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LES QUATRE CAUSES D'ARISTOTE: ORIGINES ET INTERPRÉTATIONS

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CRISTINA VIANO
CARLO NATALI
MARCO ZINGANO

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CAUSATION WITHOUT GLUE: ARISTOTLE ON CAUSAL POWERS[1]

Anna MARMODORO

1. Introduction

This essay argues that Aristotle thought there is a *real connection* between cause and effect, and that he understood that connection as a type of *ontological dependence* between cause and effect. Aristotle had an original theory of causation, which has not hitherto been given its place in the history of metaphysics. In a nutshell, causation is the fulfilment of an agent's causal powers in what is acted upon. The realization of the agent's power occurs in dependence on coming in contact with a passive power, on which the active power operates[2]. This interpretation will be articulated in what follows.

2. The state of the art in brief

Two factors have impaired our understanding of Aristotle's theory of causation: firstly, our modern general conceptual commitment that only efficient causes are causes; secondly, the received view that Aristotle did not allow for relations in his ontology[3] — which has concealed from us

[1] Thanks are due to the *European Research Council* for supporting the research that lead to this publication.

[2] I extend this explanatory model for causation in terms of activation of powers to the four types of Aristotelian causes: efficient, but also formal, final, and material, in my *Power Structuralism in Ancient Ontologies*, monograph in progress.

[3] From the scholarly literature on Aristotle this view has trickled down to the contemporary metaphysics: Dipert (1997), p. 348-9, e.g. says: «Aristotle regarded relations just as ways of speaking that are ultimately reducible to monadic aspects of substance … His argument seems to be that irreducible relations are conceptually incoherent, or result in an infinite regress». Bird (2007), p. 139, agrees: «Aristotle in the *Categories* … rejects the

his unique realist account of causation by means of ontological dependence. Aristotle's conception of causation and relationality are different from ours; but are to be found, as I argue elsewhere, throughout antiquity[4].

Our conception of causation changed in the 17th century, when experimental philosophy and atomism began to gain ground in the world of philosophy and science. For the ancients, there are more types of cause than the efficient cause; but not for us, and in consequence these further types that the ancients included in their accounts of causation have not been taken to be causes[5]. The two most striking examples of this treatment of ancient causation in the state of the art literature regard Aristotle and Plato. It is helpful to start from Plato because it is with Gregory Vlastos' exegesis of Plato that the semantic explanation of ancient causes began.

Plato introduces the Forms as the causes that explain why things are characterised by properties; e.g. beautiful things are beautiful by virtue of their relation to the Form of Beauty, which is a transcendent property[6]. As is well known, Aristotle criticised, in the *De Generatione et Corruptione*, Plato's treatment of Forms as causes on the ground that these transcendent entities cannot bring about change in things: they cannot function as efficient causes[7].

A seminal work by Vlastos (1969) responds to the criticism, setting out a view that has received widespread support in the secondary literature: Platonic Forms are not efficient causes that bring about changes in

idea that primary (and secondary) substances are relational. In effect Aristotle argues that all relations may be reduced to monadic properties of things».

[4] And also in the medieval philosophical tradition; see my *Power Structuralism in Ancient Ontologies*, monograph in progress.

[5] See e.g. Sorabji (1981), p. 26-44; Frede (1987), p. 125-150.

[6] See for example *Phaedo* 100d: «I simply, naively and perhaps foolishly cling to this, that nothing else makes it beautiful other than the presence of, or the sharing in, or however you may describe its relationship to that Beautiful we mentioned, for I will not insist on the precise nature of the relationship, but that all things are beautiful by the Beautiful».

[7] *GC* 335b, in particular 18-24: «Neither of these theories, however, is sound. For if the Forms are causes, why is their generating activity intermittent instead of perpetual and continuous — since there always *are* participants as well as Forms? Beside, in some instances, we *see* that the cause is other than the Form. For it is the doctor who implants health and the man of science who implants science, although Health itself and Science itself *are* as well as the participants; and the same principle applies to everything else that is produced in accordance with a capacity».

things; rather, Forms are 'logical causes', and 'partaking' in a Form (of Beauty) means that the thing satisfies the definition of the Form's essence (being beautiful). Thus, on Vlastos' view the relation between a Form and a thing is not metaphysical, but *semantic*, providing an explanation of why the thing is beautiful.

Vlastos' interpretation of the causal role of the Platonic Forms is significant more broadly because it allows for avoiding the metaphysical underpinning of *any type* of non-efficient causation in antiquity. Efficient causation is what causation is for us; non-efficient causation is seen as problematic, and Vlastos' 'semantic ascent'[8] dissolves the metaphysical problem into an *explanatory* reading of types of non-efficient causation.

A similar reductive interpretation of Aristotle's four causes into a combination of efficient causation and explanation is to be found in Charles' (2000) causal-explanatory reading of essence in Aristotle[9]. This reading follows the nearly unanimously received view that Aristotle's doctrine of the four causes (the material cause, the efficient cause, the formal cause, and the final cause) is a theory of explanation (e.g. Fine 1986; Charles 1984; Waterlow 1982; Annas 1982; van Fraassen 1980; Nussbaum 1978; Barnes 1975)[10].

Making a departure from the received interpretation, I will argue that there is a common conception that runs through all four Aristotelian *causes*.

3. Aristotelian relations

I will here argue that Aristotle can account for relations without reifying them in his ontology, and has a unique account of relationality. I will briefly present my interpretation of the relationality of causal powers, and then proceed to show how the proposed account of causal powers can allow for a unified account for all four Aristotelian types of cause.

[8] The expression 'semantic ascent' is borrowed from Quine (1960).

[9] See Charles (2000), see in particular chapter 13.

[10] A dissenting voice was Freeland's (1998), who offered an interpretation of Aristotle's four causes as causes, based on a real nomic relation between universals. Although this is a novel interpretation, it appears to be an application of Armstrong's (1989) theory of causes as relations of nomic necessitation between universals to Aristotle's doctrine of the four causes. But Freeland's reading cannot do justice to Aristotle's material cause as potentiality, which is not captured in nomic relations between universals.

My starting point is Aristotle's account of relatives in the *Categories*. Examples of relatives are: 'larger than', 'double of', 'perception of', 'knowledge of', 'position in relation to' etc. Relatives are defined thus:

> «All things are relative which are called just what they are, of or than something else — or in some other way in relation to something else» (6b 6-7).

As we shall see, predicates containing relative terms are treated by Aristotle as monadic predicates, e.g. 'is a master', 'is a slave'.

Nevertheless, my argument is that for Aristotle, *relatives are ontologically dependent on each other*. Relativity, as Aristotle explains it in the *Categories*, rests on ontological dependence. The reason is this: relatives, say R_1 and R_2, are *counterfactually dependent* on each other: if there is no R_1 there is no R_2. Aristotle says: «if there is no master there is no slave either» (*Cat*. 7b 6-7). Thus notwithstanding the monadic status of the relatives, a type of relationality enters Aristotle's system, through ontological dependence.

Now, causes for Aristotle are *relative* items in the ontology, just as a master and a slave are, for as we read in the *Physics*:

> «The term "relative" is applied sometimes with reference to excess and defect, sometimes to agent and patient, and generally to what can move and what can be moved. For what can cause movement is relative to what can be moved, and *vice versa*» (200b 29-32).

So the account of relationality briefly sketched above will apply to causes too. In efficient causation for example, two co-relative powers, the agent's and the patient's powers (e.g. being a 'mover' and being 'moveable') are interdependent as per the counterfactual relation of there being no mover if there is no movable, and vice versa[11].

Aristotelian causes are *relational* (through ontological dependencies of various kinds) in two dimensions: the agent's power is interdependent with the patient's power to be acted on (e.g. the mover's power to the

[11] But a movable thing can move itself too, *qua* other; i.e. it can causally affect itself, *qua* other. For example in the *Physics* Aristotle says that «a man who is a doctor might cure himself. Nevertheless it is not in so far as he is a patient that he possesses the art of medicine: it merely has happened that the same man is doctor and patient» (192b 23-27). Namely, one and the same person might happen to be a doctor and sick, and hence act (*qua* doctor) on herself (*qua* 'curable', i.e. *qua* recipient of medical treatment).

movable's power). But, also, the potential power relates to the realised power (e.g. the potential mover to its actually moving something):

> «A thing is capable of causing motion because it can do this, it is a mover because it actually does it» (202a 16-7).

The active and passive powers (e.g. mover's and movable's powers) are related by being interdependent, and also by interacting, for their mutual realisation. Their *interdependence* is captured by Aristotle's counterfactual account of the relatives. Their *interaction* is described by Aristotle as the agent's power being realised *in* the patient. So the agent's power metaphysically belongs to the agent, but physically it comes to be present and to be realised in the patient.

In a paradigmatic passage illustrating causation through the case of teaching and learning (which I will analyse in detail in the following sections) Aristotle says:

> «Teaching is the activity of a person who can teach, yet the operation is performed in something — it is not cut adrift from its subject but it is of one thing in another» (*Phys*. 202b 6-8).

The significance of this claim is that the interaction of the active and the passive powers is not reified by Aristotle as a relation, but as an *ontological extension* of the agent onto the patient.

Aristotle does *not* posit a relation between active and passive powers to explain the mechanism of causation. He treats the active power as 'extending' onto the passive one, not through a relation, but by constitutionally 'spreading' itself onto the patient.

(In the following sections I will expand on my interpretation of the relation between active and passive powers in causation with particular reference to *Phys*. III 3).

While the relation between a *potential* power (e.g. of the teacher to teach) and the *realised* power (of the teacher teaching) is not the same as the relation between the agent's and patient's powers, i.e. teacher and learner, Aristotle's account of the latter provides a way of understanding the former too *without reifying a relation* between the potential power and its future end when it is realised[12].

[12] The relation between a potential power and its actuality is investigated in Marmodoro (2013, forthcoming).

The pivotal point is that ontological dependence is the key to understanding the *causal status* of the material, formal, and final causes in Aristotle, because it is common to them and to efficient causation. The difference between efficient and non-efficient causation is that the efficient involves *interactive agency* between the causes (powers) for the realisation of the potentiality (e.g. of a fire to heat a pot), while non-efficient causation does not involve interaction (e.g. in the case of the matter of a statue and the statue). It is ontological dependence which will lead us to the unified account of the four causes in Aristotle.

4. The metaphysical building blocks of causation[13]

I turn now to investigating in detail Aristotle's account of the interaction between cause and effect, focussing on the analysis Aristotle gives of the interaction between mover and movable in his discussion of κίνησις (change, motion) in *Physics* III. Aristotle's definition of κίνησις is fairly broad (see e.g. 201a 9-10; 201a 27-9; 201b 4-5; 202a 13-14). It allows for a great variety of cases to come under the mover-movable relation, including such cases as aging or ripening which we would consider untypical cases of causation; but includes uncontroversial instances of causation, such as building, heating, doctoring, etc. Aristotle's model of mover-movable will serve as a good model for explicating the metaphysics of a causal connection[14].

What are then the building blocks of a causal connection such as the one existing between a mover and a moved? Aristotle begins with a programmatic stance: accounting for motion does not require appealing to any new, primitive category of being:

> «There is no such thing as motion over and above the things. It is always with respect to substance or to quantity or to quality or to place that what changes changes. But it is impossible, as we assert, to find anything common to these which is neither 'this' nor quantity nor quality nor any of the other predicates. Hence neither will motion and change have reference to something over and above the things mentioned; for there *is* nothing, over and above them» (*Phys.* 200b 32-201a 3).

Instead of introducing new metaphysical building blocks to explain motion and causation, Aristotle makes use of his three well known

[13] The account here proposed draws on Marmodoro (2007).

[14] I argue elsewhere that all these changes are to be explained with the same model (Marmodoro 2013).

principles: the form, the privation of form, and the substratum that remains through change. In addition, he appeals to his distinction between being in potentiality and being in actuality, which is a primitive distinction of ways in which things are[15], and will play a crucial role in accounting for the connection between cause and effect.

Aristotle analyses efficient causation as the transmission of the form from the mover to the movable[16]:

> «The mover will always transmit a form [εἶδος], either a 'this' or such or so much, which, when it moves [κινῇ], will be the principle and cause [ἀρχὴ καὶ αἴτιον] of the motion, e.g. the actual man begets man from what is potentially man» (*Phys*. 202a 9-12).

So, in general terms, causal interaction consists in the transmission of a form from an agent to a patient, and results in the actualisation of properties (powers) in both objects in relation to one form, the transmitted one. But since the agent transmits and the patient receives the form, their achievements are of different types[17], because they relate to the same form differently. Thus the actuality of the agent as an agent is the *transmission* of the form, and the actuality of the patient as patient is the *reception* of that form (resulting in the effect).

The transmitted form is then the cause; the privation of the form in the patient is what allows for its reception, and the physical process facilitating the transmission of the form is what stimulates and grounds the causal change (e.g. in building, the movements of the hands of the builder facilitate the transmission of the form of the house to the construction materials; for a fire, contact facilitates the transmission of the form to the object heated). I shall follow Aristotle in speaking of 'contact' as the generic condition that stimulates the causal process in the case of efficient causation:

> «For 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» (*Phys*. 202a 5-7).

[15] «We have distinguished in respect of each class between what is in fulfilment and what is in potentiality» (*Phys*. 201a 9-10).

[16] On the transmission of the for, see Marmodoro (2013, forthcoming).

[17] «It is contrary to reason to suppose that there should be one identical actualisation of two things which are different in kind. Yet there will be, if teaching and learning are the same, and agency and patiency» (*Phys*. 202b 1-3).

Contact facilitates the transmission of the form from the mover to the movable. A reciprocal process constitutes a second instance of causal action between them.

An important and well-recognised Aristotelian distinction is that between movement (κίνησις) and activity (ἐνέργεια). In the case of movement, whether spatial or qualitative, the transmission is a process that takes place through time. While it lasts, the transmission has not been completed. The unfolding of the stages of transmission marks the *incompleteness* of the causal process (e.g. building a house). Once the transmission is completed, the causal interaction is not taking place any more. The agent is not acting on the patient, which now possesses the transmitted form. So the process of realisation of the agent's potentiality to transmit the form and the patient's potentiality to receive the form is the causal process which lasts until the transmission is completed. The reception of the form by the patient is the causal effect, namely the change.

> «Take for instance the buildable: the actuality of the buildable as buildable is the process of building. For the actuality must be either this or the house. But when there is a house, the buildable is no longer there. On the other hand, it is the buildable which is being built» (*Phys.* 201b 9-11).

So the causal process of transmission, i.e. the change, is actual while these potentialities are being realised, and only before they are fully realised. In that sense the causal process is actual only when the potentialities that drive it are *incompletely actualised*:

> «Motion is thought to be a sort of actuality, but incomplete, the reason being that the potential whose actuality it is, is incomplete» (*Phys.* 201b 31-33).

Understanding causation as transmission of the form plays an important role in Aristotle's account for causation by providing a way of *selecting the cause* and underpinning the *direction of causation*. Both issues have been widely and controversially discussed in contemporary and ancient accounts of causation.

5. Selecting the cause

What sets apart the cause of a certain effect from the mere conditions for its coming about? Consider the case of teaching and learning, which is Aristotle's paradigmatic example in *Physics* III. Is the pupil's

understanding of the Greek language a cause of her learning the theorem, metaphysically on a par with the teacher's teaching?

Plato had already drawn in the *Phaedo* the distinction between the cause and the means towards its realisation:

> «Imagine not being able to distinguish the real cause (τὸ αἴτιον τῷ ὄντι) from that without which the cause would not be able to act as a cause (ἐκεῖνο ἄνευ οὗ τὸ αἴτιον οὐκ ἄν ποτ' εἴη αἴτιον) » (99a-b).

But it is Aristotle who makes explicit in *Physics* III 3 the criterion that sets apart the cause from the means or necessary conditions for causation to occur. The form that is transmitted is the principle and the cause of the motion. Everything else that happens in the process, or even the conditions of its happening, is the means for the transmission of the form. Thus the form of heat transmitted from the fire is the cause of the combustion, while such factors as the dryness of the material is the means or condition that makes the transmission of the form possible. Furthermore, since causal efficacy consists in the transmission of the form, activities or processes required in the agent or the patient for the transmission to occur (such as the builder fetching her tools) are enabling the transmission rather than constituting the transmission.

There may be further processes necessitated for the transmission of a form, as in the case where both the agent and the patient undergo changes — as it happens in most of the cases. Aristotle says, in very broad terms:

> «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» (*Phys.* 202a 6-7).

This remark explains the motion of the mover. It suffers a reciprocal impact by the necessary contact with the movable. During the causal interaction, changes take place in the movable, but may also take place in the mover due to its engagement in moving the movable[18]. So, the agent may be involved in different motions in the course of the causal

[18] We have seen that Aristotle distinguishes the motion of the mover, due to necessary contact with the movable (e.g. a hot item becoming colder by touching the cold item it is heating), from the motion in the movable due to the mover's causal efficacy (e.g. the cold item becoming hotter). The first is in the mover and the second in the movable. But there is a third type of change that the mover undergoes: namely, it becomes a mover in actuality — thus the teacher becomes a teacher in actuality as the learner is learning. This change is different from the change the mover suffers due to contact with the movable, as in the case of something hot becoming colder by touching something cold, since not all

interaction, due to the contact with the patient, which is necessary for the transmission of the form. All of these motions are required for the effect to occur, although as a side effect rather than enablers.

But since the causal interaction is the transmission of the form, at the time of transmission the causal form must be present in the agent not only in actuality, but in a *transmissible state*.

That the form has to be present in the agent in actuality is captured by Aristotle in a clear example:

> «The *actual* man (ὁ ἐντελεχείᾳ ἄνθρωπος) begets man from what is potentially man» (*Phys.* 202a 10).

But possessing the form in actuality is not all that is required for causation to take place. Consider the teacher who possesses knowledge of a theorem, but only in a language that her pupil would not understand. Possessing knowledge of the theorem does not make her into a teacher (of the theorem) until she embodies this knowledge in the spoken English words that transmit it to the student.

In addition to the agent possessing the form in a transmissible state, actual transmission requires that the conditions are such that they allow the form to be actually transmitted, and that there is a patient suitable for receiving the form at hand.

The transmissibility of the form is a very significant, and entirely unexplored feature of Aristotle's theory of causation. Two aspects of it are particularly important.

The first is the *context relativity* of transmission: since the form must be transmissible to a particular type of object and in a particular set of circumstances, the agent must possess the form in a transmissible state relevant to the type of object and type of circumstances of the transmission. An example is the teacher transmitting the lesson in an oral lecture or in a printed article. The teacher possesses the lesson in different ways — in her memory, her lecture, and the article. Two of them are transmissible forms, each fitting the circumstances in which transmission takes place.

Secondly and for the same reason, namely that the form must be transmissible to a particular type of patient and in a particular set of

movers are changed by the moved, as for instance the teacher who does not get affected by the learner although he does become a teacher in actuality as he teaches.

circumstances, no type of transmission is more privileged than others; it has no more claim to be causation than the others. This means that no type of possession of the form by the agent is more privileged than others. Thus, whether the lesson is in a lecture or in an article, neither is more genuinely the lesson than the other.

Consider a sculptor having the form of the statue in mind, which is a way of possessing the form in a non-transmissible way in their imagination; and also having the form embodied in the movement of her hands through which she sculpts the statue, which is a way of possessing the form in a transmissible way. Or further consider the mathematician having the demonstration of a theorem in mind, and having it written on the blackboard; or the father having the form of human being and having it embodied in the semen that will generate a child.

In some cases, the agent does not possess the form in actuality until the transmission occurs. In the case of the colour of a surface, Aristotle considers the properties of the surface of the object in the dark as only the first actuality of colour in the object[19]; this gives the object only the potentiality to have visible colour; the object possesses visible colour in actuality only when it is perceived in the light:

> «Since the *actualities* of the sensible object and of the sensitive faculty are *one actuality* in spite of the *difference between their modes of being*, actual hearing and actual sounding appear and disappear from existence at one and the same moment, and so actual savour and actual tasting, etc., while as potentialities one of them may exist without the other. The earlier students of nature were mistaken in their view that without sight there was no white or black, without taste no savour. This statement of theirs is partly true, partly false: 'sense' and 'the sensible object' are ambiguous terms, i.e. may denote either potentialities or actualities: the statement is true of the latter [since without sight there is no actual white or black], false of the former [since without sight there is potential white or black]. This ambiguity they wholly failed to notice» (*De an.* 426a 15-26).

Here the actual surface properties of a coloured object are only potential colour. The object possesses colour in actuality when, and only while it is seen.

Aristotle says with respect to sound that an object's sounding lasts only while it is heard by a perceiver:

[19] It is the sense in which a mathematician is a mathematician even when asleep.

> «It is possible to have the capacity to hear and not to hear, and that which can produce sounds is not always doing so. But when that which can hear is hearing and that which can produce *sound* is producing it, then hearing in actuality and *sounding* in actuality come to be at the same time, and one might call the one hearing and the other sounding» (*De an*. 425b 28-426a 1).

By extension, an apple's surface 'reddens' in the world only while interacting with a perceiver, that is: perceptible forms of objects in the world are actualised only for the duration of the interaction between the object and the perceiver. Under normal perceptual conditions, the interaction of a red apple with a perceiver grounds the actualization of the redness of the apple and of the experience of red by the perceiver. The perceiver's experience of red and the actualised perceptible form in the apple are distinct from one another (the one is a state in the perceiver, and the other a property of the object), but they have co-extensive life spans, sustained by the physical causal interaction between object and perceiver. Thus, the object possesses the colour red when and only when the perceiver is experiencing the red apple. When the apple is not perceived, it has the perceptible form of red only as a power to be actualized[20].

6. The direction of causation

The passages from the *De Anima* quoted at the end of the previous section, read in conjunction with *Physics* III 3, show us how Aristotle addresses a further important question for any theory of causation. Does causation follow the order of time, with causes preceding their effects? And if not, is it mere convention that in the causal interaction between the teacher and the pupil, teaching is the cause and learning the effect? Is there any metaphysical grounding to the determination of the cause and the effect? Aristotle says:

[20] Aristotle claims mutual dependence and a complete temporal co-extension between the sounding, say, of a bell, and our hearing it. The relation is analogous to the one holding between teaching and learning, where neither happens without the other, for Aristotle. It follows that if no one is hearing, there is no sounding. Does this mean that, for Aristotle, there are no sounds if there is no hearing? And similarly for all other perceptual forms? This is not Aristotle's claim. Aristotle is not identifying sound and sounding.

> «A man may have hearing and yet not be hearing, and that which has sound is not always sounding. But when that which can hear is actively hearing and that which can sound is sounding, then the actually hearing and the actual sound come about *at the same time* (these one might call respectively hearkening and sounding)» (*De an*. 425b 26-426a 1).

Contrary to what common sense might lead one to think, Aristotle is clear that actual causes do not precede their actual effect in time; teaching and learning (by being taught) have the *same life span*. The potential to teach is in the teacher before she engages in actual teaching (and even if she may never engage in actual teaching) and so is the corresponding passive power in the learner, but their actualization is one and the same (hence there is complete overlapping in time):

> «Motion is the fulfilment of the potentiality of the movable by the action of that which has the power of causing motion … 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 is capable of acting. Hence there is a single actuality of both of them alike» (*Phys*. 202a 13-18).

But even if the actualization of the active power and the actualization of the passive power overlap completely in time, the direction of the transmission of the form is asymmetric; and determines which is the agent and which the patient in causal interaction[21].

This criterion is particularly helpful for analysing cases where the form (the cause) is possessed by the agent only in a transmissible state and only at the moment of transmission[22]. In these cases, both the agent and the patient have the potentiality to possess the form, and both come to possess the form actually only at transmission time. Also each of them is necessary for the other; the agent can be an agent only by acting on the patient, and the patient can be a patient only by being acted upon by the agent. Yet, the causal agent is the one from which the form is transmitted which is the one that possesses the form potentially as opposed to merely being able to come to possess the form. The ultimate difference between the two states is that when the agent and the patient come to possess the form in actuality only one of the two changes by such a possession and not the other.

[21] For further arguments, see Marmodoro (forthcoming).

[22] For example, consider a geometer solving a problem for the first time while lecturing on it.

7. The metaphysics of causal interactions

During the causal interaction the mover moves in actuality, and the movable is actually moved. These two actualities are coincident in time (as mentioned in the section above), and not casually so. The one occurs only if the other occurs too, so their coincidence needs to be metaphysically explained.

Aristotle examines a variety of alternative metaphysical accounts of what happens to the mover and the movable in causation in a dialectical puzzle (ἀπορία λογική) in *Phys.* III 3, 202a 21-b 5, to which I referred elsewhere as the Actualities of Motion Dilemma[23]. In the course of this long and intricate argument, Aristotle rejects some of the possible alternative accounts, while introducing metaphysical tenets he will finally include in his own metaphysical explanation of the coincidence in time of agency and patiency.

In brief, in the Dilemma Aristotle considers two possibilities: that the two actualities, of the mover and the movable, are different, or that they are one and the same. If they are different, either both actualities occur in one of the two, namely in the mover or the moved, or one occurs in each. If both the actualities occur in one of them, then, first, one of them will not have its own actuality realised in it; e.g. the actuality of the mover will occur in the moved, not in the mover; but how could that be? And secondly, whatever has both actualities in it will change in two different ways in relation to one form[24]. If on the other hand the actuality of the mover is in the mover, and the actuality of the movable is in the movable, then either the causal agency of the mover will impact on the mover itself, not the movable, or it will impact on nothing, in which case it is not being a mover in actuality. Finally, if the actualities of the mover and the moved are the same, then we reach absurdity, since agency and patiency cannot be the same.

Aristotle's own solution will be that the two actualisations, of the agent's and of the patient's respective powers, are different, interdependent, and asymmetrically realised, as we shall see.

Just before developing the Dilemma, Aristotle sketches his own position:

[23] See Marmodoro (2007), p. 207, p. 230-231.
[24] E.g. it will come to be heating and be heated by the heating at the same time.

> «The solution of the difficulty is plain: motion is in the movable. It is the fulfilment of this potentiality by the action of that which has the power of causing motion; and *the actuality of that which has the power of causing motion is not other than the actuality of the movable*; for *it must be the fulfilment of both*. 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 [the mover] is capable of acting. Hence *there is a single actuality of both alike*» (*Phys*. 202a 13-18).

But how can it be that 'the actuality of that which has the power of causing motion *is not other than* the actuality of the movable'? *Prima facie* absurdities seem to follow:

> «It is contrary to reason to suppose that there should be one actualisation [ἐνέργεια] of two things which are different in kind. Yet, there will be if teaching and learning are the same, and agency and patiency. To teach will be the same as to learn, and to act the same as to be acted on — the teacher will necessarily be learning everything that he teaches, and the agent will be acted on» (*Phys*. 202b 1-5).

Aristotle does not draw back from his solution in view of these difficulties, but is led to innovate. He maintains:

> «There is nothing to prevent two things having one and the same actualization (not the same in being, but related like the potential is to the actual)» (*Phys*. 202b 8-10)[25].

Does his solution help him address the objection we encountered just above, that teaching will be the same as learning and that the teacher will learn what she teaches? Aristotle proceeds to refine his answer by a series of examples. So enriched by the examples, his solution does avoid the objection, as I argue below.

Aristotle gives four examples to elucidate his solution to the causal connection problem. He sets up the problem by stating the *explanandum*:

> «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» (*Phys*. 202a 16-17).

The action of the mover can be realised only by acting on the movable. This requires Aristotle to explain how the mover's capacity is bound

[25] The qualification «related like the potential is to the actual» is discussed below.

up with the movable. Immediately following his statement of the problem, he proceeds to offer his explanation by restating his solution and elucidating it with the first two examples:

> «Hence there is one and the same actuality [ἐνέργεια] of both [the mover and the movable] alike, just as one to two and two to one are the same interval, and the steep ascent and the steep descent are one» (*Phys*. 202a 18-20).

The first example is ambiguous. On the one hand the interval from one to two can be taken to be *the same* as the interval from two to one, being either an arithmetical unit of value one, or a geometrical magnitude of value one. On the other hand, the two intervals can be taken to be *different*, such as the positive and negative values of the number one, or vectors with opposite directions. I take the example in the latter way because**,** as we shall see, the metaphysics of the two intervals require them to have *different essential natures*, as the positive and negative unit values do, or as opposite vectors do; whereas taken in the former way the two intervals are one and the same, *described in two different ways* — from one to two, and from two to one[26]. The second example is also ambiguous, between the stretch of land being the same inclined-road for both ascent and decent, or the stretch of land being two routes.

But Aristotle does proceed to offer an explanation of the sameness involved in these examples:

> «For these are *one and the same*, although their definitions [λόγος] are *not one*. So it is with the mover and the moved» (*Phys*. 202a 20).

This is important, but not complete. It is important because it blocks the objection that teaching would end up being the same as learning, by stating that they have different essential natures. But if they have different essential natures they are not one and the same entity described in two different ways. Whatever it is that is common between the two intervals or the ascent and descent must have two different definitions. Commentators who read λόγος as 'account/description' rather than 'definition' take the examples to be introducing a common single entity in each case, e.g. unit value one, or the inclined road (or the relation

[26] I consider the ancient, medieval and modern alternative interpretations of the example in Marmodoro (2007), p. 220-221.

between the extremes)[27]. For reasons that will become clear in the discussion of Aristotle's subsequent examples and explanation, I take λόγος here to mean 'definition', by contrast with interpretations which read the examples as involving one entity under two descriptions. My reading requires that whatever it is that the two intervals or routes share in common is not any familiar type of entity of the Aristotelian ontology, since it has two different definitions of what it is to be it.

It follows on my reading that when Aristotle says that there is a single actuality [ἐνέργεια] of both the mover and the movable (as there is between the two intervals or the two routes), he must be telling us that the mover and the movable are so related in their activity as to be *one* in some sense, but *not one* in the definitions that describe what each of them does or suffers. What makes the definitions of the vector lines two are opposite directions; but what makes these vector lines one? It is the non-directional interval between one and two that is the same for both vector lines. The interval would not be the same, for example, between vector lines one to two and four to three. Similarly with the uphill and downhill routes; they are different because of their opposed directions but are both the same stretch of land, as opposed to two routes on different sides of the hill that share no common stretch of land. Although these examples and this explanation go some way towards explaining what Aristotle means by claiming that the actuality of the mover and of the movable is the same, his position is not as explicit as in the explanation we shall find in his next set of examples, to which I now turn.

After the Dilemma Aristotle states his own position**,** resolving the puzzles encountered in the course of the Dilemma itself. On the issue we are examining here, Aristotle says:

> «Nor is it necessary that the teacher should learn, even if to act and be acted on are one and the same, provided that they are not the same in respect of the account [λόγος] which states their essence [<τὸ> τί ἦν εἶναι] (as raiment and dress), but are the same in the sense in which the road from Thebes to Athens and the road from Athens to Thebes are the same, as has been explained above» (*Phys*. 202b 10-14).

The use of the technical expression, coined by Aristotle himself, for essence, <τὸ> τί ἦν εἶναι, settles the issue as to whether by 'account',

[27] This view is held by the majority of the commentators, ancient and modern.

λόγος, he means description or definition of nature. This is further supported by his immediate example of things that have the same account, namely raiment and clothing. 'Raiment' and 'clothing' are one thing, under two names or descriptions, but with one definition which expresses its essence. In *Top*. I 7, 103a 25-7, Aristotle says that whatever is one in essence is one in the primary sense (κυρίως), and indeed we find there the very same example of the 'raiment' and 'clothing' to illustrate this type of oneness. It follows that the route from Thebes to Athens differs in definition from the route from Athens to Thebes since they are not, as Aristotle tells us, like raiment and clothing. The reference back to what 'has been explained above' is to the passage we just examined, 202a 19-20, on the relation of the uphill route to the downhill one that differs in account, λόγος. Hence there, too, Aristotle intends λόγος to be the definition of essence.

But there is further evidence that here λόγος is the definition of essence and not a mere description. This comes in an unexpected metaphysical observation that Aristotle makes immediately afterwards. This observation also makes it evident that Aristotle's aim in the two passages we are examining, in which he says that one «actuality … must be the fulfilment of both [the mover and the movable]», or that «to act and to be acted on are one and the same»[28], is to carve out a sense of *qualified sameness*, a sense different from identity of substances:

> «For it is not things which are in any way the same that have all their attributes the same, but only those to be which is the same» (*Phys*. 202b 14-16).

Aristotle must be referring to the attributes of substances, because he uses the expression 'everything which belongs' (ταὐτὰ πάντα ὑπάρχει) to these substances, which excludes the underlying substratum as the subject of the quoted sentence above. Furthermore, although he only talks of substances that have the same being (τὸ εἶναι τὸ αὐτό), he must mean by 'being' the whole constitution of such things, namely matter and form[29]. The reason is that if he meant only that these substances

[28] Ἐντελέχεια γάρ ἐστι τούτου [καὶ] ὑπὸ τοῦ κινητικοῦ. καὶ ἡ τοῦ κινητικοῦ δὲ ἐνέργεια οὐκ ἄλλη ἐστίν (202a 14-5); μία ἡ ἀμφοῖν ἐνέργεια (202a 18); οὔτε μίαν [*scilicet* ἐνέργειαν] δυοῖν κωλύει οὐθὲν τὴν αὐτὴν εἶναι (202b 8-9).

[29] For sameness of individuals there needs to be sameness of number, and hence of matter, not only sameness of essence. Aristotle says in *Metaph*. Δ 6: «Some things are one in number, others in species, others in genus, …; in number those whose matter is one, in

would be the same in essential form, the statement would be obviously false; two trees of the same species do not have all their attributes the same. Of course, if he meant that the two substances are the same in form, whether form is essential or accidental, he would be stating a tautology when he claimed that such substances would have their attributes the same. We should then take Aristotle to be claiming that things with the same constitution, have the same attributes — are indiscernible; having the same constitution and being indiscernible, then, makes them identical. Aristotle mentions the indiscernibility of things with the same constitution, in order to set it apart from the sameness of items that are one and the same but different in being that he is discussing here when he says that «to act and to be acted on are one and the same» (202b 11).

It is a cornerstone of Aristotelian substantial essentialism that if the essences are of different kinds, their material substrata are different in number, e.g. a wolf and a rabbit. But this is not the case with the causal agent and patient, which is why Aristotle is at pains to explain their unique metaphysics. What it is to be an agent is different from what it is to be a patient; their definitions are different (202a 20, 202b 22), and with them, their kind (202b 1). But what makes the case of agent and patient metaphysically unique is that although the definitions stating their essences (<τὸ> τί ἦν εἶναι, 202b 12) are different, «to act and to be acted on are one and the same» (202b 11).

Aristotle's examples have already prepared us for understanding this statement. There is a kind of sameness that the route from Athens to Thebes has with the route from Thebes to Athens, because these routes are realised on the same road. The line from one to two is realised on the same interval as the line from two to one. In all such cases, their ground of realisation is one and the same despite their essences being different in kind. Aristotle finally states this explicitly:

species those whose definition is one, …. The latter kinds of unity are always found when the former are; e.g. *things that are one in number are also one in species, while things that are one in species are not all one in number*» (1016b 31-6). Matter here has the role of the particularising principle, securing the numerical identity of the individuals. I argue for this claim in Marmodoro (2009). If one attributes to Aristotle a different particularising principle than matter, then that principle must be understood to be evoked in the present passage — 202b 14-16.

> To generalise, teaching is not the same in the primary sense [κυρίως] with learning, nor is agency with patiency, but that to which those belong [ᾧ ὑπάρχει] [*scilicet* is the same for both], namely the motion [κίνησις]; for the actualisation [ἐνέργεια] of this [teaching] in that [learning] and the actualisation [ἐνέργεια] of that [learning] through the action of this [teaching] differ in definition (202b 19-22, slightly modified)[30].

The motion to which teaching and learning belong is the substratum of the two actualities. It is the activity between the two interacting substances that facilitates the transmission of the form (cause) and thereby makes actual both the teaching and the learning. As such, the motion is the actuality of the agent's potentiality to teach and the patient's potentiality to learn (202a 13-16), in other words, the agent's operation on the patient. It is the fulfilment of both potentialities (202a 16, a 18). Since the two potentialities differ in kind, their actualities differ in kind too[31]. The actualities of the two potentialities (for teaching and learning) are fulfilled in the interaction, the motion, which is the common activity that actualises them both — the teaching-learning activity.

Teaching causes learning. Neither can happen without the other. The teacher is not teaching if the learner is not learning, and the learner (i.e. 'instructee') is not learning (being instructed) if the teacher is not teaching. These two potentialities can occur in actuality only together. Their interdependence is captured by the fact that they are actualised by one and the same activity. Both of them therefore characterise that activity essentially, which in this case is an instance of teaching and learning. The activity bears the two forms by being en-formed by it, where the two forms are tied together by interdependence.

[30] Since there is disagreement between the interpreters on the translation of this passage, I report here the original text: ὅλως δ' εἰπεῖν οὐδ' ἡ δίδαξις τῇ μαθήσει οὐδ' ἡ ποίησις τῇ παθήσει τὸ αὐτὸ κυρίως, ἀλλ' ᾧ ὑπάρχει ταῦτα, ἡ κίνησις· As Hussey (1983), p. 72, notes, there two ways of understanding the passage: (i) «the change in which these things are present, i.e. of which it is true that it is an acting-upon and a being-acted-upon, is the same as being acted upon»; (ii) «the change in which these things are present, i.e. of which it is true that it is both an acting-upon and a being-acted-upon, is the change». The latter (ii) is the way in which the majority of the interpreters, including myself, read the passage (e.g., Philoponus 383, 21-2, Ross 1979, p. 362, and Gill 1980, p. 137). Hussey (1983), p. 6, though, opts for (i), and so does Charles (1984), p. 14. I have argued elsewhere (2007), p. 225-226, against the Hussey-Charles reading.

[31] Because the agent's and the patient's capacities are *essentially different*, the one being the capacity of transmitting the form and the other being the capacity to receive the transmittable form, the realisation of the two different capacities is also essentially different.

The *oneness* of the activity reflects the interdependent actualisation of the cause and the effect. The *two forms* that the activity bears preserve the bipolarity of the causal interaction; and causes are born together with their effects.

In sum, in causation two essential natures en-form an underlying activity. The activity supports both natures together because of the relation that these two natures have to each other. So the two natures co-actualised in one underlying substratum make up the 'causal connection' between the two interacting substances, the agent and the patient. The one nature is the agent's actualised potentiality and cause, and the other nature is the patient's actualised potentiality and effect; the two are bound together by interdependencies in their common grounding on the underlying activity. Thus, for example, the physical movement of the carpenter's hands and chisel on the hard wood constitute the carpenter's carving, and the log's being shaped into a statue.

We are now in the position of revisiting an explanatory remark Aristotle makes regarding the mutual actualisation of the cause and the effect. In describing his own position on the oneness of the actualities of the agent and the patient (*Phys*. 202b 8-22), where, as we saw, he explains that they share the same substratum, he introduces it by saying:

> «There is nothing to prevent two things having one and the same actualization (not the same in being, but r*elated like the potential is to the actual*)» (202b 8-10).

Here Aristotle is making the same point with which he concludes this section, that what is common between two co-actualised potentialities are not their respective actualities, which differ in kind (e.g. teaching and learning), but their substratum, the underlying activity. The way Aristotle introduces this position is that the potentialities of the agent and patient have one and the same actualisation (not by becoming one thing; not by realising the same type of being; not even by having one actuality serve as the actuality of both of them, since both the agent's and the patient's beings are actualised in the process, but) by having one and the same activity actualise both of them, underlying them both as potential (substratum) to actual. For example, the activity of the embroidering hands and needle on the material is related to the embroidering and to the decoration of the material in the way that the wood is related to the statue of

Hermes[32]. Thus, although in the Dilemma Aristotle objected to two potentialities having one and the same actuality because teaching would end up being the same as learning (202b 1-5), here he is saying that what is the same is only *the underlying activity* that actualises, *not their actuality*. They are two mutually bound potentialities in that they can be actualised only together in one and the same actualisation process. Their respective actualities will characterise the nature of this process in different ways, but the process will be one insofar as the same physical activity realises teaching and learning, or sculpting and being carved into shape[33]. The activity that is the substratum to the actuality of the agent *qua* agent and of the patient *qua* patient is one and the same but belongs to both substances and thus ties agent and patient together. But Aristotle raises a further metaphysical question: where are the actualities *of* the mover as mover and *of* the movable as movable? Are they *in* the mover or *in* the movable (ἐν τίνι; 'in what?', 202a 25)? By asking *in what* the action *of* the agent and the passion *of* the patient are, Aristotle distinguishes in one and the same question two metaphysical relations: the one is 'belonging to a subject' and the other is 'occurring in a subject'[34]. We need to examine why this distinction arises here, how it can be understood, and what role it plays in Aristotle's account of causation.

Let us first look at Aristotle's own attempt to justify the distinction. He says:

> «Since then [the agent's action and the patient's passion] are both motions, we may ask: in what are they? » (*Phys*. 202a 25).

[32] The position is then further refined by the requirement mentioned above, that the movements of the hands and needle on the cloth underlie two actualities at the same time, embroidering and being decorated; while the wood of Hermes underlies only one actuality at a time — the statue of Hermes.

[33] Because of the brevity of the description at 202b 8-10, different readings of it can justifiably be given, leading to alternative understandings of the relation between the potential and the actual. In particular, it can be read as saying that the actuality of the patient is the potential for the actuality of the agent, related to it as matter to form. But I have argued in Marmodoro (2007), p. 229-230, that the subsequent explanation Aristotle gives in the same passage, and his examples, support the common underlying activity interpretation.

[34] Being 'in a subject' in the context of *Physics* III 3 should not to be understood along the lines of inherence in the *Categories*, as, for instance, red inheres in an apple. The reason is that the *Categories'* inherence in the substance entails belonging to that substance as subject; whereas, as we shall see, here, e.g. heating something belongs to the fire but occurs in the pot.

> «It is not absurd that the actualisation of one thing should be in another. Teaching is the activity of a person who can teach, yet the operation is performed in something — it is not cut adrift from a subject [the teacher], but is *of* one thing [the teacher] *in* another [the learner]» (*Phys*. 202b 5-8).

The first passage makes a general point, too broad to be illuminating in the present context. It tells us that in relation to motions we can ask the question of where they take place. Thus, my walk can take place in the park, and my tanning at the seashore. But in neither case am I doing something (at least in any way significant) to, or am I changing, that in which my motion takes place. My walk and my tanning are external to the park and the seashore. They are 'in' them in a locational sense, which must not be the point Aristotle wants to make, if he is to distinguish e.g. my tanning taking place in the seashore from its taking place in me, who tans[35]. The second passage gives us a clearer idea of the type of distinction that Aristotle has in mind. He concentrates on one of the two actualities, the agent's, and says that teaching is performed by the teacher in something. If this is to be more illuminating than the first passage, we must take Aristotle to be saying something other than that teaching takes place in a classroom. Indeed he does tell us that teaching takes place in the learner. But how is this to be understood, and generalised?

A clue as to what Aristotle means by talking of where an action takes place, can be found in the following dialectical move which is part of the Dilemma of the Actualities of Motion:

> «[Suppose] the agency is in the agent and the patiency in the patient. [Then] … the motion will be in the mover, for the same account will hold of mover and movable. Hence either *every* mover will be moved, or, though having motion, it will not be moved» (202a 26-31).

The key ideas in this argument are that where the actuality of the mover as a mover is there also will be where the motion is; and the thing the motion is in is set in motion. Aristotle's justification for the first claim is that if, as per the initial hypothesis, the action of the mover moves the movable, then it must be that the action of the mover generates motion. But if the action of the mover is in the mover, the generated motion will, for that reason, also be in the mover. But then the mover

[35] Contrast Hussey *ad locum* who holds that «there is nothing to suggest that anything other than a local sense of 'in' is intended» (1982), p. 65.

will be in motion, for otherwise «though having motion, it will not be moved», which is treated as absurd and closes this branch of the argument. So the motion is where the actuality of the mover as mover is; and where the motion is, it sets that thing in motion.

In that case we can interpret Aristotle's question 'in what?' ('ἐν τίνι; 202a 25) as asking: 'Where does the power get realised'? 'Where does the realisation of the power occur?'

Let us revisit in this light the distinction between 'belonging to' and 'occurring in'. The «actuality of that which has the power of causing motion» (202a 14), i.e. the actuality of the mover as a mover, belongs to the mover as subject. But since the mover's power to cause motion is actualised in the movable, «motion is in the movable» (202a 13-14). This asymmetry with respect to where the actualisations of the passive and active powers respectively occur underpins the direction of transmission of the form, and thus the direction of causation.

On this interpretation it follows that the agent is dependent on the patient for the actualisation of its own power to act, in the sense that the patient is an *external necessary condition* for the agent's causal power to be actualise in the course of the interaction between agent and patient. The patient is the ground of realisation of the agent's causal power. Thus, the agent is ontologically dependent on the patient for its being an (actual) cause.

The significance of this is that the causal interaction of the active and the passive powers is not reified by Aristotle as a relation, but as an *ontological extension* of the agent onto the patient. Aristotle does *not* posit a relation between active and passive powers to explain the mechanism of causation, but treats the active power as 'extending' onto the passive one, not through a relation but by 'spreading itself' onto the patient — by making the patient's constitution part of the agent's own constitution; by having the patient as the ground of realization of the agent's own causal power.

In conclusion, Aristotle builds causal interactions between things out of the things' powers, which come to be mutually realised. Their mutual realisation binds them together into a net of ontological dependencies. So, from one point of view, a causal interaction consists in two things realising the powers they have in potentiality; from another point of view, their realisation is an activity which bears two forms (e.g. teaching and learning, or sounding and hearing). Potentiality, actuality, and ontological

dependence suffice to bind things' powers causally, without introducing any additional metaphysical glue to do the job.

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