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Whole, but not One

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1. Introduction

This chapter investigates the problem of the unity of objects from the point of view of an ontology that posits only instances of physical powers (e.g. mass, spin, charge) at the fundamental level of reality.^{1, 2} The account I put forward is a neo-Aristotelian one. One of the keystones of Aristotle's metaphysics is his hylomorphism, the view (as I interpret it) that objects are *unified wholes* analysable in their component matter and form. In my understanding of Aristotle, matter and form are holistically rather than mereologically composed in a hylomorphic composite.³ I submit that Aristotle had philosophically sound insights on holistic composition; on the other hand, he also assumed that a whole is *ipso facto* metaphysically one. It is with this assumption that I take issue in this chapter. By contrast with Aristotle, I distinguish being a *whole* and being *metaphysically one*; and I give in this chapter arguments for such distinction. I show how powers may combine in both ways, into wholes, and *further*, into metaphysical unities.

For the sake of building my neo-Aristotelian approach on firm foundations, in this chapter I also engage with E. J. Lowe's critique of Aristotle's hylomorphism. Lowe, while often declaring how inspirational Aristotle was for his own work, considers Aristotle's key doctrine of hylomorphism unable to meet, in his words, 'the challenge of explaining how *a new substance* is brought into existence' when matter and form

¹ The preparation of this chapter benefited from a fellowship at the Paris Institute for Advanced Studies (France), with the financial support of the French State, managed by the Agence Nationale de la Recherche, programme 'Investissements d'avenir' (ANR-11-LABX-0027-01 Labex RFIEA+). The chapter draws (*verbatim* in some sections) on two previously published papers of mine: 'Aristotle's hylomorphism without reconditioning', *Philosophical Inquiry*, Volume 37, Issue 1/2, 2013, pp. 5–22; and 'Power mereology: structural versus substantial powers', in M. P. Paoletti and F. Orilia (eds.), *Philosophical and Scientific Perspectives on Downward Causation*, Routledge, 2017, pp. 110–27.

² I have argued for such ontology in my 'Power mereology: structural versus substantial powers', in M. P. Paoletti and F. Orilia (eds.), *Philosophical and Scientific Perspectives on Downward Causation*, Routledge, 2017.

³ There is much controversy in the literature as to how to interpret Aristotle's view; for reasons of space here I can only state my own interpretation and refer the reader to my 'Aristotle's hylomorphism without reconditioning', *Philosophical Inquiry*, Volume 37, Issue 1/2, 2013, pp. 5–22, which includes also a review of some modern interpretations of Aristotle's views.

combine (2012, 236). In response, I show that Lowe had not captured the essence of Aristotle's theory of holistic composition, and that his 'reconditioned' version of the theory does not fare well in addressing the very question that Lowe thinks Aristotle failed to address successfully.

2. Lowe's Critique of Aristotle's Holism

In his analysis of Aristotle's hylomorphism Lowe concentrates on what he identifies as its main desideratum, which is 'to justify the judgement that a new concrete object—an "addition of being"—really has been brought into existence, rather than some previously existing things merely being re-arranged' (2012, 236). Lowe interprets Aristotle as accounting for the emergence of a new entity by positing that matter and form, the parts of an object, are (in a Fregean fashion) 'incomplete entities'. According to Lowe, what allows for the emergence of a new unified object is the mutual 'saturation' of its parts. No additional metaphysical glue is needed; it is the incomplete nature of the parts that secures that they get unified. Lowe characterizes the view thus:

The key point is that, on this view, individual substances exhibit 'internal' ontological complexity, being combinations of 'incomplete' entities that are completed by each other in the substance. (2012, 231)

Lowe explains this (supposedly) Aristotelian account of the unity of substance through the incompleteness of its parts thus:

unless we can see the new substance as being a combination of items neither of which can exist independently of the other in just such a combination, rather than as merely being composed of other independently existing things, each possessing their own features, we shall be unable to justify the judgement that a new concrete object... really has been brought into existence. (2012, 235)

Lowe finds this (putative) Aristotelian view problematic; I take it, on the ground that incompleteness is an unexplained concept:

What I don't understand is what it means to say that the completed house's form—the way in which its 'matter' is organized—is an 'incomplete' constituent of the house which 'combines' together with that equally 'incomplete' matter to constitute the house, a complete substance. (2012, 236)

I agree with Lowe that what he describes here would not offer an explanation of how a substance is a new entity, rather than a mereological sum of its parts arranged in a certain way. There is no reason anyone should expect that two incomplete entities could make up a complete whole over and above the sum of its parts; for instance, half a pear and half an orange do not make up a whole fruit. But the two parts of a drawbridge over a river do make up a complete bridge. Why? Because of their complementarity. This is the sense in which, each on its own, is incomplete. Complementary entities complete each other on account of what is achieved when they complement one another. For

Aristotle, the wholesomeness of the achievement is what licenses the description of the contributing entities as incomplete. Complementary entities may be either existentially independent of each other, like a peg and a bookshelf; or dependent on each other, like quarks (which cannot exist on their own); or both, like the parts of a computer. Their joint achievement may be either a function that can be performed only together (e.g. a calculation) or a new entity they jointly bring about (e.g. a bookshelf on a bookcase, a computer, or a baryon (consisting of three quarks)). The nature of the achievement will determine whether the result is a new function or a new entity.⁴ In the case of matter and form, if they are thought to be incomplete in a complementary way, the achievement of their mutual completion is a new entity. The difference between them and the case of the baryon is that the fusion between the quarks is *physical*, by means of a physical bond; but the fusion of matter and form is *metaphysical*, and this has to be explained.

Aristotle however, I argue, did not distinguish the two ways, physical and metaphysical, in which a compound object is formed. This conflation (which Lowe too did not see) is perpetuated in much contemporary metaphysics. On the one hand, Aristotle says that the substantial form is responsible for the physical formation and constitution of a substance; he writes that since ‘substances [...] are *formed naturally* and in accordance with their *nature*, [...] it would appear that this nature is their substance’ (namely their substantial form) (*Metaphysics* VII 17, 1041b, 29–30, my emphasis). On the other hand, the substantial form determines what a substance is, where all the constituents of the substance are defined by their functional role in the substance, assigned to them by the substantial form; Aristotle writes that ‘we shall define each part [of a substance], if we define it well, not without reference to its *function*’ (*ibidem*, 1035b, 16–18, my emphasis). On my reading of Aristotle, it follows that the substantial form is responsible *both*, for the constituents of the substance being *physically structured* as they are in the substance; but also for the constituents making up a whole whose parts are *defined* in terms of the nature of the whole.⁵ So a particular substance is both physically constituted the way it is in virtue of its substantial form; and it is a metaphysically united whole of a particular sort in virtue of the substantial form. The substantial form plays, for Aristotle, both, a physical and metaphysical unifying role; Aristotle runs these together as if one, as the quotation below illustrates; and since Aristotle, the two roles have *not* been teased apart in metaphysics:

[I]t would seem that this [what unifies the constituents of a substance] [...] is something, and not an element, and that it is the *cause* that makes this thing flesh and that a syllable [i.e. what sort they are]. And similarly in all other cases. And this is the substance [essence/nature] of each thing (for this is the primary cause of its being); and since [...] substances are *formed*

⁴ Note that these two types of emergence, that of a novel property (function) versus that of a novel entity, are often run together in the literature.

⁵ See my ‘Aristotle’s hylomorphism without reconditioning’, *Philosophical Inquiry*, Volume 37, Issue 1/2, 2013, pp. 5–22.

[physically] in accordance with a *nature of their own* and by a *process of nature*, their substance would seem to be this kind of ‘nature’ [i.e. form], which is not an element but a principle.

(*Metaphysics* VII 17, 1041b, 25–31; my emphasis)

Notwithstanding this ambiguity in Aristotle’s claim that the substantial form unifies a substance into a whole, his account of hylomorphic composition withstands philosophical scrutiny. As I argued elsewhere, following Scaltsas (1994), I take Aristotle to hold that being unified into a whole *re-identifies* the parts into being what they cannot be apart from the whole. The parts are re-identified according to the unifying principle of the whole, the substantial form. Once re-identified, they have *no distinctness* in the substance; they exist in it holistically.⁶ If they were severed from the whole, they would lose their functional identity, which is conferred to them by the form, on the basis of their role in the whole substance. Thus, if severed, the parts would lose their form and become like (originative) matter is to the substance it can constitute (e.g. like extracting marble from a statue).⁷

Does Aristotle’s hylomorphism require any sort of ‘reconditioning’? My view is that it does not; yet, there have been many recent attempts in current metaphysics to ‘recondition’ Aristotle’s views by rejecting one or the other of the premises on which his hylomorphism is based. Lowe too, however, among others, offers a way of ‘reconditioning’ Aristotle’s hylomorphism, by jettisoning matter from the ontology, on the ground that he considers matter an unintelligible notion.⁸ Lowe illustrates his view by means of the following example:

When ... the electron is captured by the proton and occupies an orbit around it, then indeed we have a new concrete object of a very different kind: a hydrogen atom ... In the newly created hydrogen atom, the proton remains exactly what it was before, just *a proton*, and the electron remains just *an electron*. A new form is instantiated ... The form does not, in any sense I can understand, ‘combine’ with the proton and the electron as to constitute with them the atom. The only things that do any ‘combining’ are the proton and the electron.

(2012, 237, emphasis in the original)

It is clear that this reconditioned account has no room for the Aristotelian notion of matter; there is no metaphysical job for it to do. On Lowe’s way of thinking about the given example, the proton and the electron are there before and after the creation of the hydrogen atom: there is no need for a material continuant that takes on a new form when a new substance is created, because the proton and the electron can do this by combining, when the composite is created.

⁶ What can be extracted from the whole exists in it only potentially, in the sense that it derives from it.

⁷ A key text for this conclusion is where Aristotle describes his *Homonymy Principle*, in the *Metaphysics*: [The parts of a substance] cannot even exist if severed from the whole; for it is not a finger in *any* state that is the finger of a living thing, but the dead finger is a finger only *homonymously*. (1035b, 24–5, last emphasis added)

⁸ Lowe writes: ‘I have no serious need for the hylemorphic category of matter’ (2012, p. 237).

This proposed reconditioning of hylomorphism is not however free of difficulties. The main one arises with the claim it makes that the generation of a new substance leaves the constituting components *as they were* (e.g. when the hydrogen atom forms, the proton and the electron remain what they were before making up the atom). For Aristotle, a hydrogen atom is, at best, an instance of a substance, but not a *model* for understanding the metaphysics of substance; reconditioned hylomorphism cannot help us understand the generation of a *new* entity (e.g. of flesh out of bread and water). How do bread and water come to constitute flesh when we feed ourselves? Aristotle's solution, as I have argued elsewhere and briefly indicated here above, is that bread and water undergo a radical qualitative and functional change when they make up flesh—a change such that they are no longer identifiable as bread and water once they constitute flesh. But what could one say in answer to the above question if one endorses Lowe's model? One might want to argue that ultimately bread and water are protons and electrons. (But do we have to assume atomism on *a priori* grounds because we assume all generation is combination?) This move however would not serve to recondition *Aristotelian* hylomorphism, as for Aristotle the ultimate level of reality comprises the fundamental powers (hot, cold, wet, and dry) and not a layer of particles (even conceding that protons and electrons are particles of a special kind).⁹

But independently of the issue of whether Lowe's account is genuinely a way to recondition Aristotle's hylomorphism or not, a further pressing question that Lowe's account gives rise to is this: how are we to understand the claim that the proton and the electron *combine* into a hydrogen atom? That is, what is the metaphysical difference between the proton and the electron on the one hand, and the combined proton and electron on the other? It is widely assumed that the difference is not primitive, but rather one that metaphysics can explain. Yet does it come down to just a difference of being related to each other or not?

3. Whole, but not One

Let us take an electron as an example of a unified entity constituted of parts: its elemental properties.¹⁰ In an ontology (like the one I endorse and I have argued for elsewhere) in which such properties are powers, this means that the electron is constituted by its elemental powers, such as the power of electric charge, of spin, etc. The question is: what is it, metaphysically, for an electron to be *constituted by* these powers? An electron *isn't* simply the compresence of powers of charge, spin, mass. These powers are arranged,

⁹ See my 'Potentiality in Aristotle's Metaphysics' in K. Engelhard and M. Quante (eds), *The Handbook of Potentiality* (Dordrecht, 2018).

¹⁰ Physics offers us a number of ways of understanding the constitution of an electron; but I submit that on any of them the electron is defined in terms of elemental properties. In the standard model, an electron is an elementary particle that is characterized by certain values of three elementary properties: mass, charge, and spin, and exhibits wave-particle behaviour. In quantum field theory, an electron, like all elementary particles, is an excitation state of an underlying physical field; different types (properties) of excitation of the field account for the different types of elementary particle. In string theory, an electron is a vibrating string, of the lepton type determining its core structure.

structured in a particular configuration, when making up an electron; there is at least composition, and more, as we have seen in the previous section of this chapter, which needs to be explained. I will argue that physical structure *unites*; while metaphysical structure *unifies*. The former brings about wholes, the latter unities. But wholes are not always unities. No degree of organization at the physical level entails metaphysical oneness, that it, being one entity. There are in nature aggregates of powers that endure and even evolve and develop over time (e.g. an organism); as well as aggregates whose component powers are functionally interconnected (e.g. a computer). Such aggregates of physically united powers (in enduring structures, and recurrently enduring ones in organic cases) are structurally united through physical causal means, such as attraction and repulsion of electrons at the fundamental level, etc. All these structures of powers exhibit physical continuity and connectedness, synchronically and often diachronically, too; but crucially, no particular instance of physical structure, here and now, can unify the structured powers metaphysically into one. A set of powers that are merely *physically united* are a *plurality* of many, just like the grains of sand on the beach. They can even be a one-something, a whole, and still be many, like the class of students who are rowdy.¹¹ By contrast, an electron is constituted of a structured plurality of powers, but it is further unified and one, and is not identical to the plurality of its powers, on any Aristotelian metaphysics. The powers of an electron (its charge, spin, and mass), which are physically united into a structure, are also *metaphysically unified*.

There are countless structures of powers in nature which are (merely) physically united. Although some structures are physically more strongly united than others, this in itself does not change their standing as merely physical structures. On the other hand, some of the physically united structures are *also* metaphysically unified; for instance, a tree, or an organism. What, then, differentiates a merely physically united structure of powers from one that is also metaphysically unified? Physical structures are ‘*numberless*’, in the sense that they do not bring with them a count principle. It is an *open question* how many entities a physical structure is, which is not determined by the structure, or even the structure’s being a whole. What is merely physically structured can be counted as one, or as many entities, or as either (e.g. as one can think of the 64 chess squares in various ways). I argue that number accrues to physical structures of powers on account of their *metaphysical unification*.

Let us begin with the question of what metaphysical unification is. How does a physically united structure become unified in such a way as to acquire number, and become one? Consider a squad of soldiers. One can think of it as a structured plurality of soldiers or a whole of many; but also, one can think of it/them as a single army unit. Similarly, a swarm of bees can be thought of as a structured plurality of insects, or as a single super-organism. What is the difference? My claim is that the difference between a structured plurality and a single individual it may constitute lies in the *dependencies* that develop between the components of the structure. Unification of structured components into a

¹¹ The reasoning is the same as W. V. O. Quine’s (1960) when he argues that what instantiates a *rabbit* instantiates just as much *un-detached rabbit parts*.

single individual involves more than ontological dependence of the parts on the whole; it involves ontological-cum-definitional dependence, namely holistic dependence.

How does a component in a physical structure (e.g. a power) become holistically dependent on the whole-structure-as-a-single-individual? The transformation demands a change in the criteria of individuation applied to the power, which results in a change in the power's ontological status. Consider the electric charge of an electron; the power is re-individuated as *a way of being* of the electron, and is no longer a discrete entity in the whole structure. It is not, anymore, an electric charge which is compresent with spin, mass, etc.; rather it is the electrically charged electron. An individual emerges from a structure of powers, as the structured powers cease being discrete parts in the structure and become qualifications of the individual.¹²

The view is then this: a physical structure of powers is a whole—an aggregate of many powers. When it is metaphysically unified, it becomes a single entity, which bears these powers as its own properties. The 'one' that emerges is a subject (e.g. an electron), characterized by its constituents as its qualifications (e.g. being charged). I call such unification *metaphysical unity*. The discrete constituents of a physical structure come to constitute a subject by becoming properties of the subject, and are henceforth individuated as such, namely, as 'of the subject', dependent on it, rather than as discrete entities.¹³ They are dependent on the subject for what each of them is (i.e. as the type of qualification of the subject each of them is). This holds of all types of constituents of a subject, whether abstract or concrete, particular or universal; they are not compresent in the subject, but unified as ways the subject is. In this sense, the subject is constituted of the physical structure of powers that makes it up, but acquires a new metaphysical structure, changing from being an aggregate of many powers (or other types of constituent) to being an individual subject, a substance, qualified by these powers.¹⁴

I submit that the metaphysical transition from a united physical *structure* of powers to a unified powerful *subject* is achieved by a holistic re-individuation of the constituents of the structure, in accordance with either sortal or mass individuation principles. The sortal or mass individuation principles dictate the type of entity that is individuated by the criteria they set for being that entity. Oneness of entity is generated by the dependence of the parts on the whole. Sortal and mass predicates enable science to 'carve' the world in ways that explain what happens in the world. Alternative carvings of the world deliver alternative numbers of entities in the world, and alternative

¹² Each qualification can be individuated *by abstraction* from the individual; this involves division of the individual by abstraction, which I have discussed elsewhere. [Reference omitted because the paper is under peer review.]

¹³ By 'discrete' here I mean that they are entities which can be individuated without reference to other individuals.

¹⁴ What follows is that the powers in the physical structure that constitutes the subject are not identical to the qualifications of powerfulness that come to thereby characterize the subject. The holism of the subject changes their ontological status from discrete components to its own qualifications.

explanations of what happens in the world. The ultimate alternatives are classified into two general types of ontology: extensional mereologists (such as David Lewis) see pluralities, where substantialists (myself included) see emergent unities. Where the mereologists see *structured compresence*, the substantialists see *holistic dependence*. These alternative ontologies derive from alternative individuation principles for entities in the world, and dependencies between them.

4. Structural versus Substantial Powers

The building blocks of all there is in nature are instances (tropes) of physical powers. They occur in nature in physical structures of dependencies. I have argued that such structures unite the powers together, but do not unify them metaphysically into individual entities. On the other hand, there exist a small number of physical structures of powers that are also metaphysically unified into individual entities, on account of the way their constituents are individuated. Thus, for instance, an electron is one entity, not on account of its being physically structured, but on account of the way the powers in the structure are holistically individuated into qualifications of the electron. The physical structure of the electron's powers *constitutes* the electron, but *is not* the electron. The electron is a single emergent (exercising) power, constituted of a physical structure of powers—mass, spin, charge, and space–time—which are holistically composed into one emergent entity, the electron, under the individuation principle of the sortal 'electron'. I call the structure of powers constituting an emergent entity a *structural power* that can be conceived of plurally; the electron is constituted of a structural power—the structure of mass, spin, charge, space–time. The unification of the structural power of electron into one is derivative from the metaphysical oneness of the electron. In itself, the structural power of electron is a structure of powers; it is a whole of many powers. Is it a power? Strictly, no; it is many powers; a powerful whole made of many powers. On the other hand, the single power of electron emerges from the unification of the physical structure of powers into a single individual; I call the emergent power of electron a *substantial power*. This is constituted of the structure of powers of the electron, but which are now re-individuated as qualifications of a subject according to the principle of the sortal 'electron'.

So why differentiate between a structural power and a substantial power? Isn't the substantial power of electron sufficient for understanding what type of power the electron is? The reason for differentiating them is twofold. On the one hand, the structural power is what *constitutes* the electron; whereas the substantial power *is* the electron. On the other, the differentiation between the structural power of electron and the substantial power of electron enables us to understand the relation between the *extensional mereological* conception of the electron (as a whole of many interrelated powers); and the *substantialist* conception of the electron (as an individual emergent power). The constitution relation turns the powers in the electron's physical structure into properties of the emergent substantial power. Although every structure of powers

could be thought of as a structural power, I reserve the term ‘structural power’ for those structures of powers which constitute substantial powers. (Thus, for instance, the winds around me are not a structural power, although they are structured.) Every science individuates its own individual subjects or substances, and hence its own substantial powers (i.e. the entities that the science needs to describe and investigate reality within its own domain of inquiry). These structural powers are holistically unified, top-down,¹⁵ according to the individuation principles of the respective concepts which figure in the scientific laws and explanations of the science in question.

Top-down unification gives rise to *downward emergence* of components. For the substantialist (and for Aristotle), the ultimate components individuated at the ground level are dependent for what they are on the whole they belong to. So even in the extreme case of a general who treats a squad of soldiers as a single superorganism, the soldiers become (for all intents and purposes in that general’s army) properties of the squad-organism. In the case of a dog, the substantialist treats it as one organism constituted of the structural (causal) unitedness of its components. These same reasons do not, by contrast, incline the mereologist to treat the dog as one individual, rather than as a sum of components. For the substantialist, the individuation concepts facilitate the top-down unification of structural powers, imposing dependence relations of the powers on the emergent subject. The difference between the two ways of individuating a dog is that on both, there is the structural power of the dog. But while the work of the mereologist stops here, when she identifies the dog with the structural power, which is an aggregate of interrelated powers, the substantialist goes further; she turns structured aggregates into individuals; the structural power of dogness comes to constitute a substantial power, the dog, as a diachronic power.

The difference between structural powers and substantial powers has not been placed on the map in the history of metaphysics or in current metaphysics so far. As we have seen, on the contrary, Aristotle claimed that in substances, the *formal* cause (namely the substantial form, e.g. being a tiger) is the same as the *efficient* cause of the substance (e.g. the physically generative power of a substance; it’s as if the substantial power of a substance were the same as the structural power of a substance. This has been held as an important insight of Aristotle, which has been repeated over the ages as an explanation of the physical oneness together with the metaphysical oneness of a substance. But Aristotle was (dare I say it!?) wrong to identify the formal and efficient causes of a substance. I have argued here that structural powers do not entail substantial powers, but only vice versa; and that structural powers constitute substantial powers, through the re-individuation of their components according to holistic sortal or mass principles (e.g. for dogs or lava).

¹⁵ In contrast with the bottom-up unification that structural powers bring about.

5. Conclusion

In this paper, I have examined the issue of the unity of objects from the viewpoint (which I endorse) that the ultimate constituents of reality are instances (i.e. tropes) of physical powers. Powers compose in two different ways, physically and metaphysically. When physically united they make up wholes, which are plural; when metaphysically unified they make up unities, which are one. The unification results from the sortal concepts we use to individuate structures of powers into entities, that is, single subjects that are qualified by the powers that constitute them as parts. I argued that structural powers are physically united, while substantial powers are metaphysically unified. No physical relation can unify a structure into one, but only into plural wholes. The unification into one is a further step which results from the holistic, top-down individuation of the constituents of a structural power into a single entity—downward emergence of components. Hence, whereas wholeness results from physical relations, oneness results from conceptual individuation. Conceptual individuation is justified either on scientific grounds, for the expediency of explanation, or on pragmatic grounds, for other kinds of expediency.

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