Potentiality in Aristotle's metaphysics[1]

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In this paper I will argue that Aristotle built his ontology *solely on powers*.[2] On my reading, Aristotelian powers are *pure* powers. That is, all there is to a power is its powerfulness; nothing inert, or impotent is needed in the power's nature to anchor the power to reality.[3] But from this – namely that all there is to a pure power is its powerfulness – it doesn't follow that all there is to a pure power is potentiality. This latter position, which one encounters in contemporary accounts of powers, has the unwelcome consequence that a world of pure powers only is a world of potentialities only. I will argue that in Aristotle's system pure powers are actualised, not by a transition to different potentialities, but by a transition to a different status of the powers themselves.

Ontologies of pure powers are invariably construed as relational ontologies – powers in potentiality are taken to be essentially related to further powers in potentiality, namely, to their manifestations.[4] Aristotle's power ontology, by contrast, is *not relational*. On the one hand, a power in potentiality is the same power as its manifestation – so being manifested does not relate a power to a further power in potentiality. On the other, although Aristotle's powers are dependent on other powers in order to be activated, they are not related to these other powers through polyadic relations, such as '*x* being the father of *y*'. For Aristotle ontological dependence is grounded on monadic properties, such as '*y* being a father' and '*x* being an offspring', that belong to interdependent entities. Thus, neither the manifestation of powers nor the interdependence among powers require introducing polyadic relations in Aristotle's ontology.

The ontological interdependence between powers structures them into a (non-relational) nexus of powers, which is the bedrock of reality for Aristotle. Some of these powers are in potentiality and some in actuality. Powers in actuality are activated powers, exercising their powerfulness; they do not cease to be powerful while activated, nor is their powerfulness reducible to mere potentiality. Thus, powerfulness is either the potentiality to bring about change, or the actuality of bringing about change.

Thus Aristotle's ontology is a structure of interdependent powers at different stages of activation. Aristotle allows for three different ontological states of a subject in reference to a

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[1] The *European Research Council* and the *British Academy* have supported two different stages of the research leading to the preparation of this article.

[2] This interpretation makes a radical departure from the traditional ways Aristotle has been understood. I articulate it and defend it more fully than the limits of the present paper papers allow in my monograph in progress, provisionally titled *Power Stucturalism in Ancient Ontologies*.

[3] Contrast with views on which a power has a categorical basis (e.g. Ellis 2010), or it is qualitative as well as powerful (e.g. Heil 2003).

[4] See e.g. Bird (2007).

power: a subject *s* can possibly acquire a power (*s* can acquire the power of playing chess, or of heating other objects); *s* can have a power in first actuality (*s* has acquired the power to play chess and is not playing chess, or the power to heat other objects but is not heating any objects); and *s* can have a power in second actuality (*s* is playing chess, or is heating other objects). On my reading, for Aristotle both the first and the second actuality statuses are compatible with a power retaining its powerfulness, even if not in all cases its potentiality. This is why powers remain powerful while in actuality. This reading of Aristotle shows his account of powers to be importantly different from the contemporary accounts of powers, in that Aristotle does not identify the *powerfulness* of a power with its *potentiality* (or, in other words, to its *dispositionality*).[5] Rather, for Aristotle, only the first actuality of a power possessed by a subject is potential, while powerfulness extends also to the second actuality, the activated power; in both states, the power is powerful with reference to change – it is capable of bringing about change, or is bringing about change.

The appropriate conditions for the activation of a power by another power are generically described by Aristotle as 'contact' between the two powers. Contact could be thought of as a relation between powers, but Aristotle does not think of it in such terms. Rather, he analyses contact in terms of place and limits, without there being a connection between a limit and what converges on it.

Aristotle thinks of powers as differentiated into active and passive powers, where an active power 'moves' or somehow 'operates on' the passive power. In most cases he thinks in fact that each power is at the same time both active and passive, since powers operate on each other. It is helpful to think, with Aristotle, of the operation of a mover on a movable as the transmission of the form of a power, e.g. the hot, onto a passive power. This should not be thought to be a literal description, but a figurative account that explains what results from the mutual activation of an active and a passive power. Thus, it should not be thought that when an active power activates a passive power there is an underlying physical mechanism for the transmission of any item, such as the form of the agent to the patient power.[6] The transmission of form is a way of describing what is brought about by *causation*, as if the patient power received the form of the agent power (although nothing is actually transferred from the agent to the patient). But as we shall see, what happens is not a transmission, but an activation of the patient power by the active power.[7] Causal change, in Aristotle, results from the mere proximity of interdependent powers.

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[5] E.g. Ellis (2001: 127) Also, Bird (2007) and Mumford (2010).

[6] Aristotle understands perception too, which is a case of causation, as the reception of form without matter by the sense organ. For a fuller discussion of the case of perception, see Marmodoro, *Aristotle on Perceiving Objects*, forthcoming.

[7] In contemporary physics, to explain how elementary particles act on one another virtual particles are posited, as *force-carriers* (in effect, force-instances). Thus, elementary particles exert forces on each other by exchanging such virtual particles – e.g. the gauge bosons. One might think that, by introducing virtual particles to *carry* forces from particle to particle, e.g. the electromagnetic force or the weak force, contemporary physics has solved the problem of causal *efficacy* by replacing causal efficacy with *addition* to, or *subtraction* from the *constitution* of the particles (e.g. more, or less, weak force) rather than with interaction between particles. But there are reasons to think that this is not the case. Virtual particles of different types interact with one another, too. For instance, in the Standard Model, vector bosons couple with fermions, and W bosons couple with a

In the above I have been discussing fundamental powers rather than complex macro-powers, such as the power to build a house or to carve a statue. In the case of macro-powers it might appear that matter is transferred from the agent to the patient, e.g. the builder lays bricks to build the house. But in fact the builder is building by simply passing on the form of the house to the bricks through her movements. (Again this is a figurative description, since the builder is not actually transferring 'a form' to the bricks.) The only thing that happens in the exercise of the building power is the mutual activation of powers, whether this mutual activation is between the powers of the builder's arms and of the bricks, or between the powers of the bricks themselves, etc. For Aristotle there is nothing exchanged between the powers. Talking of the transmission of the form is only a way of describing the type of causal action of a power upon another: *as if* the form of the one was transmitted onto the other power.

Before coming to a more detailed discussion of Aristotle's position, it might be helpful to put my interpretation in a nutshell, to contrast Aristotle's views, as I understand them, to his predecessors', and to bring out the novelty of his account, not only in relation to ancient metaphysics, but for contemporary philosophy too.

The Pre-Socratics described the world by introducing principles that were aimed at explaining change in nature. Movement or force gives rise to generation and change in some type of stuff or other; e.g. the hot and the cold, or condensation and rarefaction change water, or air, or amorphous stuff, or atomic formations, etc. Plato, on the other hand, focused on a problem that did not arise in the Pre-Socratics, namely the instantiation of universals in his ontology; but he neglected providing a metaphysical account of generation and change. He reified instantiation as the relation of participation in the Forms, which take on the role of universals among other roles. But change receives brief explanation in Plato, metaphysically as the occurrence of participation in Forms,[8] and physically as the rearrangement of elements[9] (which is akin to Pre-Socratic types of explanation of change). Aristotle, by contrast, does *not* reify the instantiation of universals into a relation, nor does he reify universal forms as such, nor matter as such – and this has important implications, to be drawn in what follows, for understanding his hylomorphism. The ultimate constituents of hylomorphic compounds are not matter and form held together by relations between them. The ultimate constituents are powers, which become activated. More graphically, the bedrock of Aristotle's reality is not a two-tier hylomorphic "clasp" between matter and form; but a single tier of powers that are either in potentiality or are activated. If we are to think of a 'cosmic generator' of creation and change for Aristotle's world, it is not the coming together of matter and form into hylomorphic compounds; but rather, it is the activation of powers from potentiality to actuality.[10]

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photon or a Z^0 boson (Couchman, 2000). Such couplings between virtual particles happen due to the effect of gauge bosons on gauge bosons of a different type. Such *primitive effect* between forces is what Aristotle, too, assumed in his theory of causation.

[8] *Phaedo* 100c-d; Aristotle, *Metaphysics* 991b3-9; *Generation and Corruption* 335b7-24.

[9] *Timaeus* 56c-e.

[10] See Marmodoro 'Aristotle's hylomorphism, without reconditioning', in D. Andriopoulos (ed.) *Substance, Wholes and Parts*, forthcoming.

For Aristotle, change is the activation of a passive power, whose nature is to suffer the agency of an active power. A passive power's activation (actualisation, realisation)[11] may be a process, such as becoming hotter; or an activity, such as seeing. For Aristotle, there is *change* in the case of the *process* only, since the resulting state from the process is qualitatively different from the initial state – as for instance in the case of heating (process), but not of seeing (activity).[12]

An important difference between Aristotle's account of powers and the contemporary ones is the following. In contemporary theories, the manifestation of a power is a *new* power that comes about, e.g. an ice cube's power to cool the lemonade in the glass is manifested in the new – lower – temperature of the lemonade.[13] But for Aristotle, this is not the case. The actualisation of a power is not a new property that comes about. Rather, it is the activation of the power, either as it is exercising its influence on the passive power or as the passive power is suffering that influence. For example, if a mango has the power to ripen in the heat, the ripening is the actualisation of active and passive powers at play. The ripe state of the mango that comes about is the 'aftermath' of the activation of the powers, not their manifestation. The powers are manifested in their activity with each other, not in the state that results from their activation.

All that happens in Aristotle's world is that powers in potentiality come to be actualised, either as agents of change or as patients of change. Change involves the mutual activation of agent and patient powers, brought about by the contact between ontologically interdependent pairs of powers, such as e.g. what can heat and what can be heated. Powers are monadic properties, since Aristotle does not reify polyadic relations in his ontology. But powers can be ontologically dependent on each other, where ontological dependence is not a 'connecting bridge', i.e. a relation or an extra entity connecting between an agent power and a patient power. In sum, nature is a cluster of interdependent powers that, when in contact, activate one another; this may result either in activity, e.g. seeing, or in a process of change, e.g. being heated.

Potentiality for change

For Aristotle, there is a primary sense of potentiality from which the other senses are derived. This is the capacity to *bring about change*:

> All potentialities (*dynameis*) that conform to the same type are *starting points* of some kind, and are called *potentialities* in reference to one primary kind, which is a starting

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[11] I will use the terms 'activation' and 'realisation' of powers interchangeably in what follows, to describe a power's reaching the end that defines its nature. See also pp. *** and footnote ***.

[12] In our common sense conception of change, both process and activity count as changes. What Aristotle wishes to capture by treating only process as change is that activity does not alter the constitutional make up of the active agent, but only puts the existing constitution to work.

[13] For instance, see Bird (2007: 7): 'Potencies are characterized in terms of other properties (their stimulus and manifestation properties)'.

point of *change* in another thing or in the thing itself *qua* other. (*Metaphysics* 1046a9-10, my emphasis)[14]

This primary sense of potentiality is that of the capacity to bring about change in another thing or in the same thing as if it were other. The former case is the standard case of causing change, such as fire heating an object or an object in movement setting something else in movement, etc. Aristotle's qualification of causing change in the thing itself as if it were other is aimed at including complex entities which have the capacity of bringing about a change in a part or the whole of themselves, e.g. an athlete training herself.

Of course the criterion of being a cause that is the *originative* source of change would require to be relativised to a context, for otherwise one could trace back endlessly origins of change. Aristotle does not mention this issue in the passage quoted, but it is a consideration he is sensitive to, as we see from his subsequent discussion of matter and the introduction of the concept of *proximate* matter:

> It seems that when we call a thing not something else but 'of' that something else (e.g. a casket is not wood but of wood, and wood is not earth but made of earth ...), that something is always *potentially* (*in the full sense of that word*) *the thing which comes after it in this series*. E.g. a casket is *not* earthen nor earth, but wooden; for wood is potentially a casket and is the matter of a casket. (*Metaphysics* 1049a18-23; my emphasis)

Aristotle's point here is two faceted. On the one hand he is introducing a strong sense of potentiality; on the other, he is associating it with a semantic/grammatical phenomenon. The strong sense of the term 'potentially' is to be found in the case of *adjacent* items in the series of changes – e.g. when the wood becomes a casket. The earth is not potentially a casket in this sense, because there is an intermediate step between earth and casket in the series of changes from earth to wood to the casket. So it is the wood that is strictly speaking potentially the casket in the present context, despite the fact that the wood comes from earth, and hence the casket comes from earth. This is the reason, Aristotle explains the corresponding semantic/grammatical point, why we call the casket 'wooden' but not earthen. For corresponding reasons, in any given change, the origin of the change, i.e. its cause, will be taken to be the immediate cause of this particular change in question, rather than an antecedent one in the causal history of this change.

A second type of potentiality Aristotle includes in his ontology is the capacity to *suffer change*:

> For one kind is a potentiality for being acted on, i.e. the principle in the very thing acted on, which makes it capable of being changed and acted on by another thing or by itself regarded as other. (*Metaphysics* 1046a11-13)

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[14] All translations of Aristotle's text are from Barnes (1995).

We might not be immediately ready to acknowledge the capacity to suffer change as a power; but it only takes some reflection to see that we do have some terms in everyday language that pick out just such capacities or powers, e.g. 'fragility', or 'malleability', or 'flexibility', etc. For Aristotle being able to change is as much of a capacity or power as being able to effect change:

> In a sense the potentiality of acting and of being acted on is one (for a thing may be capable either because it can be acted on or because something else can be acted on by it), but in a sense the potentialities are different. For the one is in the thing acted on; it is because it contains a certain motive principle, and because even the matter is a motive principle, that the thing acted on is acted on ... for that which is oily is inflammable, and that which yields in a particular way can be crushed; and similarly in all other cases. But the other potency is in the agent, e.g. heat and the art of building are present, one in that which can produce heat and the other in the man who can build. (*Metaphysics* 1046a19-28)

A notion that is peculiar to Aristotle's account is conceiving of passive powers as originative sources of change (1046a11-13; a23). It is natural for us to think that an originative source of change is a power to *bring about* change; but it is not as natural to think that an originative source of change is a capacity to *suffer* change. Yet Aristotle sees both active and passive powers as originative sources of change, the one as a source that changes something, and the other as a source of suffering change. In fact, Aristotle gives several examples of originative sources of suffering change to make his point clear, such as for example, oil or brittle matter.

The distinction between the active and the passive capacities or powers also serves to set up the conditions under which change takes place. This is determined in the *definition of a capacity*. What is specified in the definition of a capacity is: the *type* of capacity the capacity in question is, namely what it is that it can do, i.e. bring about or suffer; the appropriate *occasion* in which the capacity can do this; the *way* in which it can do it; and any other *conditions* that need to obtain for it to do what it does. When all the conditions set out in the definition are met, including the active and passive powers coming in *contact*, in the relevant sense of contact for the type of power they are, then *necessarily* the agent power acts on the passive power and brings about its effect:

> Since that which is capable is capable of something and at some time in some way – with all the other qualifications which must be present in the definition–, ... as regards potentialities of ... [those things that are non-rational; e.g. the fire] ... when the agent and the patient meet in the way appropriate to the potentiality in question, the one *must* act and the other be acted on ... For the non-rational potentialities are all productive of one effect each. (*Metaphysics* 1047b35-1048a8; my emphasis)

The necessity is natural necessity, stemming from the nature of the capacities/powers themselves, on satisfaction of the conditions in the definition of their natures. Aristotle did not talk of laws of nature. Yet, it is clear from normativity expressed in this passage, that the

definitions of powers determine the conditions whose satisfaction is the instantiation of laws of nature.

Causal Agency

We must now come to examine and try to comprehend the nature of the *agency* of the capacity/power of a mover on the capacity/power of the movable. There are two aspects of a mover's causal agency that reveal its nature. The one is what it brings about, and the other is how it achieves it. Aristotle describes what the mover does to the movable in terms of the transmission of the form of the moving power:

> The mover will always transmit a form, either a 'this' or such or so much, which, when it moves, will be the principle and cause of the motion, e.g. the actual man begets man from what is potentially man. (*Physics* 202a9-12)

So the form could be a substantial form, as in the case of the transmission of the form of a human being to the menstrual fluids in the generation of an embryo; or it could be a quality, a such, as for instance heat or weight, etc. But what does it mean to say that the form of the moving power is transmitted? Aristotle wants to find a way to explain the change that is brought about by the moving power. In his example above, the generation of a new human being is accounted for by the transmission of the form of a human being, which is the principle and the cause of the motion. The form transferred is the form that determines the end/goal (*telos*) of the potentiality in the moving power's definition. Thus a parent has the potentiality to generate a human being, and a painter the potentiality to generate a painting on canvas. These are the ends that the movers' powers are directed towards, in their potential state, e.g. the ends that the parent and the painter have respectively. They express what the powers can bring about when actualised. Aristotle's explanation of causation in terms of the transference of a form from the moving power to the passive one should not be taken as a literal but a figurative description. Aristotle is not reifying the form of the power into an active agent of its own, over and above the power. There is no homunculus-form that is transmitted from the parent to the offspring. There are only motions transmitted from the parent to the menstrual fluids by the sperm that is implanted in them; the heat in the parent's sperm generates the motions in the fluids, which gradually shape the embryo, as Aristotle tells us explicitly.[15] Similarly, there is no form of a statue that is literally transferred from the sculptor to the marble; a sculptor transfers the form of a figure in her mind to the marble through the movements of her hands and chisel. Nevertheless, talk of transmitted forms is the best way to *describe collectively* the type of effect that the respective moving powers have on the passive ones. The movements generated from the heat of the sperm in the first case, and from the hands of the sculptor in the second bring about changes of particular types, which are determined by the kind of moving power that is acting on the passive one. The resulting change is *as if* the sperm transferred a form onto the menstrual fluids, which en-formed them and shaped them into an embryo; and *as if* the sculptor transferred a form onto the marble

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[15] See Aristotle, *Generation of Animals* II.2-3.

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which en-formed it into a statue. There is no such magic; Aristotle's account is cogent and intuitive. Macro-changes emerge from micro-changes brought about by the fundamental powers (i.e. as we will see, the hot, the cold, the wet and the dry), which affect their passive correlates. Even if one took Aristotle to be saying that, literally, there is a (reified, matterless) form that is transmitted to the passive power, this would still *not* explain how causation takes place. We would want to know how that form does it; what causal efficacy a form can have on a passive power. Assuming Aristotle is looking for an answer as to *how* a power affects another, adding a further item to the causal series would not offer an explanation. It would only continue the regress generated in the search for the mechanism of causal efficacy.

Then how does causal efficacy operate? Even if macro-level powers depend on micro-level powers to bring about their effects, how do micro-level powers exert their causal efficacy on other micro-level powers? As we shall see, Aristotle avoids the regressive series of introducing further intermediaries by assuming the *efficacy* of a moving power on a passive one; all that happens is that 'when the agent and the patient meet in the way appropriate to the potentiality in question, the one *must* act and the other be acted on' (*Metaphysics* 1048a6-7). The transference of the form of the moving power to the passive one is not a description of the mechanism of causal efficacy, but only a collective description of the type of qualitative change that takes place in the passive power. Examining closely the behaviour of active and passive powers will help us understand how this change is effected.

Stimulus and Appropriate Conditions

Aristotle acknowledges that there is a variety of what we would call *enabling conditions* for the activation of a power, pertaining to the right time, the right situation, the right external conditions; he summarises them in saying that the mover is capable of something 'at some time in some way (with all the other qualifications which must be present in the definition)' (*Metaphysics* 1048a1-2). On the other hand, he collectively describes the *stimulus* that triggers powers that are in the right circumstances into causal activity by the general condition of 'contact' between them:

> To act on the movable as such is just to move it. But this it does by contact, so that at the same time it [the mover] is also acted on. Hence motion is the fulfilment of the movable as movable, the cause being contact with what can move, so that the mover is also acted on. (*Physics* 202a5-9)

So contact is the triggering condition, along with all the other conditions mentioned in the definition determining the enabling conditions for causal efficacy to take place. It is therefore important to come to understand what is involved in the contact between the active power and the passive power it operates on. Aristotle tells us that:

> Things are said to be in contact when their extremities are together. (*Physics* 226b23)

He further explains that

> Things are said to be together in place when they are in one primary place and to be apart when they are in different places.[16] (*Physics* 226a21-3)

So things that are in contact have their extremities in the same place. For the purposes of causation, having the extremities in the same place will have to be understood as either touching or being in proximity, since it must have been as clear to everybody then as it is to us that there is causal impact even when things are merely proximate, namely, in the same place in the sense of same spatial region. For example, proximity to a fire is sufficient for heating, and even for catching fire.

We saw above that for Aristotle to act on the movable is to move it, and that this is achieved by contact. In examining his concept of contact as defined, we see that the contact between mover and movable involves the coincidence of place of the extremities of the mover and the movable, e.g. the chisel of the sculptor and the wood, or the flames of the fire and the pot resting on it. But once contact is achieved, what does the operation of the mover on the movable involve? Is it something over and above the contact between them, and if so, what? Is there a relation established from the mover to the movable that is responsible for the change the movable suffers, or is there a different mechanism of causal interaction? The answer to the question of how the mover operates on the movable and brings about change will not involve for Aristotle positing any 'bridge', relation or connection from the mover to the movable. He grounds his theory of causation in his account of relations in terms of monadic properties and counterfactual dependence. To this I turn now.

Non-relational powers

We know from Aristotle's *Categories* (chapter 1) and from the *Metaphysics* (book VII chapter 4) that even accidental properties (e.g. being pale, or being hot) have essences and definitions. Furthermore, properties cannot exist unattached, on their own, but they have to belong to a subject (see *Categories* chapter 2). If we then consider a relation between two things, for example, Marco being the father of Pietro, and we try to think of this relation as a single polyadic property that conjoins the two, Marco and Pietro, decisive difficulties follow. On the one hand, this polyadic property would belong to both subjects, since it can only exist by belonging to something(s) as subject, and both subjects have a claim to it by being conjoined by it. On the other hand, although Marco is related to Pietro as a father, Pietro is not related to Marco as a father, but as a son; hence, either the polyadic property would belong to Pietro without being true of him; or the polyadic property would have two different natures, endowing each of the two conjoined entities with different qualifications, which is incompatible with the property being one and the same. The asymmetry of the relation introduces plurality of natures in it, and this plurality undermines its oneness.

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[16] Aristotle defines place as 'the innermost motionless boundary of what contains' (*Physics* 212a20-21).

Conceiving of relations as polyadic properties was not even entertained by Aristotle. For him relational predicates are accounted for in terms of monadic properties – monadic properties of a special kind, which he called the *pros ti* (the 'toward something') type of property: such properties are in themselves pointing toward something other than themselves. Thus, Aristotle says:

> We call *relatives* all such things as are said to be just what they are, *of* or than other things, or in some other way *in relation to* something else. For example, what is larger is called what it is *than* something else (it is called larger than something); and what is double is called what it is *of* something else (it is called double of something); similarly with all other such cases. (*Categories* 6a36-b3)

(Aristotle does not distinguish between relatives and relations. I take it this is for the reason given above: that neither relatives nor (asymmetric) relations can be single polyadic properties with a single nature each that belongs to (is true of) the two relata.)

What does Aristotle mean by taking relatives to be *pros ti* – toward something? He explains it as follows:

> All relatives are spoken of in relation to correlatives that reciprocate. For example the slave is called slave of a master and the master is called master of a slave (*Categories* 6b28-30)

Pros ti properties are monadic properties such that their manifestation or activation depends counterfactually on the activation of their correlatives. Someone is actually a master only if there is a slave of whom he is master; and vice versa for the slave.[17] Reciprocating correlatives are not related to one another but are *ontologically interdependent*, as Aristotle states clearly:

> If there is no master, there is no slave either … When there is a slave there is a master; and similarly with the others [*sc.* other relatives] ... Also, each carries the other to destruction; for if there is not a double there is not a half, and if there is not a half if there is not a double. So too with other such cases. (*Categories* 7b6-22)

So the 'pointing' nature of relatives is Aristotle's way of depicting ontological dependence. This is what binds monadic properties into reciprocal pairs for their activation, e.g. being a master and being a slave. But ontological dependence is not a polyadic relation between relata. Just as there is no polyadic connection binding a species to its genus, in spite of their ontological interdependence, similarly, for Aristotle, there is no polyadic connection binding one activated monadic property to its correlative.[18] A species is ontologically dependent on its genus, and yet there is no entity stretching over to bind them; the same holds for relata even if their ontological interdependence is different in kind than the genus-species one. And

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[17] Aristotle's account of relatives is different from Bennett's (2011a) account of superinternal relations. For Bennet superinternal relations are such that the intrinsic nature of one relatum grounds the obtaining of the relation, as well as the existence and nature of the second relatum. For Aristotle it is the nature of both correlative monadic properties that grounds the nature of their interdependence.

[18] See also pages *** below.

the same holds for matter and form, and subject and property, where Aristotle is explicit that there is no (polyadic) entity unifying them into one.[19]

The dependence of the mover on the movable

The reason why we examined Aristotle's account of relatives in the foregoing section is that Aristotle considers causes as relatives; namely, the agent and patient in a causal pair are causal relatives. In *Metaphysics* book V Aristotle explains the term 'relative' or 'relation' as follows:

> Things are relative [*pros ti*] (1) as double to half, and treble to a third, ... and that which exceeds to that which is exceeded; (2) as that which can heat to that which can be heated, and that which can cut to that which can be cut, and in general the active to the passive; (3) as the measurable to the measure, and the knowable to knowledge, and the perceptible to perception. (1020b26-31)

Causal examples such as heating and being heated are included in the above among relatives such as double and half, and they are collectively grouped under the description of being active and being passive. It follows that generally, for Aristotle, the mover and the movable, namely the active and the passive powers in causal interactions, are causally engaged through two monadic properties rather than a polyadic one. In the causal cases, the two monadic properties are the powers themselves, namely the moving power and the passive power. Using the example just given, it would be the heating power and the power to be heated, the cutting power and the power to be cut, the power of perception to the power of being perceived, and generally the active and the passive powers. According to Aristotle's account, then, the active and passive powers are monadic properties that are ontologically interdependent.

We saw that Aristotle explained the ontological dependence between relata as an existential dependence; e.g. nobody is a slave if there is no master. Similarly here, the ontological dependence between the causal relata entails that there is no mover if there is no movable. But here the question arises whether the ontological dependence determines the potential or the activated state of the powers in question. Clearly, if there is nothing that can be affected, then the mover will not bring about any effect; there is no actual moving – changing – if there is nothing that can be moved – changed. For instance, if nothing can be heated, no heating will take place either. But can there be a mover in potentiality, even if there is nothing that could be moved? Could there be a knife in a world where nothing could be cut? We already saw that the definition of a power mentions the end toward which the power is directed: what the power is capable of bringing about (*Metaphysics* 1047b35-1048a8). But if there is nothing that can be so affected, how can there be a power whose nature is to bring about that effect? Aristotle believes in some form of the Principle of Plenitude, namely, that what is

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[19] See *Metaphysics* 1045b8-16; b21-22.

possible will happen.[20] If so, then it follows that he believes that the end of each power in potentiality must be realisable. So, there could be no mover, even in potentiality, in a world where it was not possible for it to move anything. Hence, we must assume that the ontological dependence between active and passive powers applies to their potential state, as much as to their activated state.

The effect of the mover on the movable

How does the active power bring about an effect on the passive power? What does Aristotle mean when he says that the mover acts or operates on the movable? How are we to understand the activity that takes place when causal powers are being efficacious? He explains that

> To act on the movable as such is just to move it. But this it does by contact, so that at the same time it is also acted on. Hence motion is the fulfilment of the movable as movable, the cause being contact with what can move, so that the mover is also acted on. (*Physics* 202a5-9)

We saw above that the definition of a power mentions the various conditions that must obtain for the power to be activated. If these conditions obtain, when there is contact, the power is activated, bringing about a change in the passive power. (In most cases, a moving agent is also moved itself in return by the contact with the agent that is moved, e.g. as in pressing against a hard surface.) We further saw that Aristotle also says that

> The mover will always transmit a form, either a 'this' or 'such' or 'so much', which, when it moves, will be the principle and cause of the motion, e.g. the actual man begets man from what is potentially man. (*Physics* 202a9-12)

But we found good reason not to take this as a description of some item actually transmitted from the mover to the movable, as if a form that was in the mover is transferred to the movable in the way that a book can be transferred from one shelf to another. We saw that the transference of the form is an explanatory principle of the type of change that takes place in the movable. Hence, the contact does not engender the transference of something, but rather the occurring of a change, whose type is explained by the form of the active power, namely, the type of agent the active power is.

My understanding of Aristotle's conception of the operation of an active power on a passive power is that if the conditions specified in the definition of the active power are met, *contact* between them triggers the change in the passive power. Aristotle says:

> All things that are capable of affecting and being affected, or of causing motion, and being moved, are capable of it not under all conditions, but only when they are in a

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[20] See Makin (2006:84).

particular condition and approach one another: so it is on the approach of one thing to another that the one causes motion and the other is moved. (*Physics* 251b1-4)

When the agent and patient fulfil the respective conditions and are appropriately near one another then the passive power suffers the effect of the active power:

> That which can be hot, must be made hot, provided the heating agent is there, i.e. comes near. (*On Generation and Corruption* 324b7-9)

Nothing else happens other than the proximity of the agent and patient under the right conditions, as specified in the definitions of their powers. It is *in the nature of the powers* to interact thus, when the enabling conditions are satisfied and their contact triggers the change. Aristotle describes the nature of an agent as having a principle of movement:

> That which contains the origin of the motion is thought to impart motion (for the origin is first amongst the causes). (*On Generation and Corruption* 324a26-28)

What we are to understand by this is that in the right conditions, the principle of the origin of motion applies, and change occurs. Things in the world are made in such a way so that they change when in proximity to some further things of a special type. The change is qualitative, not a transference of matter. Transferring matter or a quantum of energy or any other item does not explain causal efficacy, since we still need a further account of how the transferred item interacts with the environment it enters. For Aristotle there is transference of form from agent to patient, but this is only a qualitative description of the type of change that occurs.

So, 'contact' for Aristotle is a key factor for causal efficacy. It does entail a type of proximity or sameness of place, but more importantly, in a causal context, it has come to mean, for him, *triggering* change, allowing 'touching' even in situations where the touching is not physical and not even reciprocal:

> If anything imparts motion without itself being moved, it may touch the moved and yet itself be touched by nothing-for we say sometimes that the man who grieves us touches us, but not that we touch him. (*On Generation and Corruption* 323a31-33)

The primary powers

Aristotle aims at a rational explanation of the world all the way down to the bedrock of reality. He says: 'the differences are reasonably distributed among the primary bodies, and the number of the latter is consonant with theory' (*On Generation and Corruption* 330b6-7). Accordingly, he offers his famous analysis of the simple elements, namely fire, air, water, and earth. In allotting the fundamental properties that characterise these elements, Aristotle narrows down the candidates to the tangible contrarieties (329b6-9), and of those, the ones that are powers: 'capable of acting and being affected ... said of things in virtue of their acting upon something else of being acted upon by something else' (329b20-21). He goes through

an analysis of the list of contrary powers of what is tangible, and concludes that they are all reducible to four primary, fundamental powers:

> It is clear … that all the other differences reduce to the first four, but that these admit of no further reduction. ... Hence these must be four. (330a24-29)

These primary powers are heat, cold, wetness and dryness.

The four simple elements are constituted of the four primary powers:

> Fire is hot and dry, whereas Air is hot and moist ... and Water is cold and wet, while Earth is cold and dry. (330b3-5)

There are no further fundamental properties that any of the simple elements possess than the two contrary powers each. The simple elements can reciprocally transform into one another by gaining or losing their powers – for instance:

> There will be Air, when the cold of the Water and the dry of the Fire have passed-away (since the hot of the latter and the moist of the former are left); whereas, when the hot of the Fire and the moist of the Water have passed-away, there will be Earth, owing to the survival of the dry of the Fire and the cold of the Water. So, too, in the same Way, Fire and Water will result from Air and Earth. For there will be Water, when the hot of the Air and the dry of the Earth have passed-away (since the moist of the former and the cold of the latter are left); whereas, when the moist of the Air and the cold of the Earth have passed-away, there will be Fire, owing to the survival of the hot of the Air and the dry of the Earth-qualities constitutive of Fire. (331b14-24)

What Aristotle is describing is the constitution of the most fundamental level of reality. There are four types of primary power, which do not exist separately each on its own, but pair-up and constitute the simple elements. The simple elements, earth, water, air, and fire, are the most fundamental separable things in nature.[21] Each element has two contrarieties, and when they come in contact the interaction between them results in the heat of fire overpowering the coldness of the water while the wetness of water overpowers the dryness of fire, giving rise to what is hot and wet, namely air.

Aristotle distinguishes the underlying matter, the contrary properties, and the composite of the two, namely the simple elements:

> Our own doctrine is that although there is a matter of the perceptible bodies (a matter out of which the so-called elements come-to-be), it has no separate existence, but is always bound up with a contrariety. A more precise account of this has been given in another work; we must, however, give a detailed explanation of the primary bodies as

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[21] They are separable at least in principle, since they are not found in pure form in nature, but mixed between them. See *Generation and Corruption* 330b21-23:

> Fire and air, and each of the bodies we have mentioned, are not simple but combined.

well, since they too are similarly derived from the matter. We must reckon as a principle and as primary the matter which underlies, though it is inseparable from, the contrary qualities: for the hot is not matter for the cold nor the cold for the hot, but the substratum is matter for them both. Thus as principles we have firstly that which is potentially perceptible body, secondly the contrarieties (I mean, e.g. heat and cold), and thirdly Fire, Water, and the like. For these bodies change into one another (they are not immutable as Empedocles and other thinkers assert, since alteration would then have been impossible), whereas the *contrarieties do not change*. (*Generation and Corruption* 329a28-b2)

Properties are not subject to change, any more than e.g. numbers are – the reason being that qualitative alteration of a property or a number (if it were possible) would give them a different identity; properties and numbers are what they are, and all they are, essentially.[22] But the composites that result from the matter and the properties, namely earth or air etc., are subject to change.

Since properties themselves do not change, when change occurs it is the entity qualified by a property that is changing, by acquiring a new property in place of the former one. Thus when the hot is replaced by the cold, it is what is hot that changes, not the property of being hot, which is in fact lost. So, when air transforms into water it loses its primary power of heat, which is replaced by the power of cold.

Thinking of properties as enmattered powers explains the particle-language that Aristotle uses in the passage quoted above, which is suggestive of constituents which do not change but transform (*Generation and Corruption* 331b14-24). He is considering the coming together of the simple elements, in this case water and fire, about which he says that the cold of the water and the dry of fire are *destroyed* (*phtharēnai*), while the heat of the fire and the wetness of water *remain* (*leipetai*). The deictically-referred-to items that remain, the enmattered powers, are the constituents that now come to *constitute* the new simple element, in this case air; and so forth.

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[22] A qualification of this assertion is in place. Aristotle explains mixing by saying that when two items, e.g. wine and water, mix,

> Then each of them changes out of its own nature towards the dominant one ... Thus it is clear that only those agents are combinable which involve a contrariety (for these are such as to suffer action reciprocally). (*Generation and Corruption* 328a28-33)

But mixing requires that:

> Each of them may still be potentially what it was before they were combined, and both of them may survive undestroyed. (*Generation and Corruption* 327b25-26)

In giving this account of mixing, Aristotle does not assume that the contrarieties themselves change, without being destroyed. It is the things mixed which change without being destroyed, and therefore their *complex natures* that somehow remain and yet are compromised – in a way that we might compare to the way the nature of a substance remains, increasingly compromised, while the substance is deteriorating towards the end of its life span. The identity criteria of complex natures need not be the same as those of simple properties.

I examined in some detail the *immutability* of primary powers, the contrarieties, because it is a feature they share with (Democritean) *atoms*. In addition to immutability there is another important similarity between primary powers and atoms: primary powers are *fundamental*; they are not constituted of any further elements, as their building blocks, any more than the atoms are constituted of any elements as building blocks. Rather, primary powers are grounded in matter that is *pure potentiality*, with no specific features of its own. Therefore, a primary power (cold, hot, wet, dry) is the *form* of the power of cold, or hot, wet, or dry, *enmattered* in pure potentiality. There are no constituting elements of primary powers, and therefore there are no further elements constituting the simple elements – air, water, earth, and fire – apart from their primary powers. In view of the fact that for Aristotle everything in physical nature is built out of the four simple elements and their mixtures, it follows that all there is in nature is built out of primary powers grounded on pure potentiality.

In light of the above considerations, it is helpful to think of Aristotle's account of the most fundamental building blocks of reality, the four primary powers (hot, cold, wet, dry) as *power-atoms*. They are not atoms of the standard kind, in so far as primary powers can be destroyed, while atoms cannot; also, a primary power cannot exist separately in nature, but must always be paired up with another primary power. But the primary powers are like atoms in that they are not the subjects of change (from what they are), and they are the fundamental elements from which everything else is built. Furthermore, all physical changes in nature derive from changes in the combinations of the primary powers. As we saw, Aristotle reduces the principles of perceptible bodies to tangible contrarieties only, and reduces all tangible contrarieties to the four primary powers (*Generation and Corruption* Book II, Ch. 2). Thus, any change in the perceptible bodies derives from a change in the primary powers.

There is a difference between atoms and Aristotle's power-atoms to be considered in further depth. Atoms are independent of one another; but Aristotle's power-atoms are not. Powers are dependent on one another – active and passive – for their fulfilment/activation/realisation.[23] Aristotle analyses relational predicates in terms of monadic properties that are ontologically dependent on one another (see above). Primary powers are power-atoms whose ontological interdependence can be explained by Aristotle as *monadic* interdependent properties. Thus, the picture that emerges is that for Aristotle the most basic stratum of reality are monadic properties, the primary powers, composed into the four elements (water, air, fire, earth), and arrayed into a *structure* of ontological interdependence on one another for their actualisation. This structured layer of interdependence is the ground of all there is in nature.[24]

Actualised powers

We need now to examine whether Aristotle's world of powers is a world of mere potentiality.

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[23] I will use the terms 'fulfilment', 'activation' and 'realisation' of a power interchangeably in what follows, to describe that the end that defines the nature of the power comes to be. See also footnote pp. ***

[24] I discuss further the ground level of powers in elemental transformations in my paper 'Reciprocity without symmetry in causation', in Jacobs (ed.) *Putting Powers to Work*, OUP forthcoming.

The problem I am addressing here is whether Aristotle's power-ontology is committed to the position that all there is or can be is potential, and that change is simply a transition from one potential state of the world to another such state. This is a problem faced by many contemporary power-ontologies, sometimes referred to as the "Always packing, never travelling" problem.[25] David Armstrong (1997: 80), following C. B. Martin (1993: 68), formulates the problem thus:

> Given purely dispositionalist accounts of properties, particulars would seem to be always re-packing their bags as they change properties, yet never taking a journey from potency to act.

The problem stems from the position held by contemporary power ontologists that the manifestation of a power is another power. This position commits them to a network of powers in potentiality, as the actualization of each power is a transition to another power in potentiality.

Aristotle distinguishes the *activation* of a power from the *realisation* of the power's end. The end of a power is given in the power's definition:

> That which is capable is capable of something and at some time in some way – with all the other qualifications which must be present in the definition. (*Metaphysics* 1047b35-1048a2)

For Aristotle, some powers have an end which is an activity, and some have an end which is a process. The former are powers whose end is realised instantaneously, such as the power to see; at any one moment you see and you have seen; Aristotle calls these "activities" (*energeia, praxis*). The latter are powers whose end is realised in stages in a process, such as the power to build a house; when you are building a house you have not built a house; Aristotle calls these "changes" (or motions, *kinēsis*). Changes have a natural completion point, when the end of the process is reached, such as the completion of the house; activities do not have a natural completion point, as e.g. in the case of seeing. Thus a power can realise its end either through a change or through an activity; changes and activities are the two ways in which powers are actualised:

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

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[25] It is Molnar (2003: 173) who called it the "Always packing, never travelling" argument.

we are living and have lived. Of these processes, then, we must call the one set movements (*kinēseis*), and the other actualities (*energeias*). For every movement is incomplete – making thin, learning, walking, building; these are movements, and incomplete movements. For it is not true that at the same time we are walking [to a destination] and have walked [to the destination], or are building and have built, or are coming to be and have come to be – it is a different thing that is being moved and that has been moved, and that is moving [to a location] and that has moved; but it is the same thing that at the same time has seen and is seeing, or is thinking and has thought. The latter sort of process, then, I call an actuality (*energeia*), and the former a movement (*kinēsis*). What, and what kind of thing, the actual is, may be taken as explained by these and similar considerations. (*Metaphysics* 1048b18-36)

Powers are actualised, according to Aristotle, into either activities or changes. The difference between them is that change has a beginning and an end which are different from each other, so completing the realisation of the end requires different stages in a process; while in activity the beginning and the end are the same, in a continuous realisation of the end. Since while change is taking place it has not reached its end point yet, it can be thought of as a potentiality in the process of being actualised, which is how Aristotle thinks about it. Namely, a change is an actuality, because the unfolding realisation of its different stages is happening; but at the same time it is not fully realised, in so far as it has not reached its end yet. In that sense a change is an *actual* process in progress, realising its remaining *potential* stages:

> The *actuality* of the potential, *qua* potential, is change – e.g. the actuality of what is alterable as alterable, is alteration; of what is increasable and its opposite, decreasable (there is no common name for both), increase and decrease; of what can come to be and can pass away, coming to he and passing away; of what can be carried along, locomotion. That this is what change is, is clear from what follows: when what is buildable, in so far as we call it such, is in fulfilment, it is being built, and that is building. (*Physics* 201a9-18)

Some confusion might arise in reading the above passage: it might appear that a power is potential before it is actualised, and again potential after it is actualised, as if there is unactualised and actualised potential. To avoid confusion it is important to distinguish between the *activation* of a power and the *completion* of the process of its realisation. To use Armstrong's terminology, a power makes the "journey from potency to act" when it is activated, and remains in actuality during its second "journey" from the beginning of the process of realisation of its end to its completion. Thus, the power of house-building becomes *actual* when *activated* at the beginning of the house-building process, and *continues to be in actuality* until all the stages of house-building are completed. Thus, although in activities the end is reached as soon as the activity is actualised, in the case of changes there are two ends: the actuality of the process itself while it is taking place, and the actuality of the end achieved on completion of that process:

> While in some cases the exercise is the ultimate thing (e.g. in sight the ultimate thing is seeing, and no other product besides this results from sight), but from some things a

product follows (e.g. from the art of building there results a house as well as the act of building), yet none the less the act [of seeing] is in the former case the end and in the latter [house-building is] more of an end than the mere potentiality [to build] is [even if it is less of an end than the completion of the house]. (*Metaphysics* 1050a24-27)

The contrast is between the potentiality for building a house (when nothing is being built) and the potentiality for a complete house (while a house is being built). In the latter case the potentiality is more of an end than the mere potentiality to build, because the power to build is actualised in the process of building the house, even if the house is not complete yet. This is what the actuality of the potential *qua* potential is – the actual process of building the house. During the building process, the power to build is *as activated* (and *as actual*) as is the power to see when one is seeing.

Thus, the *actuality* of a power is best understood as the *activation* of the power. When the power is actively doing what it is in its own nature capable of doing, then the power is actualised. Prior to this it exists but in a potential state. Thus the actuality of a power, whether for an activity or a process, is the activation of the power.

> That which is in the primary sense potential is potential because it is possible for it to become actual; e.g. I mean by 'capable of building' that which can build, and by 'capable of seeing' that which can see (*Metaphysics* 1049b12-15)

(By contrast, the actuality of the outcome resulting from a change, e.g. of a house, is something other than – beyond – the change itself.) Thus powers for activities and powers for changes can be either in potentiality or in actuality, when activated.

A power in potentiality is the same power as that power in actuality, i.e. when it is activated. The difference between potential and actual power is *not a numerical difference*. As a consequence, Aristotle's powers are *not* relational by each being directed toward *another* power as its manifestation, which is the usual position in contemporary ontologies of powers.[26] In Aristotle's system, we should understand manifesting as internal to a power, just as a girl's maturing into womanhood is internal to her.

Apart from manifesting, a power is also *interdependent* with other powers, i.e. active with passive powers. This too is intrinsic to powers, being specified in the definition of a power, which gives the enabling conditions under which the power can be activated. These conditions involve pairing up each power with its correlative power for the possibility of their mutual realisation. Thus, the house-building power depends for its activation on there being buildable material, which will suffer the changes brought about by house-building. The actuality of the house-building power is the activity of building; but this activity essentially requires something external to the power itself in order to obtain, i.e. the availability of materials that have the power to be built. It is this essential dependence of each power on external conditions (such as its correlative power) for its activation that makes Aristotelian

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[26] See e.g. Bird (2007) chapters 5 and 6; Psillos (2006), and my discussion of his paper in Marmodoro (2009).

powers part of a structured network of powers.[27] But being thus structured does not turn Aristotelian powers into polyadic relations, since, as we have seen, for Aristotle's properties are monadic properties.

The numerical oneness of a potential power and its activated state –its manifestation– shows that Aristotelian powers in actuality are still *powers*. It is *not* the case that a power in actuality becomes inert, losing its powerfulness and turning into a categorical property. E.g. the actualised power to see is exercising seeing, and the actualised power to build is exercising building. In fact, far from being inert, activated powers are at their *most powerful* while they are exercising their powerfulness.

The powerfulness of a power before and after it is triggered into activity is a different matter from the issue of whether a potentiality is preserved when it is actualised (as e.g. in the case of the potentiality to solve mathematical exercises), which we are not examining here. The former issue is whether the powerfulness of a power is essentially tied to the power's *capacity to be triggered* into activity – a capacity which is lost when the triggering occurs and the power is actualised (at least the potentiality for *this* triggering is lost);[28] or alternatively, whether powerfulness is not tied to being triggered but is *exhibited all along in the exercise of the power after triggering occurs*, for as long as the power is activated. My claim is that there is no indication that Aristotle thought that powerfulness is only the potentiality for being triggered. Contemporary power ontologies seem to consider triggering as the only mark of powerfulness – or at least they treat the exercise of a power, while it is bringing about a change, as instantaneous, without duration.[29] On the contrary, there is reason to believe that Aristotle thought that the *powerfulness* of a power is manifested both in its potentiality for activation, and in its exercise while bringing about a change:

> A thing is *capable* of causing motion because it can do this, it is a *mover* because it actually does it. But it is on the movable that it is capable of acting. (*Physics* 202a16-18, my emphasis)

This is the solution that Aristotle's power ontology can give to the "Always packing, never travelling" argument. Aristotle's ontology is not an ontology of potentiality only, because powers continue to be powerful while in actuality. *Powers in actuality are the backbone of nature.* Powers in potentiality are grounded on activated powers. There is no need, therefore, to introduce categorical properties in the ontology for the sake of grounding powers in potentiality; powers in actuality provide this support. Consequently, there is no need for Aristotle to introduce anything other than *pure powers* to ground his ontology. His is a world of powerful potentialities and actualities.

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[27] Thus, reality is a structured *network* of powers; as opposed to an *aggregate* of powers with no internal connectivity.

[28] Even if the potentiality to be actualised is preserved when the power is actualised, as e.g. in the case of mathematical abilities, the claim here is that an actualised mathematical ability is powerful because problems are being solved, not because it can be put to further use to solve problems when another occasion arises.

[29] See for example Martin (2008: 51), discussed by Mumford in his contribution to the present volume 'Mutual manifestation and Martin's two Triangles'.

The actuality of a power is its activation, bringing about activity (e.g. seeing), or change (e.g. house-building). The activation of a power requires its correlative (active or passive) power, where both powers are monadic and yet interdependent properties. We saw above that what triggers the activation of correlative powers is contact between them, when other conditions relevant to those specific kinds of powers obtain. Thus, the mutual actualisation of two powers is the activation of two monadic properties that are dependent on each other; each of them undergoes a transition from potentiality to actuality, while remaining the very same monadic property. Hence, the metaphysics of Aristotle's nature is at the bedrock of reality monadic primary powers, which together comprise a structure of interdependent actualities and potentialities.

The potentiality of the four causes

Our examination so far has focused on powers that are the origins of change – movers that act on movables. We have found that all such powers are monadic interdependent properties, in potentiality or in actuality. The primary powers, to which the other powers are reducible,[30] interact with each other in the cyclical transformations of the primary elements they constitute,[31] thereby making up a structure of interdependent powers that is the foundation of all there is in nature.

In his *Physics* and the *Metaphysics*, Aristotle developed his theory of the Four Causes, which account for the constitution of each thing in nature. The four causes are the principles that explain what substances are, and give a scientific understanding of the nature and makeup of each substance, namely what the physicist or the biologist will be looking for in studying the substances in their respective domains are the four courses of these substances. The four causes are: the material cause, the formal cause, the final cause and the efficient cause of a substance. So far in our discussion we have focused on the efficient causes, namely physical powers, which Aristotle explained in terms of potentiality and actuality. We shall now follow Aristotle in examining the other three types of cause, to see what it is that they have in common, as causes, with the efficient causes, and whether this extends the notion of potentiality to apply to these further causes, too.

In *Metaphysics* Book IX Aristotle applies the account he gave of efficient causes in terms of potentiality and actuality to explain the other two principles of being: matter and form (material and formal causes). With this achieved, *potentiality* and *actuality* become the *most fundamental principles of being* in terms of which the metaphysics of nature, according to Aristotle, is to be understood.

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[30] See discussion of *Generation and Corruption* 330a24-29, pp. *** above.

[31] 'All the other things – the things, I mean, which are reciprocally transformed in virtue of their qualities and their powers, e.g. the simple bodies – imitate circular motion. For when Water is transformed into Air, Air into Fire, and the Fire back into Water, we say the coming-to-be has completed the circle, because it reverts again to the beginning'. *Generation and Corruption,* 337a2-6.

Aristotle introduces the discussion in *Metaphysics* Book IX by giving in outline the research questions he will pursue:

> Since 'being' is in one way divided into 'what', quality, and quantity, and is in another way distinguished in respect of potentiality and fulfilment, and of function, let us now add a discussion of potentiality and fulfilment. First let us explain potentiality in the strictest sense, which is, however, not the most useful for our present purpose. For potentiality and actuality extend further than the mere sphere of motion. But when we have spoken of this first kind, we shall in our discussions of actuality explain the other kinds of potentiality. (1045b32-1046a4)

Aristotle extends his discussion of potentiality and actuality from the causes of change to matter and form, and through the issue of the form, to all the different kinds of being, in the second half of Book IX, Chapters 6-10. He does not offer conceptual analyses of potentiality and actuality. Rather he utilises many different kinds of example through which he builds an analogy between the primary sense of potentiality and actuality and their extended senses. The primary one is the sense in which potentiality and actuality apply to efficient causation, relating to the domain of change, which Aristotle explains in Book IX, Chapters 1-5 and his other works. His analogies are the following:

> Since we have treated of the kind of potentiality which is related to movement, let us discuss actuality, what and what sort of thing it is. In the course of our analysis it will also become clear, with regard to the potential, that we not only ascribe potentiality to that whose nature it is to move something else, or to be moved by something else, either without qualification or in some particular way, but also use the word in another sense, in the pursuit of which we have discussed these previous senses. … Our meaning can be seen in the particular cases by induction, and we must not seek a definition of everything but be content to grasp the analogy,– that as that which is building is to that which is capable of building, so is the waking to the sleeping, and that which is seeing to that which has its eyes shut but has sight, and that which has been shaped out of the matter to the matter, and that which has been wrought to the unwrought. (1048a25-b4)

The matter Aristotle is talking about here can be understood either as the original matter from which a substance is made, such as the logs of wood from which a ship is made, or the underlying matter of the ship which is the entity that remains if we abstract away the form of the ship. Further on, Aristotle explains that:

> Matter exists in a potential state, just because it may attain to its form; and when it exists actually, then it is in its form. (1050a15-16)

The form is any of the types of being that would fall under the categories of being, in terms of which Aristotle explains the changes that take place in generation and destruction or in alteration. Clearly the sense in which matter is in the form, whether Aristotle is talking of original matter or underlying matter, is by being en-formed by the form; namely, the form is instantiated in that matter.

One important feature of the potential is that it can be triggered into actuality. Aristotle does not mention that this feature of the potential does not apply to matter as potential. Neither the logs of wood from which the ship is made, nor the wood constituting the ship are triggered into becoming en-formed, in the way that powers which are efficient causes are. Aristotle does indeed tell us that the extended sense of potentiality and actuality is different from the primary one, but he does not specify what the differentiating feature is. Yet, this feature differentiates in an important way the potentiality of, say, the wood in the ship from the potentiality of fire. If then it is not through the role that contact plays, or more generally through the role of the stimulus conditions in efficient causation, that the two kinds of cause, matter and form, can be shown to be cases of potentiality, what is it that they have in common with efficient causes?

Aristotle does not specify what the grounds of the analogy between the two types of potentiality and actuality are. But I will here propose what I take them to have in common, which allows Aristotle to talk of potentiality and actuality in relation to the Four Causes generally. The feature I want to focus on is that of *incompleteness*, which Aristotle introduces in Book IX Chapter 6. He uses it to distinguish change from activity:

> Of these processes, then, we must call the one set movements, and the other actualities. For every movement is incomplete – making thin, learning, walking, building; these are movements, and incomplete movements. For it is not true that at the same time we are walking and have walked, or are building and have built, or are coming to be and have come to be – it is a different thing that is being moved and that has been moved, and that is moving and that has moved; but it is the same thing that at the same time has seen and is seeing, or is thinking and has thought. (1048b28-34)

But Aristotle explains the incompleteness of change as an instance of the *incompleteness of potentiality*:

> Motion is thought to be a sort of actuality, but incomplete, the reason for this view being that the *potential whose actuality it is is incomplete*. (*Physics* 201b31-33, my emphasis)[32]

This is Aristotle's key conception of potentiality: incompleteness. It is hard to overemphasise the importance of this tenet within Aristotle's metaphysics. It is a conception that will allow us to understand fundamental aspects of his system, and in particular aspects that we find counterintuitive from our contemporary perspective.

The most fundamental role of incompleteness in Aristotle's system is that it helps us understand the 'dynamism' associated with the notion of potentiality. Aristotle explains the notion of the incompleteness of a process as incompleteness in achieving a task that is achievable in time:

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[32] Aristotle makes the same point *verbatim* in the *Metaphysics*:
> Movement is thought to be an actuality, but incomplete; the reason is that the potential, whose actuality it is, is incomplete. (1066a22-23)

Cf. also *Physics* 257b9: 'Motion is an incomplete fulfilment of the movable'.

> Since of the actions which have a limit none is an end but all are relative to the end, e.g. the process of making thin is of this sort, ... (i.e. without being already that at which the movement aims), this is not an action or at least not a complete one (for it is not an end); but that movement in which the end is present is an action. E.g. at the same time we are seeing and have seen, ... while it is not true that at the same time we ... are being cured and have been cured. (1048b18-25)

It is easy enough to understand the incompleteness of a process that has different stages of development, while it has not reached the end. What makes it easy is that the process that has been achieved thus far is self-standing. Even if the process stops midway, it can stand incomplete, as the completeness is one that is achieved *over time*. But it is more difficult to understand cases of incompleteness in which what is incomplete cannot be observed but is accessible only through abstraction. Such is the case of constitutional incompleteness, e.g. of matter and form in a substance, which do not occur in nature in the way that a half-built house does, but always as composites of matter and form.[33] Nevertheless, Aristotle's account of potentiality requires that we comprehend the incompleteness of substances when conceived of without one of their constitutive principles.

Globally in his system, we find Aristotle using the notion of potentiality in relation to two cases: for the process of *change*, whether generation or alteration; and for the *constitution* of an entity. In cases of change, the process can be observed unfolding in time as it gets completed, by achieving its stages of development. But in the cases of constitution, incomplete entities such as constituent matter and form have to be conceptualised through abstraction of the primary principles making up the entity. In the cases of generation, incompleteness can be understood in time rather than through abstraction, as the incompleteness of the form of a child. Further cases – and possibly the paradigmatic cases – of *constitutionally incomplete entities* are the efficient causes we have been examining above. They exist incompletely as potentialities *in nature*; they are completed constitutionally by contact with their correlate powers in the right circumstances, at which stage they are actualised by being activated into exercising their powerfulness. Thus the power of heat is potentially a heater, being incomplete by lacking the form of heating, but it comes to be actually en-formed by the form of heating when a heatable object comes in contact with it. Efficient causal powers are not observable in their incomplete, potential, state; for, observation is causal interaction, which activates the powers.

In the case of the constitutional incompleteness of the matter and form of a substance (the topic to which the second half of book IX of the *Metaphysics* is devoted), matter and form can be thought of as being *potential* – not because they are dynamic in the sense that they can bring about change; but because their constitutional state when considered by themselves is a state of incompleteness (matter lacking form, or and form lacking matter), and as such it is a state that is *in need of completion*. We can comprehend the incompleteness of the matter or

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[33] The matter, such as the marble for a statue or the pieces of wood for a house, are not the matter that remains when we abstract the form of a statue or a house, because lumps of marble and plunks of wood do have forms of their own, even if they are thought of as privations (because non-substantial). The matter that remains is an abstract entity.

form of a substance by abstracting the corresponding constituents of the substance; the corresponding abstract entities of matter and form need completion to occur in nature.[34]

The significance of *incompleteness* in Aristotle's metaphysics is, I submit, far greater than has so far been appreciated. On account of the notion of constitutional incompleteness, the focus of the inquiry into the power to change shifts: from change being a primitive capacity in things (e.g. between opposites), to an explanation of change being fuelled by the mutual dependence between the building blocks of reality on each other. The *constitutional incompleteness* of potentiality, I argue, is the key to Aristotle's conception of *ontological dependence*. It is why a power depends on a correlative power to receive its form and change;[35] why matter depends on form to be qualified; why form depends on matter to be instantiated; why a master depends on a slave to rule, etc. In all cases, a single item (concrete or abstract) is tied to another single item through the need to constitutionally complete one another.

Incompleteness is the key to understanding Aristotle's *final causation* in a way which undermines the criticisms his account has received in modern philosophy, on account of allowing for backward causal efficacy. On Aristotle's account of final causation,[36] as I propose to understand it, the final end is not reified so as to be efficaciously operative, backwards, on an entity or process which itself is directed towards its final end. Rather, the final end represents the type of incompleteness that the entity or the process has. The incompleteness is relative to an occurrent capacity; the capacity is present in the entity or process themselves, or in their environment. For instance, the final end of a human embryo is the state of a mature human being that the embryo is aiming toward; the embryo is incompletely developed by comparison to that state; yet, there is a capacity in the movements that the sperm is transferring to the embryo (deriving from the parent's movements) to change and develop the embryo into a mature human being. In *Metaphysics* IX Aristotle says:

> Nature also is in the same genus as potentiality; for it is a principle of movement – not, however, in something else, but in a thing itself *qua* itself. (1049b8-10)

So the final end represents the respect in which the entity or process that has this end is incomplete; their incompleteness is relative to an occurrent capacity for the final end, whether this capacity is their nature, or in their environment.[37]

In his discussion of potentiality and actuality, Aristotle considers different types of entity that are potential and can be actualised. The primary one is a power in potentiality and its

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[34] There are secondary senses of lacking e.g. form, as in the case of an object whose form is a privation, e.g. a lump of bronze, but I will not expand the discussion in this area.

[35] Although there is nothing physical that is transmitted between the powers, the reception of the form of the active power by the passive power indicates the respective metaphysical incompleteness of the powers, which is exhibited as the efficacy of the active power on the passive power.

[36] E.g., that every coming to be is for the sake of an end (See *Metaphysics* 1050a7-9).

[37] Generally speaking, there may be many – even arbitrary – ways in which something incomplete can be completed. Aristotle's teleology selects one of those ways as describing the type of incompleteness an entity or a process have on the basis of the systematically occurring capacities present in the entity or process to complete entities or processes of that type, if nothing prevents.

activated state. We saw that a power in potentiality is incomplete with respect to the form of the activity it is directed towards, e.g. heating, which the power comes to actually possess when activated. The activation of such a power is an instance of *efficient causation.*

Further types of entity Aristotle examines in his discussion of potentiality and actuality are the constituent matter, and the form that en-forms it in a substance. These are potential in a different sense than the sense in which potentiality applies to change:

> All things are not said in the same sense to exist actually, but only by analogy ... for some are as movement to potentiality, and the others as substance to some sort of matter. (1048b4-6)

This different sense of actuality and potentiality applies to the non-efficient causes. We saw above that on this extended sense, the potential is *not triggered* into actuality. But what is *common* between this analogous sense of potentiality and the sense in which efficient causes are potential is that they all have some kind of *incompleteness.* Thus, matter can be thought of as being potential:

> Matter exists in a potential state, just because it may attain to its form; and when it exists actually, then it is in its form. (1050a15-16)

Read constitutively, this claim tells us that the matter of a substance, when considered in abstraction without its form, is potential because it is incomplete, lacking the form. It is actualised when it has its form, thus constituting the substance. The original matter of a substance (rather than the abstracted matter which constitutes the substance), when considered as such, is also potential; thus for example, an embryo which develops into a human being. The incompleteness of the embryo is its lack of the form of a human being. Since the embryo is a concrete particular, as opposed to the abstracted matter of a substance, the sense in which it lacks the form of a human being is different from the sense in which the abstracted flesh and bones considered in abstraction do. Nevertheless, the embryo is the original matter from which the human being is generated, and as such it is potentially the human being into which it will be transformed. Matter as potential then, whether original matter or abstracted matter, that comes to be in its form when in actuality, is an instance of *material causation.*

Analogously, the form, considered in abstraction as non-enmattered, is incomplete too, and thus in a potential state, in that it can come to be enmattered. It should not be thought that the fact that Aristotle speaks of the form as *an actuality* conflicts with the potentiality status of the form; not any more than the status of a change being in actuality conflicts with its potentiality status (*Physics* 201a10-11). The sense in which a form is *an* actuality is compatible with its being *in* potentiality, when considered in abstraction as non-enmattered; the form is *an* actuality because it stands for what a substance is, as stated in the substance's definition, whether the form is enmattered or not; while the form is *in* actuality because it is enmattered. Form as potential then, which comes to be in its matter when in actuality, is an instance of *formal causation* or *final causation*:

> Why are these things, i.e. bricks and stones, a house? Plainly we are seeking the cause. And this is the essence (to speak abstractly), which in some cases is the end, e.g. perhaps in the case of a house or a bed, and in some cases is the first mover; for this also is a cause. But while the efficient cause is sought in the case of genesis and destruction, the final cause is sought in the case of being also. (*Metaphysics*, 1041a26-32)

We see therefore that the four causes all involve some form of metaphysical incompleteness, which accounts for their potential status, and explains what it is for each one of them to attain actuality. There are significant differences between the four causes, and in particular, between those that involve change, and those that involve abstraction from the constitution of substances. There are corresponding differences in the types of incompleteness in each case; in the dependence on internal or on external factors for their completion; in the completeness being achieved by change or by being constituted, involving development or abstraction, and so on. But what is significant for understanding their role as causes is that in each case, there is a sense in which there is a *metaphysical incompleteness*, which grounds *potency*, which explains their *causal role*. Thus in Aristotle's system, all the fundamental principles of being are to be thought of as instances of some type of incompleteness, and therefore of potency, with the corresponding ontological interdependencies between them.

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