to belong (for not with the chancing thing does the chancing thing grow together), and how the thing from the inside to that from the outside? For the membrane is between. (438a25-b2)

438a25 ἄλογον δὲ ὅλως τὸ ἐξιόντι τινὶ τὴν ὄψιν ὁρᾶν, καὶ ἀποτείνεσθαι μέχρι τῶν ἄστρων, ἢ μέχρι τινὸς ἐξιοῦσαν συμφύεσθαι, καθάπερ λέγουσί τινες. τούτου μὲν γὰρ βέλτιον τὸ ἐν <τῇ> ἀρχῇ συμφύεσθαι τοῦ ὄμματος. ἀλλὰ καὶ τοῦτο εὐήθες· τό τε γὰρ συμφύεσθαι τί ἐστι a30 φωτὶ πρὸς φῶς, ἢ πῶς οἷόν θ' ὑπάρχειν (οὐ γὰρ τῷ τυ- 438b1 χόντι συμφύεται τὸ τυχόν), τό τ' ἐντὸς τῷ ἐκτὸς πῶς; ἡ b2 γὰρ μῆνιγξ μεταξύ ἐστιν.

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of expecting even animal dissection of any but a very rudimentary kind before the time of Aristotle."