ARISTOTLE ON *PNEUMA* AND ANIMAL SELF-MOTION

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One puzzle surrounding Aristotle's work *De motu animalium* is the function ascribed to *pneuma*. Why, in accounting for animal motion, does Aristotle make use of a material that is elsewhere compared to *aithēr*, the stuff of the stars? A second puzzle—one that has received more attention in recent literature—is why, in *Physics* 8, Aristotle calls animals 'self-movers' if their motion is caused by something external. A number of scholars exploring Aristotle's reasons for assigning a particular status to animal motion have proposed philosophically sophisticated accounts of the sense in which animals have a particular responsibility for their own motion. Without denying the value of these accounts for understanding action, I suggest that Aristotle's reason for calling animals self-movers is much simpler than that proposed in the recent literature. I also propose that his reason for calling animals self-movers is critical to understanding the role of *pneuma* in the account of animal motion.

The relevant capacity that animals—including humans—possess is, I suggest, merely the ability to move locally in response to other kinds of change. The issue is not about causal 'fresh starts'. Inanimate things can move when acted upon by other moving bodies—a rolling stone sets another in motion—but animals have the ability to move locally in situations where the immediate causes acting on them do not include something moving in place. This answer may seem simplistic, but I think that Aristotle takes this ability to initiate *local* motion to be worthy of note. He draws on *pneuma*, in turn, to explain this ability.

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1. Animal self-motion

A number of recent scholarly accounts of the self-motion of animals begin from an apparent tension surrounding Aristotle's claim in *Physics* 8 that animals are self-movers.

> Aristotle sometimes calls animals self-movers, but in two crucial passages in *Phys*. VIII, he appears to deny that they are. Is this apparent inconsistency due to Aristotle's philosophical development, or is his position as a whole consistent?[1]

The apparent tension arises because Aristotle designates animals as self-movers, creating a special category distinct both from things that 'move and are moved' and from an unmoved mover. Morever, he denies that a man is a mover 'by being moved by something else'.[2] Yet on the other hand Aristotle clearly denies that animal motion is uncaused, and indeed gives an account of the way in which animal motion is caused by external stimuli (*Phys*. 8. 2, 253^{a}14–18; 8. 6, 259^{b}7–14; *De anima* 3. 10, 433^{a}18–20). It is in response to objects of desire and avoidance, and the changes these cause, that an animal pursues or flees.

David Furley focused attention on two crucial passages from *Physics* 8, as follows:

> We see that there plainly are things that move themselves, such as the class of things with souls, and animals; and these suggested that it may be possible for motion to arise in something from total nonexistence, since we see this happening to them (being immobile at some time, they are then put into motion, as it seems). Well, we must note this, that they move themselves with *one* motion, and this not strictly; for the cause is not in themselves, but there are other natural motions in animals, which they do not have because of themselves—for example, growth, decay, respiration, which are motions undergone by every animal while it is at rest and not moved with its own motion. The cause of this is the environment, and many of the things that enter [the animal], such as food . . .
>
> But this [sc. that animals move from a state of rest, having been moved by nothing external to them] is false. We always see one of the connatural parts of the animal in a state of motion, and it is not the animal itself that

[1] M. L. Gill and J. G. Lennox, 'Introduction', in M. L. Gill and J. G. Lennox (eds.), *Self-Motion: From Aristotle to Newton* [*Self-Motion*] (Princeton, 1994), xiii–xxi at xv.

[2] *οὗτος δ' οὐκέτι τῷ ὑπ' ἄλλου κινεῖσθαι*: *Phys*. 8. 5, 256^{a}8.

is the cause of the motion of this, but perhaps its environment. In using this expression, that a thing moves itself, we speak not of every [kind of] motion but only of locomotion [*αὐτὸ δέ φαμεν αὑτὸ κινεῖν οὐ πᾶσαν κίνησιν, ἀλλὰ τὴν κατὰ τόπον*]. So nothing prevents—perhaps rather it is necessary—that many motions come about in the body because of the environment, and some of these move the mind or desire, and the latter then moves the whole animal . . .[3]

Of several attempts at reconciliation, some seem not to be specific enough. Gill's account of the way in which animals are self-movers focuses on the particular explanatory role of active capacities or *δυνάμεις* in Aristotelian natural philosophy: she takes these to be the justification for taking animals to be responsible for their own change.[4] Regardless of the fact that other causal factors are involved in instigating natural processes, she argues, natural things stand in a privileged position with respect to certain causal processes of which they are said to be the origin. She relates the special status of active *δυνάμεις* to Aristotle's rejection of the explanatory adequacy of an account of the physical mechanisms involved in causation. Natures are needed to explain why causal processes work as they do.

This is surely right as an account of the explanatory role of active capacities and natures in Aristotle, and helps make sense of the fact that elements are not self-movers. However, it does not quite account for the particular point Aristotle is making in *Physics* 8. Taking Aristotle's notion of active *δυνάμεις* as a way to describe the particular sense in which animals are responsible for their own motion cannot account for the fact that Aristotle says that 'self-mover' refers to *local* motion, not all kinds of change (*Phys.* 8. 2, $253^{a}14$–15; 8. 6, $259^{b}7$; cf. *De anima* 3. 9, $432^{b}8$ ff.): as Gill recognizes, Aristotle takes animals to have *δυνάμεις* for all kinds of change.[5] Not all living things are called self-movers.

Meyer's suggestion is that the distinction between accidental and non-accidental causes can reconcile Aristotle's claims about ani-

[3] *Phys.* 8. 6, $259^{b}1$–17, and 8. 2, $253^{a}11$–20, translation by David Furley, 'Self-Movers', in Gill and Lennox (eds.), *Self-Motion*, 3–14 at 6.

[4] M. L. Gill, 'Aristotle on Self-Motion' ['Self-Motion'], in Gill and Lennox (eds.), *Self-Motion*, 15–34.

[5] Gill, 'Self-Motion', 17. She tries to accommodate this by differentiating between calling local motion 'strictly "self-changes"', in contrast to the actualization of other capacities.

mal self-motion.[6] The suggestion is that the external stimuli causing animal self-motion are merely accidental causes, while animals themselves are non-accidentally causes of their own motion. Thus animal motion could be caused by external factors while the animal itself is said to be the source of change.

While this distinction is surely available to Aristotle, it does not seem to offer a basis for distinguishing animal motion from that of elements. The external instigator of natural motion is said to be a cause of the motion of elements only accidentally, inasmuch as it removes an impediment or instigates the elemental transformation that then results in a new natural motion (*Phys.* 8. 4, $255^{b}23–31$). Whatever caused the change of wood to fire is accidentally the cause of the rising of fire; fire's own nature is non-accidentally the cause of its own rising. Animals are explicitly distinguished from elements by their capacity for self-motion (*Phys.* 8. 4, $255^{a}6$).

Waterlow recognizes that 'self-changers' are only a subclass of things that change by their nature, and that the account needs to be more restricted.[7] She proposes that Aristotle has in mind the 'logical complexity of that which has the change': both agent and patient are contained within it.[8] While this feature of self-movers is clearly important, again, it does not show why animals rather than plants or complex artefacts are self-movers. Nor does it show why self-motion is explicitly restricted to *local* motion.

These responses are, I think, too broad to pick out the particular sense in which animals are self-movers while other things are not. Two other accounts, focusing on intentionality and the role of final cause in desire, are specific to animal action in the right way, inasmuch as they are fundamental to an account of action. None the less, I suggest that neither is Aristotle's reason for calling animals self-movers.

First, Furley develops an account of the sense in which animals have a unique causal role in self-motion because of the intentional nature of objects of desire. An agent desiring an external object necessarily desires it *under a certain description*: the causal process depends on the way the situation is understood by the desirer, and in

[6] S. S. Meyer, 'Self-Movement and External Causation', in Gill and Lennox (eds.), *Self-Motion*, 65–80.

[7] S. Waterlow, *Nature, Change, and Agency in Aristotle's Physics* [*Nature*] (Oxford, 1988), 205–6.

[8] Ibid. 208. See P. King, 'Duns Scotus on the Reality of Self-Change', in Gill and Lennox (eds.), *Self-Motion*, 227–90.

this sense animals are uniquely implicated as the cause of their own actions.[9] Furley's proposal focuses on an issue similar to the one Nussbaum identifies when she argues that the faculty of *phantasia* involves interpretation or 'seeing as', and hence that animals are responsible for their actions in a way that inanimate things are not.[10] Furley takes it that, since the object of desire cannot be identified independently of the psychological capacities of the desiring agent, animals are correctly described as self-movers.

Second, Freeland argues that, while intentionality does play a role in causing action, this is not the primary justification for calling animals self-movers: 'what is crucial for defining animals as self-movers is that their behavior exhibit some underlying objective goal-directedness'.[11] She reminds us that Aristotle is not concerned to allow for freedom or indeterminism of animal action—as the focus on intentionality might suggest—and thus for the kind of agency associated with responsibility.[12] Freeland's view is that Aristotle focuses on the animal's capacity to read the situation in a way conducive to its own good and to act accordingly. Agency, she argues, is not the capacity for underdetermined response, but the capacity for goal-directed response: the difference between self-mover and automaton is the capacity to aim at some good.[13] A subjective notion of the good—the goal as perceived by the animal—Freeland argues, is secondary to the role of objective good. Animals are self-movers in the sense that they can pursue their own good.[14]

Freeland's proposal to focus on the goal-directedness of animal action does not, as she recognizes, undercut the importance of perception in accounting for the particular capacities of ensouled beings.[15] Otherwise, the response of a plant—or even a well-designed

[9] Furley, 'Self-Movers', 12–14.

[10] M. C. Nussbaum, *Aristotle's* De Motu Animalium*: Text with Translation, Commentary, and Interpretive Essays* [*De Motu Animalium*] (Princeton, 1978), 256–69.

[11] C. A. Freeland, 'Aristotle on Perception, Appetition, and Self-Motion' ['Self-Motion'], in Gill and Lennox (eds.), *Self-Motion*, 35–64 at 53.

[12] Ibid. 39. I believe my proposal is compatible with Aristotle's claim at *NE* 3. 1, 1110^{a}16, that action is voluntary in that the ἀρχή of motion is in the agent: again, this means the origin of *local* motion, and does not preclude there being other kinds of external causes, so long as the agent is not pushed. I thank Ricardo Salles for urging me to clarify this.

[13] Freeland, 'Self-Motion', 59.

[14] Ibid. 51. The objective nature of an animal's good and the fact that causal processes support action to this end delimit the role of the agent in the process.

[15] Freeland recognizes that perception—and the intentionality this implies—is essential to distinguishing the goal-directedness of animal action from the goal-directed growth of plants or natural motion of elements: Freeland, 'Self-Motion', 53.

artefact—would count as goal-directed in Freeland's sense, i.e. from an objective point of view. Both intentionality and desire are important in understanding the logic of action: both certainly seem important in explaining the capacities animals have that are not shared by inanimate things. The animal itself must feature in any account of its action.

None the less, this does not entail that Aristotle takes either to be his reason for calling animals self-movers. Neither Furley's answer nor Freeland's shows why only *local* motion is at issue. Scholars look beyond *Physics* 8 for an account of self-motion in order to resolve an apparent tension, but there is a much simpler reading, on which the tension does not arise. I propose that Aristotle takes the claim that animals are self-movers to be commonsensical: an animal, unlike a plant or a stone, can get up and move around without being pushed or pulled by other moving bodies. Certainly, its motion is caused, but not immediately by something else *moving locally*. The apparent tension arises only because *κίνησις* can be used of change generally or of local motion specifically.

When Aristotle claims that a thing moves itself with respect only to local motion, not every kind of change, he should not be taken to deny that animals cause change in other categories than local motion. Animals are said elsewhere to be the cause of non-local changes, say, generation.[16] But ordinary usage identifies animals as distinguished by the ability to move around when they are not pushed. Animals are not the origin of change in the absence of any other change, but of local motion in the absence of other local motion in the immediate vicinity. What animals can do that inanimate things cannot is to be the first thing moving locally in an immediate context where there are other changes occurring, but not local motion.

There would be no tension between granting to animals a capacity for self-motion, thus understood, and affirming that change requires a cause. In particular, it would not prevent Aristotle from denying that the cosmos could begin moving from a state of rest.

[16] *Phys*. 3. 2, 202^{a}9–11; *NE* 3. 5, 1113^{b}18. Gill points out that the organism is also the origin of changes that result in acquired capacities: Gill, 'Self-Motion', 17. Waterlow, *Nature*, 211 n. 5, notes that the claim is problematic. Catherine Wilson suggests that Aristotle's position might be disambiguated by taking change to mean different things, although I disagree with her suggestion as to how this might work out: 'De Ipsa Natura: Sources of Leibniz's Doctrines of Force, Activity and Natural Law', *Studia Leibnitiana*, 19 (1987), 148–72.

Furley thinks that, in *Physics* 8, Aristotle qualifies the claim that animals are self-movers because he is concerned that assigning self-motion to animals might be taken to entail that the cosmos as a whole should also be capable of initiating its own motion.[17] Given that all changes require some prior change of some kind (*Phys.* 8. 7, $260^{a}27$–$^{b}14$; $261^{a}4$–12), then if the cosmos were completely at rest, there would be no change—such as those an animal undergoes when it initiates pursuit or avoidance—to cause local motion. Aristotle need not share Furley's concern: he can dismiss the analogy to the cosmic case, since self-motion of the cosmos as a whole from a state of complete rest would be by definition a case of uncaused change.

Animals, I claim, are self-movers inasmuch as they can initiate local motion in response to other kinds of change. This may seem too simplistic a solution to a vexed problem. Why would Aristotle create a new category for describing things that 'initiate' change merely inasmuch as only local motion is at issue, but are in no sense causal 'fresh starts'? What makes this worthy of a distinct category, for Aristotle, is not only the common intuition that there is something special about animals' ability to walk, fly, or swim, but also that very few natural processes can be the first in a chain of local motion. Aristotle recognizes that changes in other categories are generally caused by an instance of local motion (*Phys.* 8. 7, $260^{a}27$–$261^{a}12$). Local motion is prior to other kinds of change (*Phys.* 8. 7, $260^{a}26$ ff.; 7. 2, $243^{a}35$), and as such, those processes that initiate local motion, while not causal 'fresh starts' *tout court*, have a special status in an Aristotelian account of change.

Local motion plays a pivotal role in Aristotle's system. Qualitative alteration, growth, and the coming to be of new substances are all initiated by something moving in place (*Phys.* 8. 7, $260^{a}27$–$^{b}14$; $261^{a}4$–12). An animal moves closer to the fire, eats, mates, opens its eyes; rain falls on clay, branches rustle, a seed blows in the wind. Aristotle's cosmology is driven by the circular motion of the heavenly sphere (*Phys.* 8. 7, $260^{b}25$–8); the particular capacity of its first mover is to be able to initiate local motion in other things without itself being acted on. Since other changes are initiated by local motion, the processes initiating local motion are exceptional and fundamental.[18]

[17] Furley, 'Self-Movers', 5.

[18] Ross takes responding by local motion to be characteristic of living things: W. D. Ross, *Aristotle's* Physics*: A Revised Text with Introduction and Commentary*

The elements, although moving locally is natural to them, are not self-movers. It might seem that the peculiarity of transformations among the four elements is that local motion follows as a consequence of substantial change: when earth becomes fire, fire rises; when air condenses, water falls. However, elemental transformation seems to follow some kind of local motion in the immediate vicinity, setting the wood alight or bringing in colder air: the elements are moved either by what instigated the elemental change or by what removed an impediment (*Phys.* 8. 4, 256^{a}1). So elemental transformations are not what people mean by self-movers: elements do not begin to rise or fall from rest with no immediate external local mover (*Phys.* 8. 2, 252^{b}18–23).[19] Cases where local motion follows from change in another category have a pivotal role in the natural order. Change usually proceeds from local motion to other kinds of change and not vice versa: first local motions are important turning points.

Aristotle, then, denies that animal motion is uncaused, but rather stresses that there is a difference of kind in the way animals and inanimate things react to the stimuli that impact on them. In *De motu animalium* he takes up this theme, saying that, apart from the motion of the heavens, animals are the cause of all *κίνησις* that does not involve the striking of bodies against one another (*MA* 6, 700^{b}11).[20] This statement recognizes that animals can be affected in different ways from what is possible for lifeless bodies, particularly by the object of desire (*MA* 6, 700^{b}15–25). The object of desire does not work by the ordinary method of bodies striking, but none the less gives rise to alterations in the animal. In a physics where local motion is usually the cause of other kinds of change, the originators of local motion merit special consideration.

There is, of course, more to say in *explaining* how animals move and how desire and perception enter in. However, such features need not constitute Aristotle's reason for calling animals self-movers. The reason is much simpler: animals rouse themselves to local motion; inanimate things do not. The ability to turn al-

(Oxford, 1936), 25: I thank Sean Kelsey for noting this. The anonymous referee notes a difficulty in the case of Aristotle's account of thunder, where condensation causes motion by 'squeezing out' cloud (*Meteor.* 2. 9, 369^{a}10 ff.). Aristotle does concede, however, that condensing—change in size—requires change of place (*Phys.* 8. 7, 260^{b}10–14).

[19] See also Gill, 'Self-Motion', 31.

[20] As the anonymous referee points out, this claim excludes the elements: thus, it supports the case that elemental transformation requires something moving locally.

teration into local motion characterizes animal self-motion. This, I claim, is the reason for introducing *pneuma* in *De motu animalium*.

2. *Pneuma*'s role in animal motion

Aristotle introduces *pneuma* explicitly in chapter 10 of *De motu animalium*. Scholars disagree on whether Aristotle has a systematic theory of *pneuma*—it makes occasional appearances in the *Parva naturalia* and the biological works—and also on its importance in this account of animal motion.[21] There is justice in Nussbaum's description of this material as 'a hypothetical gap-filler whose workings cannot be scrutinized too closely'.[22] It appears late in the account of animal motion: some think he has already given a complete account without mentioning *pneuma*, which is not mentioned at all in the account of animal motion at *De anima* 3. 9. Nussbaum rightly argues that a new material, analogous to the *aithēr* (*GA* 2. 3, 737^{a}1), is introduced to perform a specific task that the four elements cannot perform.[23] I depart only from Nussbaum's suggestion that *pneuma*'s function is to unify the organism, counterbalancing the tendencies of the elements of the body to rise and fall in opposite directions.[24] Another task, I argue, is more clearly indicated.

I propose that the task performed by *pneuma* is anticipated in chapter 7. There, Aristotle compares animal locomotion to that of *automata* and carts (*MA* 7, 701^{b}2): *automata* here are some sort

[21] Discussions include W. Jaeger, 'Das Pneuma aus Lykeion', *Hermes*, 48 (1913), 31–70; A. L. Peck, 'Appendix B', in *Aristotle*, xiii. *Generation of Animals*, trans. A. L. Peck (London, 1943), 576–93; F. Solmsen, 'The Vital Heat, the Inborn Pneuma and the Aether', in *Kleine Schriften*, i (Hildesheim, 1968), 605–11; D. M. Balme, *Aristotle's* De Partibus Animalium *I and* De Generatione Animalium *I* (Oxford, 1972), 157–64; S. Clark, 'Appendix A: *Pneuma*', in *Aristotle's Man: Speculations upon Aristotelian Anthropology* (Oxford, 1975), 202–5; M. C. Nussbaum, 'The *Sumphuton Pneuma* and the *De Motu Animalium*'s Account of Soul and Body', in Nussbaum, *De Motu Animalium*, 143–64; G. Verbeke, 'Doctrine du Pneuma et Entéléchisme chez Aristote', in G. E. R. Lloyd and G. E. L. Owen (eds.), *Aristotle on Mind and the Senses: Proceedings of the Seventh Symposium Aristotelicum* (Cambridge, 1978), 191–214; G. Freudenthal, *Aristotle's Theory of Material Substance: Heat and Pneuma, Form and Soul* [*Aristotle's Theory*] (Oxford, 1995).

[22] Nussbaum, *De Motu Animalium*, 163.

[23] Ibid. 159. At p. 347 Nussbaum notes that the animal turns qualitative change into local motion, but does not take this as the reason for introducing *pneuma*.

[24] Ibid. 161.

of wind-up toy.[25] The sinews and bones are compared respectively to the cords and pieces of wood: the sinews move the bones just as the cords move the wooden pieces when the tension on them changes. The point of comparison, as Furley suggests, is simply that the animal, like the puppet and the cart, is able to transform an initial change into a *different* motion: the wooden pieces move in several directions when they are jerked; the cart is pushed forward but moves in a circle; animals can transform qualitative alteration into local motion of the limbs.[26] Animal motion is distinguished from these toys in that it allows for more variation: this is because the part undergoing change can take on different shapes as well as different sizes (*MA* 7, 701^{b}13–16).

Aristotle talks about expansion and contraction at the *origin* of motion, and how a small change in the origin can result in a considerable change in other regions of the body, just as a tiny change in the rudder produces a considerable change of course (*MA* 7, 701^{b}24–7). The role of sinews—like that of the rudder—is to *augment* the effect, acting as a rigid body positioned so as to translate a small change at one end into a large change at the other. The reference to ideas of the first chapter is evident: a spatial configuration allows a small motion at one end of a rigid body to translate into a larger motion at the other.[27] In animal motion, an initial expansion in the *pneuma*, by the leverage of the sinews, produces a larger motion of the bones.[28]

In chapter 10 it is clear that Aristotle is returning to the idea that there is a specific body capable both of being affected and of initiating motion. This body must have a certain δύναμις and ἰσχύς. This term ἰσχύς, strength or force, seems to emphasize that it is

[25] The *automata* are driven by the release of the wound cords: like the cart, they continue moving when the external agent is no longer touching them, as at *GA* 2. 1, 734^{b}17. Cf. A. Preus, *Aristotle and Michael of Ephesus On the Movement and Progression of Animals*, translated with introduction and notes [*Aristotle and Michael*] (New York, 1981), 84–5; Nussbaum, *De Motu Animalium*, 347.

[26] D. Furley, *Two Studies in the Greek Atomists* (Princeton, 1967), 216. Nussbaum, *De Motu Animalium*, 144, 347, suggests that the transformation is from simple to complex: while this is true in the case of the puppet, the cart's motion is simple but different from the initial push. Cf. *GA* 2. 1, 734^{b}11; 2. 5, 741^{b}9; Preus, *Aristotle and Michael*, 84–5.

[27] In the pseudo-Aristotelian *Mechanica* various devices are treated as applications of a single principle involving different lengths of radii.

[28] It is only as a further illustration of the capacity of a small change in the pericardiac region to produce a large effect that alterations like blushing are introduced (*MA* 7, 701^{b}31).

not merely a passive capacity but an active force impelling other things. This is done by pushing or pulling, which are accomplished by expansion or contraction of the relevant material. *Pneuma* is able to expand and contract *ἀβίαστος*, unforced, and to push and pull other bodies when it does so.[29] Sense perception, *phantasiai*, and thoughts were said earlier to cause alteration, i.e. heating and cooling: these, we are reminded, involve changes in size (*MA* 7, 701^{b}16–24). *Pneuma* causes motion *not by alteration* (*μὴ ἀλλοιώσει*, *MA* 10, 703^{a}25). I take it that the point is not that the *pneuma* does not alter—it is in fact the part that heats or cools in experiencing desire—but that this is not how it acts. It is by the resulting *quantitative* change—expansion or contraction—that it causes motion.

Why would this capacity require a new material? In explaining how it pushes or pulls other bodies, Aristotle drops the curious remark that the body in question must be 'heavy in relation to the fiery and light in relation to the opposite ⟨of the fiery⟩' (*MA* 10, 703^{a}23–4).[30] *Pneuma*, if it is indeed analogous to *aithēr* (*GA* 2. 3, 737^{a}1), would literally be neither heavy nor light, i.e. have no tendency for upward or downward motion. I suggest that what 'heavy' and 'light' represent here is the ability to force other elemental bodies aside. The four ordinary elements can only do this in some circumstances: *τὰ φυσικὰ σώματα* overcome one another *κατὰ τὴν ὑπεροχήν*, 'according to excess' or 'predominance'; whichever element is present in excess of the other will prevail (*MA* 10, 703^{a}25–8). This falls short of the capacity requisite here. Animal motion needs a small amount of matter in an enclosed space to expand and push the sinews. If one of the four elements were acting on the sinews by the ordinary process of pushing aside, in which the body exceeding in quantity would prevail, the sinews would win every time and the animal stay put. The role of *pneuma*, then—that for which it is well adapted by nature (*MA* 10, 703^{a}18–22)—is to act on the sinews without being in excess.

If one of the four elements were the material expanding and pressing the sinews aside, it might moreover lose its power to act on a given body. Heating or cooling, say, water to any significant degree will result in elemental change into vapour or ice, and this

[29] Accepting Nussbaum's emendations, which make better sense of the text: Nussbaum, *De Motu Animalium*, 51.

[30] Peck draws a parallel to a passage in *De caelo*, where the ability to act on other bodies is attributed to air on the grounds that it is both light and heavy: it can cause motion in both directions (*De caelo* 4. 2, 301^{b}20 ff.): Peck, 'Appendix B', 587–8.

will affect its heaviness or lightness.[31] If the 'overcoming' power of elements—their ability to move one another—is constituted by their elemental nature, then elemental transformation will compromise this power. *Pneuma* does not turn into one of the other elements, does not move other elements by means of its inherent upward or downward tendency, and—we are told—can act on both light and heavy. The point seems to be that, unlike elements that change on expansion so as to become less capable of moving heavier bodies, *pneuma* retains its capacity for forcing other bodies aside. We do not get an explanation of how this works, just a stipulation of the task *pneuma* needs to perform.

Animal self-motion is, for Aristotle, one of the few cases where local motion begins and, as such, it is markedly different from the transmission of impact by inanimate things. This is not the only occasion where *pneuma* is introduced to perform an atypical feat. The account is compressed, opaque, and unsatisfying, but the aim is discernible: *pneuma*'s role is to respond to qualitative change so as to cause local motion, pushing other bodies aside even when it is not in excess. Against the background of *Physics* 8, it is apparent that the initiation of local motion, in the absence of an immediate local mover, is unusual and requires an account.

Pneuma is said to be the *ὄργανον*, the tool or instrument, of motion (*MA* 10, 703^{a}20). While Aristotle compares animal motion to moving artefacts, *automata*, the role of the analogy here is markedly different from the comparisons between organisms and working artefacts found in later philosophers.[32] In particular, Aristotle is not using the techniques available for building working artefacts to explain the causal processes operating in organisms. Rather, he radically separates the artificial from the natural case, by introducing into the latter a theoretical material with properties stipulated to be different from those of ordinary matter. Comparisons to artefacts are, for him, of limited value in helping us to understand what organisms do.

[31] Here I depart from Nussbaum's idea that *pneuma* is lighter than some elements and heavier than others in order to have a unifying function, counteracting the upward and downward tendencies of elementals: Nussbaum, *De Motu Animalium*, 161; followed by Freudenthal, *Aristotle's Theory*, 137.

[32] A point made by Dennis Des Chene in his recent account of the machine analogy in Descartes: a comparison to a machine 'need not be mechanistically conceived': *Spirits and Clocks: Machine and Organism in Descartes* (Ithaca, NY, 2001), 14.

3. Conclusion

I have been arguing that Aristotle's reason for calling animals self-movers is the simple fact that they, unlike inanimate things, are able to move locally in response to other kinds of change. In most cases, change in other categories is preceded by local motion; there are few cases where change occurs without local motion immediately causing it. This pre-theoretical characterization of the capacity of animals for 'self-motion' removes any apparent tension from Aristotle's account and also helps us to understand the role of *pneuma* in the process.

The function of *pneuma* is to show how animals are able to turn the qualitative changes associated with desire—heating or cooling—into local motion. It is distinguished from the four elements by its ability to do this without alteration; it seems to be credited with a particular capacity to force aside other elements even when it is not in excess, and to expand or contract without forfeiting its force. Aristotle needs to show how the alterations caused by the object of desire give rise to local motion. The motive for introducing *pneuma* in the account of animal motion is, I suggest, precisely to show how this unusual feat is possible.

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