Sorting Out Aristotle: Toward a Modern Model of Aristotelian Form

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Abstract

Were Aristotle and the tradition that followed him Platonists? Were they resemblance nominalists? Or some kind of trope theorists? I will lay out four modern theories of properties and their instantiation--- extreme nominalism, relational Platonism, constituent Platonism, and trope theory—and then ask which of these provides the best foundation for a viable and distinctive version of Aristotelian philosophy. I will not focus on the interpretation of particular texts but on the question of which interpretation makes for the most coherent and defensible version of the Aristotelian project, including such elements as the Porphyrean structure of species and genera, the unity of substantial form, the reality of both substantial and accidental change, the unity of substances through time, the definability of form, the place of prime matter, and substances as composites of form and matter. The result will be a novel version of trope theory, one that builds upon ideas of ibn Sina and Thomas Aquinas.

1. Introduction

Despite the tremendous influence of Aristotle on succeeding generations of philosophy, there has never been a consensus about the correct interpretation of central claims of this theory. This interpretive problem also plagues many of his successors, such as Boethius, Avicenna, Thomas Aquinas, or Duns Scotus. I will focus here on Aristotle's notion of form (*eidos*) and its relationship to the universal/particular dichotomy. I hope that looking at the problem of the One and the Many as it has been addressed in contemporary metaphysics may shed some light both on the correct interpretation of Aristotle and his successors and on the question of the most promising avenue for articulating and defending a distinctively Aristotelian viewpoint in contemporary philosophy.

A few preliminary assumptions. I will assume that Aristotle's theory is an example of what I have called *staunch hylomorphism* (Author 2014). Staunch hylomorphism includes three essential elements:

1. A sparse theory of fundamental entities. Substances are all both hylomorphic compounds and fundamental entities. There are few substances in the world, and so relatively few substantial forms. It is not the case that any old property is a form of a substantial hylomorphic compound.
2. A sparse theory of essences. Only substances have essences or natures in the strict sense. An essence or nature is an entity that accounts for the possibility and actuality of all properties, acting as a principle (*arche*) of motion (change) and rest.
3. A powers ontology. The natures of substances confer fundamental causal powers and potentialities on substances (both active and passive), and those powers are involved in explaining all change and activity.

Note that I do not identify essences with powers. Rather, powers flow from or are grounded by essence. In fact, I reject the idea that essences are properties of any kind. The essence of a particular substance is the compound of its substantial form with its matter. Nor, as will become clear, do I identify substantial form with any kind of property or capability. Both *form* and *matter* are theoretical postulates, like *gravity* or *quark*. They are not to be identified with any entity or category of entity pre-theoretically or naively available to us. Aristotle reaches a theory of form and matter through an inference to the best explanation, not simply by linguistic analysis or phenomenological reflection. Furthermore, I will resist the idea that the definition of a form or essence should be in terms of a conjunction of properties. Instead, I take definition to be a kind of ontological relation among entities—a sort of metaphysical process of *making-definite*.

I take it as obvious that Aristotle's notion of *form* bears some intimate relation to the ideas or universals of Plato's philosophy. Like Plato's Forms, Aristotle's forms are intended to solve the problem of resemblance. What is it for two concrete particular things (like two horses or two spheres) to resemble each other? What makes some classes of things *more natural* than others (to use David Lewis's terminology)? (Lewis 1983) Like Plato, Aristotle takes for granted that there

is a real explanation for these facts—that resemblance facts have *grounds* (to use a contemporary term). If so, we can immediately exclude so-called Ostrich Nominalism from our list of possible interpretations of Aristotle, since Ostrich Nominalists take it that there are no general facts about resemblance. There are for the Ostrich Nominalists as many ways of being similar as there are basic concepts in our theoretical repertoire, and there no one thing that all cases of similarity have in common.

For similar reasons, we can exclude Extreme Resemblance Nominalism: the view that resemblance is a primitive, ungrounded relation between concrete particulars. For one thing, from an Aristotelian perspective Extreme Resemblance Nominalists get the order of explanation wrong: they suppose things have common natures because they resemble each other, instead of the other way around. Secondly, Extreme Resemblance Nominalists have no explanation for the formal facts about the resemblance relation. Why is resemblance symmetric? Why is perfect resemblance transitive, and nearly perfect resemblance nearly transitive? Sophisticated versions of resemblance nominalism, such as those of David Lewis (Lewis 1983) or Gonzalo Rodriguez-Pereyra (Rodriguez-Pereyra 2002), exhibit unexplained formal properties that are exact counterparts to symmetry and transitivity.

Finally, Extreme Resemblance Nominalists cannot explain why we find Porphyrean trees in nature. In contemporary science, we find such trees in both particle physics and in biology, and to a lesser degree in chemistry. For Extreme Resemblance Nominalists, it has to be taken as a brute fact that the natural resemblance classes group themselves into such trees. In a similar way, Extreme Resemblance Nominalism lacks any explanation of the existence of determinable properties with subordinate and incompatible determinates.

That leaves us with three possible options:

1) Relational Platonism
2) Constituent Platonism
3) Trope Theory

In section 2, I will argue that neither version of Platonism provides a plausible interpretation of Aristotle's theory. In section 3, I explain why Aristotle is best thought of as a trope theorist. Section 4 is the heart of the paper, in which I develop Aristotle's theory in detail, demonstrating its great explanatory power in comparison to both extreme nominalism and Platonism. In Section 5 I demonstrate that my version of Aristotle's theory is the best explanation of seven data points developed in section 2. I argue in section 6 that my interpretation of Aristotle offers three important hermeneutical payoffs, and I conclude with section 7.

2. Aristotle and Platonism

The distinction between relational and constituent Platonism was first drawn by Nicholas Wolterstorff (Wolterstorff 1970, see also Oliver 1996 and Loux 2006). In both cases, resemblance between two particulars is grounded by some relation to a common universal. For relational Platonists, this relation is an extrinsic one—a primitive relation of instantiation or exemplification. For constituent Platonists, the relation is intrinsic: a particular contains universals as immediate proper *parts*.[1] Aristotle is often interpreted as a constituent Platonism. Boethius suggests such an interpretation in his commentary on Porphyry's *Isagoge*, and David Armstrong labels his own constituent Platonism 'Aristotelian'. It is harder to find explicit attributions of relational Platonism to Aristotle, but such a view could be implicit in many interpretations of Aristotle as a merely reformed Platonist—i.e., as a Platonist who limits the domain of universals to *infimae species*.

There is at least some tension between any kind of Platonism and Aristotle's relegation of species to the status of merely secondary substances in *The Categories*. In addition, many of Aristotle's objections to Plato's theory of Forms focuses on the reification of universal entities as *separate* from particulars (see *Metaphysics* Alpha 9, *Nicomachean Ethics* 1, 6). This obviously contradicts relational Platonism, but it is not clear that constituent Platonism fares any better. A universal that forms a part of a particular is still in some sense a "separate" entity, insofar as it also exists as a part of many, mutually separate particulars. As Plato himself recognized (in

[1] The universals that are predicated of a particular have to be immediate parts of it. Otherwise, every property of one of my proper parts would be a property of me as well.

Parmenides 131b), the constituent version is in at least one respect worse: it makes a universal separate from itself, by making it exist in more than one separate particular. And as Aristotle argues in Zeta 13, the substantial form would have to be the primary being (*ousia*) of more than one thing, which seems impossible. In addition, immanent Platonism results in a weird kind of reduplication: "Ideas cannot be in things. There would be a sky besides the sky, except that it will not exist separately but in the same place; and this would be even more impossible." (*Metaphysics* Beta 2)

Relational Platonists have to account for the causal relevance of remote universals. In order to be causally relevant, such Platonists must attribute localized causal powers to the universals themselves. For example, the connection between Socrates' bare particular and the universal of rationality must be responsible for Socrates' responding in laughter to appropriate stimuli.[2] But if universals have localized causal powers, they seem to be located "within" the exemplifying particulars, and so the distinction between relational and constituent Platonism collapses.

In addition, relational Platonism faces a dilemma with respect to truthmaking (and truthmaker theory is an important component of any Aristotelian program). Either something exists that ties a universal to each of its instances or not. Such a tie could be either a nexus that exists separately from the universal and particular or a whole (a state of affairs) that contains both the particular and the universal as proper parts. If there are no nexuses and no such states of affairs, then there is no truthmaker for the fact that a given particular instantiates a given universal. In order to be a truthmaker for a predicative truth, a nexus would have to essentially connect this universal to this particular, so that it is impossible for the nexus to exist without constituting such a connection. But such a nexus would make the universal explanatorily redundant, at least as a part of the truthmaker of the corresponding predicative facts. And if a universal for property P isn't part of the truthmaker for P-facts, what could tie it to individual nexuses or ordinary particulars? And how could it be a ground for the similarity of P-things? So, relational Platonists should rely on states of affairs instead. But then a state of affairs connecting a bare particular with a substantial universal will be what David Armstrong called a *thick particular*. The real substance should be

[2] See Aristotle's argument in Gen et Corr. II.9. "If forms cause coming to be, why do they not do so continually?"

identified with such a state of affairs rather than with the bare particular. And so, once again, the distinction between relational and constituent Platonism collapses.

But constituent Platonism has its own difficulties. There is of course the weirdness of having a single entity multi-located. If a universal is a part of many things in disparate locations, it would seem prima facie to be spatially separated from itself (as noted above).

Nonetheless, I will claim that Aristotle's principal argument against any form of Platonism is an *inference to the best explanation*. There are certain data about substances for which Aristotle's version of trope theory provides a better explanation than can either version of Platonism. The relevant data to be explained falls into two major categories: facts about the accidents of substances, and facts about the Porphyrean tree of substantial species and genera.

Here is a rough inventory of the data to be explained:

1. The reflexivity, symmetry and transitivity of exact resemblance.
2. The world's substances are partitioned into mutually exclusive genera of maximum generality, and each genus is divided by mutually contrary differentiae into sub-genera, resulting in a finite Porphyrean tree. The leaves of the tree are the *infimae species*, with each *infima species* being the essence of a class of substances. Consequently:
    a. Each member of a species is essentially a member of all of its containing genera.
    b. The genera are ordered by the proper subset relation.
    c. If neither of two genera is a proper subset of the other, then the two are disjoint (with an empty intersection).
    d. Nothing can belong (in either the same world or different worlds) to two distinct immediate sub-genera of the same genus.
    e. There are maximally general genera of substances.
3. There is a distinction between the essence of a substance and its accidents (a distinction between what it is to be that thing, and how that thing happens to be).
4. Substances can be generated and corrupted.

5. Substances persist through intrinsic accidental changes.
6. The essences of substances are fully unified. There are differentiae that modify generic forms *per se*, with contrary differentiae resulting in distinct immediate sub-genera.
7. There are cases of *per se* predication of accidents: accidents that modify other accidents *per se* (*kath' auto*).

As I have argued the extreme nominalist cannot explain datum 1. In contrast, Platonists have ready explanation to hand: particulars resemble each other exactly just in case they instantiate the same universals, and *instantiating the same universals* is clearly an equivalence relations.

First of all, the two versions of Platonism cannot explain the relation between species and genera (datum 2) without making ad hoc stipulations. Platonists must either deny that there are any generic universals, or else they must suppose that there are brute necessary connections between species and their containing genera. For example, we have to postulate that whenever the universal of equinity is instantiated by or included in a substance, so is necessarily the universal animality. Even if animality were an essential part of equinity, it wouldn't be an immediate part of any particular horse.

If Platonists deny the existence of generic universals, then their account of similarity fails to be fully general, forfeiting any advantage they might have over the resemblance nominalist. It will be an ungrounded fact that the several species of animal resemble each other generically. If, alternatively, they postulate generic universals, then this creates, beyond the need for many brute necessities, the further problem of accounting for the absolute or per se *unity* of substances. If, for example, a horse is essentially a horse, an animal, a living organism, and a body, which is it one substance and not four?

Platonists also face difficulties in distinguishing between essences and accidents (datum 3). Each substance is just a blob or bundle, either composed of multiple universals along with (possibly) some bare particular (constituent Platonism) or simply consisting of a single particular related to a bundle of extrinsic universals (relational Platonism). Why should some of these universals be

counted as essential to the substance and others merely accidental? Any such distinction would seem to be arbitrary and conventional rather than a matter of cutting nature at the joints.

These difficulties engender further problems of accounting for the generation and corruption of substances, and for the persistence of substances through intrinsic change (data 4 and 5). If a substance is just a bundle of universals, why can substances persist through some changes and not through others? If the substance includes or consists of an enduring bare particular, wouldn't all natural change (other than total annihilation or creation *ex nihilo*) be mere alteration, with no possibility of generation or destruction?

Aristotle's account of accidents and of differentiae gives us reason to think that if there are universal constituents of substances, some of those universals must modify others, through what Aristotle described as *per se* predication (data 6 and 7).[3] For example, a color universal modifies a surface, but *having a surface* is itself a quantitative or spatial universal. Similarly, knowledge is a modification of mind, and both *being a case of knowledge* and *being a mind* are universals. Otherwise, we would have to suppose that whiteness and superficiality, geometrical knowledge and mindedness, and footedness and animality bear no essential relation one to another. We would have to countenance white non-surfaces, two-footed non-animals, and unminded things with geometrical knowledge. We would lose the fact that *white* is a way of being a surface, *two-footed* is a way of being an animal, and *knowing geometry* is a way of being minded.

Consequently, William of Ockham argued,[4] the constituent Platonists (like the early Walter Burley) must attribute contrary modifications to the same universal at the same time, echoing Aristotle's argument against the Platonist in *Metaphysics* Zeta 14 (1039a31-b9). The same universal of having a spherical surface is white in this particular and black in that one. The universal of mindedness is knowledgeable about geometry in one particular and lacking such

[3] This is the second mode of *per se* (*kath' auto*) predication, in which the concept of the subject is included in the predicate. See *Posterior Analytics* 1.4 (73a34-b26). If a universal predicate includes a universal subject in its definition, then either the predicate must be taken as a predication or modification of the other universal, or there is a brute necessary connection between two separate universals, each modifying some third thing. Why should the inclusion of one universal in a bundle depend necessarily on the inclusion of a separate one? If the universal includes the other in its definition, it would seem to make the second metaphysically redundant.

[4] *Summa Logicae* (pars I, chs. 14–15, and 40–41); see Loux 1974..

knowledge in another. The universal of animality two-footed in one particular and four-footed in another, and so on.

The best way to capture these connections is to follow Aristotle and take whiteness in this thing as an actualizing of one of the potentialities of the thing's property of having a surface, treat two-footedness in this thing as an actualizing of one of the potentialities of this thing's animality, and treat geometrical knowledge as an actualizing of one of the potentialities of this thing's mindedness. In this way we both avoid destroying the unity of the substance by taking it to contain an unstructured bundle of universals and minimize the number of brute necessary connections among separate entities. This leads us to a version of trope theory.

3. Aristotle and Trope Theory

So, by process of elimination, we seem to be left with some form of trope nominalism as the best version of Aristotelianism and the best interpretation of Aristotle and his followers. Forms are tropes, particular, individual entities related in some very intimate way to properties.

There are two versions of trope theory: *modular* tropes and *modifying* tropes (see Author and Pickavance 2017, 166-200; Garcia 2015, 2016; Loux 2015, 31). The distinction parallels that between self-exemplifying and non-self-exemplifying universals. A modular trope of property F has F itself, while a modifying trope of F does not. So, a modular trope of sphericity would itself be spherical, while a modifying trope of that property would not be spherical but would only make something else (its bearer) spherical. Which is the better interpretation of Aristotle's forms?

Let's start by considering accidental forms. An accidental form of whiteness, for example, is not itself a surface of any kind. Rather, it belongs to the surface of some substance. But only surfaces can be white. Hence, the accident of whiteness cannot itself be white. It must be a modifying trope, not a module. What makes whiteness an accident rather than a substantial form is the fact that the definition of whiteness refers to something beyond the trope that has a nature of its own (in this case, the surface).

However, there are other accidents that are best interpreted as modular tropes: for example, the quantitative tropes of spatial extension. If a substance has an ovoid part, it is plausible to suppose that it includes a quantitative accident that is itself ovoid. Certain other aggregative accidents, like mass and charge, might also best be thought of as modular (self-exemplifying tropes). Intensive quantities, like temperature or viscosity, would fit better into the modifying category.

What about the substantial form? Here we have to deal with an ambiguity in Aristotle's language. Sometimes he uses *form* (*eidos*) to refer to the form proper (*sans* matter) and other times he uses it to refer to a substance's *essence*, including both the form (in the strict sense) and the substance's matter considered abstractly (*Metaphysics* Zeta 10.1035b32). Albert the Great and Thomas Aquinas refer to these as the *forma partis* and *forma totius* (respectively). (See *De Ente et Essentia*, chapter 1, par. 47.) A substance's essence is self-exemplifying. Socrates' essence, his what it is to be a human being, is itself human (*Metaphysics* Zeta 6.1031b18-20). However, the form proper, being immaterial, cannot be self-exemplifying. Socrates' soul (*sans* matter) is not an individual human being, although 'soul' can (like 'form') be used to refer to Socrates' whole essence (Zeta 10.1036a15). Consequently, we should classify Aristotle's substantial forms (in the narrow or strict sense) to be *modifying* tropes.

Like Platonism, trope theory has both relational and constituent versions, depending on whether we suppose modifying tropes to be proper parts of their substances. I will argue below that we should adopt the constituent version, at least with respect to substantial forms and quantitative accidents.

4. The Best Version of Aristotelian Trope Theory

Can a constituent modifying-trope theory do the explanatory work that Aristotle intends for his theory of forms to do? In particular, can it account for the phenomena 1-7 of section 2?

The answer in each case is Yes, so long as we analyze trope resemblance in terms of grounded numerical distinctness, a solution recently defended by Jeffrey Brower and (somewhat later and

independently) by me (Brower 2016, Brower 2017, Author 2018). In order to be superior to extreme resemblance nominalism, the Aristotelian theory must provide a principled explanation of datum 1. In order to be superior to Platonism, it must also provide principled explanations of data 2-7.

Two substantial forms are *conspecific* (intuitively, belong to the same species) if and only if their numerical distinctness is not metaphysically fundamental but instead *derived*, and, in particular, derived by the numerical distinctness of some class of bare particulars (prime-material entities, entities of pure and unqualified materiality).[5] Socrates' substantial form and Callias's substantial form are numerically distinct, but they are not distinct of themselves but only by virtue of the prior numerical distinctness of Socrates' matter and Callias's matter (together with the fact that some of Socrates' matter is contemporaneous with some of Callias's matter).

Definition 1: Conspecificity. Substantial forms x and y are *conspecific* if and only if either (a) x = y, or (b) their numerical distinctness is wholly grounded by the numerical distinctness of the members of the class of prime-material entities.

Just as two conspecific forms are individuated by their respective prime-material substrates, so two forms of different species but the same genus are individuated by their respective differentiae. I will assume that each differentia belongs to some category of accident (or, has an intrinsic duplicate that belongs to some category of accident), and that it is contrary accidents that are *fundamentally* distinct. If a substantial form F belongs to some genus G, then that form

[5] To be precise, there are three cases to consider: (i) the two forms are contemporaneous in origin, (ii) the origin events of the two forms are temporally ordered (one earlier than the other), and (iii) the two forms originate in distinct, alternative worlds. In case (i), it is the numerical distinctness of *contemporaneous* prime-material bits that is the ground of the distinctness of conspecific forms. I will argue that the prime-material bits are fundamentally time- and world-bound, and so each substance is composed of different prime matter at different times and possible situations. Some of these prime-material elements stand in a simultaneous, intra-world relation of *contemporaneity*. If this relation of contemporaneity is metaphysically fundamental and both irreflexive and symmetric, then it is in fact this relation that grounds the distinctness of distinct, conspecific, contemporaneous forms. In the case of (ii), I will assume that temporal order is a metaphysically fundamental, irreflexive and symmetric relation between prime-material entities. In case (iii), we also have an irreflexive and symmetric relation, that of inhabiting distinct worlds. In cases (ii) and (iii), it is the distinctness of the prime-material entities underlying the generation events involving the two conspecific forms that grounds the distinctness of the forms. If we accept both actualism and presentism, then we would suppose that all real substances are contemporaneous, and we would have to consider only case (i).

has to express itself through one of a class of *proper accidents* (to use the scholastic term), with each member of this class being contrary to the others. (A quantity or quality is a *proper accident* of a species or genus if and only if it is essential to members of that species or genus to possess that quantity or quality.) This class of proper accidents is the relevant class of specific differentiae.[6] Each substantial in the genus must express itself in exactly one differentia from that class, and it is impossible for a substantial form to change this mode of expression (since substantial forms do not undergo any kind of intrinsic alteration). If and when a substance is generated, the efficient cause of the generation is responsible for ensuring that the substantial form of the new substance expresses itself in exactly one appropriate differentia,

If we have a class of genera that belong to a common super-genus, then the same set of facts iterates. There will be some generic differentiae that are responsible for the numerical distinctness of any two substantial forms belonging to different genera in the super-genus. And so on, until we reach one of the highest genera in the category of substance. Any two substantial forms belonging to different genera at the highest level will be fundamentally distinct from each other. Here again, the metaphysical buck stops.

Definition 2: Highest Level Difference. Two substantial forms are *different at the highest level* (i.e., belong to the different highest-level genera) if and only if their numerical distinctness is fundamental (ungrounded).

In summary, if we take two substantial forms at random, there is a range of possibilities. It could be that the two forms are fundamentally distinct. In that case, they belong to different genera at the highest level. It could be that their numerical distinctness is grounded by the distinctness of a class of level-n differentiae, in which case the forms belong to different species of a level-n genus that is not at the highest level. And, finally, it could be that the distinctness of the two forms is grounded by the distinctness of a class of prime-material entities, in which case the two forms belong to the same species.

[6] This is probably not quite accurate. Differentiae are *like* proper accidents, but with this difference: proper accidents are individuated by the substances they inform, while differentiae are (like substantial forms) individuated by the prime-material entities they inform. Or, perhaps, there are species of forms, some members of which are accidents and others are differentiae (depending on their individuation conditions).

Definition 3: Congenericity. Two substantial forms x and y are *congeneric at level n* if and only if (i) they are either conspecific or (ii) they are congeneric at some level k < n or (iii) there is some class A of level-n differentiae such that the distinctness of x and y is wholly grounded by the mutual distinctness of the members of A.

Definition 4. Differentiae of Level 1. A class A of accidents is a *class of differentiae of level 1* if and only if the mutual distinctness of the members of A is ungrounded, and, for any substantial forms x, y, and z, if the distinctness of forms x and y is wholly grounded by the mutual distinctness of the members of A, then: the distinction of x and z is likewise grounded if and only if (i) y and z are conspecific or (ii) the distinctness of y and z is also wholly grounded by the mutual distinctness of the members of A.

Definition 5. Differentiae of Level n + 1. A class A of accidents is a *class of differentiae of level n + 1* if and only if the mutual distinctness of the members of A is ungrounded, and, for any substantial forms x, y, and z, if the distinctness of forms x and y is wholly grounded by the mutual distinctness of the members of A, then: the distinction of x and z is likewise grounded if and only if (i) y and z are conspecific or congeneric at level n or (iii) the distinctness of y and z is also wholly grounded by the mutual distinctness of the members of A.

I will count the class M of prime-material entities as a class of level 0.

If we consider the class of all human substantial forms, the pairwise numerical distinctness of the members of that class is wholly grounded by the pairwise numerical distinctness of certain prime-material entities, the entities each of which is the prime matter of some human being. On this supposition, we can assert a counter-possible or *per impossibile* conditional:

> **(PIC1)** If all the members of M (the prime-material entities) were *per impossibile* numerically identical to each other, then the members of S (where S is any *infima species* of substances) would also be numerically one.

Now consider a pair of substantial forms that belong to the same genus but not to the same species, like the forms of Socrates and Bucephalus the horse. These two forms do differ intrinsically, and so their numerical distinctness is not grounded in the numerical distinctness of the members of a class of prime-material entities. However, it is still not the case that the two forms are primitively or fundamentally distinct. Instead, the distinctness of the substantial forms is wholly grounded in the mutual distinctness of a class of differentiae, one for each of the species in the lowest common genus. The relevant class of differentiae might include rationality (the differentia for humans) and fleet-footedness (the differentia for horses). Any pair of differentiae are fundamentally distinct from each other. Here, as in the case of prime-material entities, the numerical-distinctness buck stops.

Let's suppose that genus G is a lowest-level genus containing a class of *infimae species*, and let's suppose that D(G) is the class of differentiae whose mutual distinctness is the ground for the distinctness of any two forms belonging to different species in G. We can again assert a *per impossibile* conditional:

> **(PIC2)** If the members of D(G) were numerically identical to each other, then any pair of substantial forms belonging to different species in G would also be numerically one.

There are some questions about the nature and ontological status of differentiae, questions which seem to have no clear answer, either in Aristotle or the subsequent tradition. Are differential forms substantial or accidental? It seems that they can be neither. They cannot be substantial forms without destroying the unity of the substance, and they cannot be accidental without introducing a vicious circularity in the grounding of distinctness, with the distinctness of substances depending on the distinctness of differentiae, and the distinctness of differentiae depending on the distinctness of their substantial bearers.

The best solution is to think of *being an accidental form* and *being a differential form* as two roles that forms from the same species can play in different substances. The mutual distinctness of the forms that play the accident role is grounded in the mutual distinctness of the class of substances, and the mutual distinctness of these forms plays no role in grounding

the distinctness of substantial forms. The distinctness of roles playing the differential role is grounded by the mutual distinctness of the world's prime-material entities, and this distinctness does ground the distinctness of certain substantial forms. The mutual distinctness of the whole species is grounded jointly by the mutual distinctness of the world's substances and its prime-material entities, and this enables the class of forms to constitute a single species.

5. The Aristotelian Trope Theory Explains the Data

In the next seven sub-sections, I will show that my preferred model of Aristotle's theory explains our seven data points from section 2: (1) the transitivity of conspecificity and congenericity, (2) the Porphyrean tree of species and genera, (3) the distinction between essence and accidents, (4) substantial change (generation and corruption), (5) the persistence of substances through accidental change, (6) the unity of essences, (7) the per se predication of accidents.

5.1 The Transitivity of Conspecificity and Congenericity

For the definitions of conspecificity and congenericity to do their intended jobs, it is crucial that both relations be *equivalence relations*—reflexive, symmetric, and transitive. If they are equivalence relations, they will partition the class of substantial forms into a set of mutually exclusive and jointly exhaustive *equivalence classes,* which will be the intended species and genera. The reflexivity and symmetry of both conspecificity and congenericity are immediate consequences of the definition. Verifying their transitivity takes a little work.

The fundamental idea is this: conspecificity and congenericity are cases of *counterfactual identity*. Two forms are conspecific if they would be identical were their contemporaneous bits of prime matter identical. Two forms are congeneric if they would be identical if the relevant pair of differentiae were identical. Since identity is transitive, there is good hope that such relations of counterfactual identity will also turn out to be transitive. This hope bears out, but it does require some assumptions about the relevant kinds of counterfactual truth.

Here are some axioms that we'll need:

Definition 6. Prime-Material Counterparts. Class A is a class of *prime-material counterparts* of x iff x is a substantial form, A is a set of prime-material entities, and, for all substantial forms y, there is a set of prime-material entities B such that: if A and B were identical, x and y would be identical.

Intuitively, a prime-material counterpart to a substantial form is any prime-material entity that has been, is now, will be informed by that form, or that would have been so informed in some possible world (counterfactual scenario). In this model, all such prime-material counterparts (whether actual or merely possible, whether past, present, or future) collaborate in grounding the numerical distinctness of the form from its conspecific, contemporaneous alternatives. In the case of substances of non-contemporaneous origin it is the prime-material entities that occur at the substances' origin events that ground the distinctness of the forms involved. In either case, the failure of the distinctness of the set of prime-material counterparts would suffice to make the forms identical.

Axiom 0: Unique Existence of Prime-Material Counterparts. If x is a substantial form, there is a unique nonempty maximal class C of prime-material counterparts of x. Call this PM(x).

Axiom 1: From Grounding to Conditional. If the distinctness of x and y is wholly grounded by the distinctness of the contemporaneous members of M, then if *per impossibile* the members of PM(x) and PM(y) were identical, then x and y would also be identical.

There should be some such connection between grounding and conditionals. If a ground is a kind of sufficient explanation, then the absence of a ground ought to be associated with the absence of the fact explained. There might be some exceptions to this, in cases in which a fact is independently by more than one set of facts, but such over-grounding should be truly exceptional.

Axiom 2: Counterfactual Equivalence of Hypothetical Identities. If B and C are both sets of subsets of M, then: if the members of the members of B were identical, the members of the members of C *might* be identical.

Once we entertain *per impossibile* suppositions about the identity of some prime-material entities, the identity of *any* such entities is also entertainable.

The *per impossibile* conditionals that I need are only conditionals with antecedents that are materially impossible: that is, propositions that are metaphysically impossible but do not contravene any principles of logic or mathematics. If two entities x and y are in fact distinct, I take it to be materially impossible for them to be identical. However, to suppose that x and y are identical does not involve supposing any logical or mathematical principle to be false.

For this reason, we should expect the *per impossibile* conditionals to be given something very like the standard Stalnaker-Lewis semantics for subjunctive conditionals. We just have to include materially impossible worlds in the semantics. None of the worlds validate logical or mathematical absurdities, and so nothing like relevance logic is required. We could model the logic using worlds with disjoint domains of quantification, interpreting each term with a function from world's to entities in that world. Thus, variables that are assigned distinct individuals in the actual world might be assigned the same individual in a different world. (See Appendix A for details.)

The next two axioms are standard axioms for the subjunctive conditional, applied to the case of *per impossibile* conditionals:

Axiom 3: Minimal Conditional Logic 1. If (if *per impossibile* s were the case, p would be case), and (if *per impossibile* s were the case, q would be the case), and (p & q) logically (formally) entails r, then (if *per impossibile* s were the case, r would be the case).[7]

[7] The entailment involved in Axiom 1 is not to be thought of as metaphysical entailment (i.e., that the consequence is true in every possible world in which the premise is true) but rather as entailment in a formal system, such as first-order predicate logic, including a KT4 modal logic (without axiom B, symmetry of accessibility). Using metaphysical entailment would result in a trivial logic for *per impossibile* conditionals. I am assuming that no

Axiom 4: Minimal Conditional Logic 2. If $(p \ \boxdot\!\!\rightarrow q)$ and $(p \ \diamond\!\!\rightarrow r)$, then $((p \,\&\, r) \boxdot\!\!\rightarrow q)$. [Where '$\boxdot\!\!\rightarrow$' represents the 'would' conditional of Lewis's Counterfactuals, and '$\diamond\!\!\rightarrow$' represents the 'might; conditional.]

Even a *per impossibile* conditional ought, like normal counterfactuals, allow for closure under logical entailment with respect to the consequents of two conditionals with the same antecedent.

Axiom 5: Grounding of Distinctness. If (i) A and B are subsets of M, (ii) if *per impossibile* the members of the members of set A were identical to the members of B, x would be identical to y, and (iii) x and y are distinct, then the distinctness of x and y is wholly grounded by the mutual distinctness of the members of M.

Axiom 5 is the converse of Axiom 1, again expressing a connection between conditionals and grounding. *Per impossibile* conditionals concerning numerical distinctness should backed by grounding relations.

Axiom 6: Fundamentality of Prime-Material Distinctness. The mutual distinctness of the members of M, the class of prime-material entities, is ungrounded.

Axiom 7. Disjoint Prime Matter. If the x and y are distinct substantial forms, then the prime-material counterparts of x and the prime-material counterparts of y form disjoint classes.

Theorem 1: Transitivity of Conspecificity. If x is conspecific with y, and y is conspecific with z, then x is conspecific with z. [Proofs of theorems are in Appendix B below.]

Next, I will show that congenericity at each level is also transitive. I will need some additional axioms:

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contravention of logical principles is involved in supposing things that are in fact distinct to be identical. See the Appendix.

Axiom 1*: From Grounding to Conditional. If the distinctness of x and y is wholly grounded by the mutual distinctness of the members of A, where A is a class of differentiae of some level, then, if *per impossibile* the members of A were all identical, the x and y would be identical.

There should be some such connection between grounding and conditionals. If a ground is a kind of sufficient explanation, then the absence of a ground ought to be associated with the absence of the fact explained. There might be some exceptions to this, in cases in which a fact is independently by more than one set of facts, but such over-grounding should be truly exceptional.

Axiom 5*: Grounding of Distinctness. If A is a class of differentiae of some level, x and y are distinct, and (if *per impossibile* the members of set A were identical, x would be identical to y), then the distinctness of x and y is wholly grounded by the mutual distinctness of the members of A.

Axiom 5* is the converse of Axiom 1*, again expressing a connection between conditionals and grounding. *Per impossibile* conditionals concerning numerical distinctness should backed by grounding relations.

Axiom 8. Grounding Distribution. If substantial forms x, y, and z are all pairwise distinct, then if any fact grounds one of the non-identities, then some fact must be a common weak ground of at least two of the non-identities.

Suppose, for example, that some fact F wholly grounds the fact that x is distinct from y. That x is distinct from y logically entails the disjunction [$(x \neq z)$ or $(y \neq z)$]. Suppose that F grounds neither the fact that $(x \neq z)$ nor the fact that $(y \neq z)$, and suppose that these two facts have no common weak ground. Then the truth of the disjunction would be strangely overdetermined, guaranteed to be true with metaphysical necessity by at least three independent grounds, even though it is a disjunction of just two simple facts.

Axiom 9. No Double Grounding of Distinctness. If the fact that ($x \neq y$) is wholly grounded by the distinctness of the members of A and by some distinct fact F, then both the distinctness of the members of A and fact F have a common weak ground.

Axiom 9 reflects a reluctance to posit more independent grounding relations concerning numerical distinctness facts than are strictly necessary.

Theorem 2: Transitivity of Congenericity. If x is congeneric at level n with y, and y is congeneric at level n with z, then x is congeneric with z at level n. [Proof in Appendix B]

5.2 The Porphyrean Tree of Species and Genera

The Porphyrean tree of genera and species (datum 2), found throughout Aristotle's scientific treatises, can be described as a directed graph with the following features:

1. The nodes of the graph are ordered by the proper subset relation (datum 2b).
2. Every path terminates in a leaf (*infima species*), with no successors.
3. Every path between two nodes is finite.
4. If any two nodes overlap, then one is a proper subset of the other (datum 2c).
5. There are nodes with no predecessors (roots—genera of highest generality) (datum 2e).

Properties 1-3 follow immediately from the recursive definitions of genera given above. The key properties to verify are properties 4 and 5.

Property 4

Suppose that A and B are species or genera, and that they overlap. Let C be the non-empty class of species in the overlap. Let species x, y, and z belong to (A-C), (B-C), and C, respectively. The forms in class A are differentiated by some class of differentiae A*, and the forms in class B are differentiated by some class of differentiae B*. There are three cases: A* and B* are classes of

differentiae of the same level, A is of a lower level, or B is of a lower level. By symmetry we can collapse the third case into the second.

Case (1): A* and B* are of the same level n. Then x and y are congeneric at level n, and y and z are similarly congeneric at level n. By Transitivity, x and z are congeneric at level n. Therefore, x, y, and z must all belong to the same level-n genus, and so A = B.

Case (2). A* is of a lower level than B*. By the definition of differentiae of level n, B must be a sub-class of A.

Property 5

Two substantial forms are different at the highest level if they are fundamentally distinct, that is, if their distinctness is not grounded by the distinctness of the prime-material entities or by the members of any class of differentiae. If two form are not fundamentally different, then they belong to the same highest-level genus. To prove that there are such highest-level genera (datum 4d), we must prove Theorem 3:

Theorem 3: The relation of *not being different at the highest level* is an equivalence relation.

I need one additional axiom.

Axiom 7. No Substantial Grounding of Difference. If x and y are substantial forms, and A is a class of differentiae, then the mutual distinctness of the members of A is not wholly grounded by the distinctness of x and y.

[Proof of Theorem 3 in Appendix B]

Consequently, there are well-defined highest-level genera, which together partition the domain of substantial forms.

5.3 The Distinction between Essence and Accident

Neither the extreme nominalist nor the Platonist has any non-ad-hoc explanation for the distinction between essence and accident. Moreover, the Platonist (whether relational or constituent) has real difficulty accommodating the fact that the essence of a particular substance grounds the actual existence and the specific potentialities of that substance. For relational Platonists, universals are supposed to lie beyond the causal nexus of spatiotemporal events. Universals are, insofar as they are "present" in space and time at all, equally present at all times and places. Let's suppose that we grant the distinction between essential forms and accidents, with essential forms grounding the potential existence or instantiation of the accidents. How then, as Aristotle argued (in *Generation and Corruption* II.9), can the Platonists explain why all essential universals are not instantiated at all times? Why don't we have an Anaxagoran world in which everything is always human, bovine, etc.?

For constituent Platonists, both essential and accidental forms are equally present in each substance, and they characterize the substance simply by being included. There's no obvious way for the presence of some universals to be explanatorily prior to the presence of others. The priority can't be merely causal, since it is metaphysically impossible for accidents to exist in the complete absence of an appropriate substance.

By allowing for the diversification of specific forms by prime matter, Aristotelians can posit distinct substantial forms for each instance of the species, forms that are brought to actuality by localized efficient causes, and that are sustained in existence by favorable internal activities and hospitable environments. Each substantial form can the ground a specific range of potentialities for the incorporation of accidental forms. This asymmetric grounding relation underwrites the distinction between essence and accident.

5.4 Generation and Corruption of Substances

A coherent version of the Aristotelian trope theory must take every difference in character or nature to depend on form, either substantial or accidental. Consequently, the class of prime-

material entities (the entities upon which the distinctness of conspecific forms depends) must be in themselves bare or character-less. If all prime-material things had a common nature in themselves (apart from their relation to form), we would be left with no metaphysical explanation of that commonalty.

The natures defined by substantial form are the basis for the principles of change and rest in the natural world. In other words, under what conditions a substance can persist, and what changes it would undergo if it did persist under those conditions, must entirely depend on the substance's form. The prime-material entities cannot persist fundamentally. At a fundamental level, therefore, prime-material entities must be both instantaneous and *world-bound* (to use David Lewis's phrase).[8] Prime-material entities are not *enduring things*. Each fundamental prime-material entity exists only at one time and in one world. It is fundamentally distinct from all other prime-material entities existing at that time and world or at any time or world. Prime-material entities, being location- and instant-bound, are also responsible for the individuation of space and time. In a world of distinct but recurring events (as supposed by Nietzsche in his myth of eternal recurrence), it is prime-material entities that ground the distinction of successive cycles. And in spatially symmetrical universes (like that of Max Black's spheres), it is prime-material entities that ground the distinctness of corresponding regions of space.

Prime-material entities can, however, persist in a derived way, in a way dependent on the substantial forms that inform them. We can model this derived persistence by means of Hans Reichenbach's *genidentity* relation (Reichenbach 1956). The genidentity relation will be a binary equivalence relation among prime-material entities. If prime-material entities x and y stand in the genidentity relation G, then they count as two stages of a single, derivatively persisting thing—the sort of thing that Roderick Chisholm (Chisholm 1976) labeled an *ens successivum*.

[8] More precisely, each prime-material entity is world-segment-bound, in the sense that it cannot have a counterfactual past or present. If two prime-material entities x and y inhabit worlds w1 and w2, then x and y are identical only if x occupies time t1 in w1 and y occupies time t2 in w2, and the history of world w1 up to and including t1 is indistinguishable, both formally and prime-materially, from the history of w2 up to and including t2. If we want to take relativity into account, we can focus instead on the complements of the forward time-cones of t1 and t2.

The genidentity relation can link prime-material entities at different times in any of three ways. First, both prime-material entities might be informed by the same substantial form, where the nature of that form dictates that the two PM entities constitute different stages of the same integral part of the substance, without any growth or diminution of that part in the intervening period of time. Second, the two PM entities might be informed by the same substantial form in such a way that the integral part constituted by the earlier PM entity is corrupted and replaced by the integral part constituted by the later PM entity. Third, this process of corruption and replacement could involve two distinct substantial forms, with a third substance (the efficient cause or agent) causing a diminution of one substance and a consequent growth of the other. In some cases, only two substances are required: namely, when a pre-existing substance absorbs some or all of another substance.

In each case, the genidentity relation is determined by the substantial forms of the local substances, and by their active and passive causal powers. Genidentity is not mere spatiotemporal continuity, although genidentical entities do follow continuous trajectories, as a matter of natural necessity.

On my conception of prime matter, each material substance contains an infinity of prime-material components. In fact, the physical world's prime-material entities must constitute a gunky continuum, with each prime-material entity having infinitely many prime-material proper parts. In many contemporary versions of bare-particular theory, there is one bare particular for each substance. That is decidedly not Aristotle's pictures. The various proper parts of a material substance must be individuated from each other, which requires each of them to have its own prime-material counterpart. Since for Aristotle matter is infinitely divisible, the domain of prime-material entities must constitute a continuum of gunk (with no atomic parts). The mereological relations among prime-material entities must, like numerical distinctness, be metaphysically fundamental.

If there are no prime-material entities, then real substantial change is impossible. If there are enduring entities with their own natures, independent of the action of substantial forms, then any change is fundamentally merely an alteration of those same enduring entities. Substantial change

requires that the ultimate material substrate lack any fundamental persistence through time and change.

However, the role of the substrate of substantial change is not the fundamental role that prime matter plays. Its fundamental role is as individuator of conspecific substantial forms. In fact, prime matter as such cannot be the substrate of substantial change, since all prime-material entities are, strictly speaking, instant-bound. However, prime matter as linked by genidentity relations, which themselves depend on both substantial and accidental forms, is suited to play the enduring substrate role. Enduring prime-material substrates are real but metaphysically derivative.

Alteration or accidental change also involves an enduring substrate and the introduction of a form, but in this case the substrate is a substance, and the form is accidental in character. An accidental form modifies a substance as a whole. Two accidental forms of the same species are derivatively distinct: their distinctness is grounded by the prior distinctness of their substantial bearers.

5.5 The Persistence of Substances through Intrinsic Change

Jeffrey Brower has argued that such an Aristotelian account offers a novel and attractive solution to the problem of temporary intrinsics (Brower 2010). Suppose that Socrates was unmusical at t1 and became musical at t2. How do we avoid the contradiction of supposing that Socrates was both musical and not musical? Three solutions have been offered: some version of serious tensism or A theory (according to which Socrates can have intrinsic properties only at the present time), some relativization of properties or property possession (Socrates has only musical-at-t1 or has-at-t1 musicality), or temporal parts (Socrates has two distinct temporal parts at t1 and t2, one timelessly musical and the other timelessly unmusical). According to Brower, Aristotle's metaphysics offers a fourth possibility: Socrates is timelessly part of two distinct wholes, one containing a form of unmusicality and existing at t1, and another containing a form of musicality and existing at t2. No substance can belong to two such wholes ("accidental unities") containing contrary forms and existing at the same point in time.

In fact, this solution does not require positing accidental unities like musical Socrates at all. We can simply say that some accidental forms do not exist or modify their bearer at all times at which the bearer exists. Socrates is unmusical at time t1 by virtue of the existence of an accidental form of unmusicality at that time whose identity is tied to Socrates. This doesn't involve relativizing the property or the mode of property possession: it is only the actuality of the accidental form that must be relativized to periods of time. Similarly, it doesn't require any alienation of Socrates from his properties or division of Socrates himself into temporal parts.

5.6 The *Per Se* Unity of the Essences of Substances

The Aristotelian version of trope theory provides an adequate explanation for the *per se* synchronic unity of substances, It is the substantial form that is responsible for the actual existence,[9] the natures, and the inter-relations of the integral parts of the substance, since the underlying prime-material entities lack any basis for any of these. It is also substantial form that is responsible for the persistence of the substance through time, since the underlying prime-material entities are in themselves instantaneous.

Unlike Platonists, Aristotelian trope theorists have no difficulty in explaining generic sameness without threatening the unity of substantial form. Every substance has a single substantial form which is conspecific with the forms in the same species and congeneric at different levels with the forms in multiple genera of increasing generality. In *Metaphysics* Eta 6, the differentia actualizes some potential of the genus, resulting in the specific form. The generic form exists only *virtually* in the resulting specific form. Generic forms have a kind of potential existence, an existence which although not actual is real, not merely a being of reason. A substantial form is in

[9] How can the prime-material entities be responsible for the numerical distinctness of the conspecific substantial forms, if those forms are responsible for the actual existence of the prime-material entities? Doesn't this involve a vicious circularity. I don't think so—mere possibilia can (even apart from actual existence) be fundamentally distinct. I take this as evidence that Aristotle's ontological views were possibilist, involving irreducible quantification over possibilia. At the least, Aristotle's domain of quantification must include everything that actually exists and everything that has or has had the potentiality (in this world) of existing. Possibilia in alien worlds, unrelated to the potentialities and powers of this world, need not be included.

itself generic in nature: it acquires its specificity through its specific differentia. The form is fundamentally generic and only derivatively specific.

5.7 *Per Se* Predication of Accidents

Since both substantial forms and accidents are tropes, the Aristotelian has no difficulty with allowing some tropes to modify other tropes. This immediately gives rise to Aristotle's distinction of per se and per accidens predication. Two tropes are related by per se predication when one modifies the other (like a red trope modifying a surface trope), while two tropes are related by per accidens predication when both modify some third entity (as when Socrates is both pale and musical).

6 Three Interpretive Payoffs

In addition to providing an attractive explanation of the data, the Aristotelian trope theory developed in section 4 has three interpretive payoffs in making sense of Aristotle's texts.

6.1 Interpretive Payoff 1: Forms both Particular and Universal

There is an apparent inconsistency in Aristotle. On the one hand, there is plan statement in the *Metaphysics* Zeta 13.1038b8-9 that no universal can be a substance. On the other hand, a simple syllogism drawn from the same text proves that no form can be a particular, either:

> Every substance is definable. (Zeta 4.1030a6-13, Zeta 13.1039a20)
> No particular is definable. (Zeta 11.1037a20ff, Zeta 15.1039b27)
> So, no substance is particular.

But this conclusion contradicts Zeta 13.

The model I propose resolves the difficulty. Substances are definable because their substantial forms are definable. Every form is in itself universal but is derivatively particular by virtue of its

informing of some prime-material entities. Forms are definable qua existing in themselves, apart from any relation to prime-material entities. However, no form does in fact exist apart from such a relation, and so every actual form is a particular. Forms are not Platonic universals, which are in no way particular, even when contained by particulars. Nor are forms self-individuated particulars, with no intrinsic universality. They are universal in themselves and particular in actual existence. That is, they are particulars *simpliciter*, but their particularity is derived or grounded and not fundamental. Hence, they can be defined as they are in themselves, but not qua particulars.

6.2 Interpretive Payoff 2: Prime Matter is Bare *Per Se* but not Bare *Simpliciter*

There have been three extant views on prime matter:

1. Prime matter is a relatively featureless substratum, essentially and fundamentally extended and persisting through.
2. There is no such thing as prime matter. The ultimate substrata are elements—simple substances with forms.
3. Prime matter is featureless in itself but always qualified by form.

Following Avicenna, Aquinas, and Brower, I have defended view 3. Just as form is universal in itself but derivatively particular, so is prime matter featureless in itself but derivatively natured. In itself, it cannot persist through time, but as natured by form it does persist, even through instances of substantial change, by virtue of genidentity relations among instantaneous bits of prime matter. Prime matter is featureless and instant-bound in itself, but natured and persisting through form.

6.3 Interpretive Payoff 3: The "Composite" Substance is Composite

There are also three views on the composite substance (which Aristotle calls the *synolon*):

1. The composite is composed of two independent parts, one universal and one particular.

2. The so-called "composite" is really simple. The 'form' and 'matter' are merely abstractions from something per se one.
3. The composite is the prime matter as informed by the substantial form. The matter and form are really distinct from each other and yet radically inter-dependent, and both are parts of the substance.

I have defended the third view, which makes sense of Aristotle's use of *synolon* without making a substance a strange hybrid of the universal and the particular. The prime matter is fundamentally particular but derivatively natured, while the form is fundamentally natured but derivatively particular. The whole substance is derivatively natured and derivatively particular.

Why are the matter and form parts of the substance? In what sense are they *parts*? Let's start with an ordinary, intuitive conception of parts, according to which hands and heads are parts of animals, for example. The parts of an animal are themselves individuated by prime-material entities. Imagine, for instance, a perfectly symmetrical starfish. Each of its five sections would have to be made distinct from the other by virtue of distinct prime-material entities. Each of the prime-material entities that individuates one of the parts of the animal in a sense is that part, as modified by the animal's substantial form. What the prime-material entity is potentially, the part of the animal is actually. Consequently, each of the parts of the substance's prime matter *is* (in a derivative way) an ordinary part of the substance.

For Aristotle, matter is continuous. It is infinitely divisible although always only finitely divided by form. For prime-material entities to complete the job of individuating the parts of substances, they must form a gunky continuum. In many cases, these prime-material entities do not correspond to any actual division of any substance. Prime-material entities are not individuals in the strict sense, since they are always divisible into parts of the same ontological category. Considered in itself, no prime-material entity is an integral whole, unifying its parts in any special way. Consequently, the principle of mereological universalism as applied to prime-material entities is unavoidable: any plurality of prime-material entities, without exception, must compose something, namely, another prime-material entity.

Consider the plurality of prime-material entities that underlie the actual integral parts of some substance (in some natural partition of the substance). This plurality must compose a single prime-material entity, which we can call PM-1, the prime matter of the whole substance.

Just as the prime-material entity underlying any integral part of the substance is in a way that part, so the whole prime matter PM-1 *is* (in a derivative way) the whole substance. However, we cannot treat PM-1 and the substance as strictly identical (in the Leibnizian sense), since they have different persistence conditions and play distinct metaphysical roles. At the fundamental level, prime-material entities are world- and time-bound, while substances are not. Prime-material entities do derivatively persist, thanks to genidentity relation. However, the genidentity relations that fix the derived diachronic identity of prime-material entities do not track the fundamental persistence of substances. In order to deny that the whole substance contains the substantial form as a part, we would have to admit that the substance and PM-1 are mereologically coincident—i.e., that they are composite and have exactly the same proper parts. This would involve rejecting the extensionality of standard mereology.

In addition, at this point I can rely on an analogue of van Inwagen's argument against universal composition in *Material Beings* (van Inwagen 1990, 75-8). Suppose that we have two distinct but coincident beings: PM-1 and the hylomorphic substance of which PM-1 is the matter. Let's suppose that PM-1 consists of the derived, persistent matter (entities whose persistence is determined by the relevant genidentity relations). We know that PM-1 and the substance have discordant persistence conditions, since the substance is mereologically inconstant, and since the prime-material components both pre-exist the generation of the substance and survive its corruption. However, if PM-1 and the substance were mereologically coincident, then the persistence conditions of PM-1 would dominate those of the substance. There would be no grounds for supposing that there is some further thing, "the substance," that persists over time, thanks to the operation of the same substantial form. Instead, we would have to say that the substantial form is responsible for the existence, at each point of time, of some body of prime-material components (like PM-1), none of which persists through the gain or loss of persisting prime-material components.

If, in contrast, we suppose that the substance is composed of both PM-1 and a substantial form, then the substance is *not* mereologically coincident with PM-1 (since PM-1 does not contain the substantial form as a part). Now we are free to suppose that the persistence-conditions of the substance diverge from those of PM-1.

The substance is to some degree mereologically inconstant: it is partly composed by a different prime-material sum at different times. However, its diachronic unity is firmly grounded in the fundamental persistence of the absolutely simple, intrinsically unchanging substantial form.

Moreover, in support of the claim that the form is part of the substance we can appeal to a simple *Why not?* argument. The substantial form together with PM-1 clearly constitute a system of entities. The activity of the form in giving existence and powers to its prime-material components ties the form and the components together in an intimate union. Why not, then, suppose that the form and the prime-material components compose a further entity? And, if they do, it seems very plausible to identify this composite entity with the whole substance. Therefore, substantial forms are parts of their substances.

A final consideration supports this thesis as an interpretation of Aristotle's systems (in *Metaphysics* Lambda 7,1073a3-13): namely, the existence of immaterial, purely intellectual substances (the celestial intelligences). Such substances contain no prime-material entities. It seems reasonable to think of them as substance of pure form. If so, they would be constituted by their substantial forms, or by their substantial forms together with their intellectual accidents. Could an immaterial substance be composed entirely of its intellectual accidents, with its substantial remaining on the outside? I don't think so, since the accidents would have to be modifying something intrinsically. They can't modify each other, since some accidents can survive the replacement of other accidents. So, they must be taken as modifying the substantial form. Hence, the form must be part of the immaterial substance, or else this accidental modification will always be extrinsic rather than intrinsic.

Returning to material substances, we can say that the whole substance and its prime matter stand in *a kind of* identity relation to each other, in the sense that every natural property of the

substance is also simultaneously conferred on the prime matter by the substantial form. However, the prime matter is only contingently and extrinsically so natured, while the whole substance is so intrinsically and essentially. It is only by adding the substantial form as a further part that the relevant distinction can be sustained.

Let me make clear what I am *not* saying: I am not suggesting that the substantial form of Socrates is essential to him *because* he contains it as a proper part. There is in Aristotle's system no such implication of parthood. Substances are mereologically inconstant. Socrates' substantial form is essential to him because it is the criterion for his diachronic and transworld persistence. We postulate that the substantial form is part of Socrates because of two facts: Socrates' prime matter is also part of him, and we want to distinguish Socrates from the totality of his prime matter.

Are accidental forms also parts of the composite substance? There is reason to suppose that at least some of them are—namely, the modular tropes of spatial extension (and perhaps also of mass and charge). I don't see any compelling reason to suppose that qualitative, modifying tropes are also parts of the composite substance.

Do substances and their modifying accidents compose a further whole? Aristotle accepted the existence of such non-substantial *accidental unities*, which did contain both a substance and an accidental form as parts (*Physics* 1.7.190a17–21, 190b18–22; *Metaphysics* Delta 6.1015b16–22, 1016b32–1017a6; *Metaphysics* Delta 29.1024b30–1). However, the existence of such accidental unities seems to be a peripheral and optional part of Aristotle's system.

7 Conclusion

Like Plato, Aristotle was concerned with the problem of the One over the Many, with the problem of giving a non-trivial, metaphysical explanation of natural commonalty. Sound abductive reasoning drives Aristotle away from Plato's account and toward a version of trope theory, a version in which substantial forms of the same species are numerically distinct but not fundamentally so. This account provides the basis for a genuine explanation of the formal

properties of resemblance (including symmetry and transitivity) and of the widely-observed Porphyrean structure of species and genera. Substantial forms also provide an explanation for compositional unity and temporal persistence. This account in turn leads to the postulation of prime-material entities as the ground of intra-specific distinctness and ultimately to the conception of natural substances as composites of form and matter. This model of the Aristotelian project yields significant interpretive payoffs, explaining in what sense form is both universal and particular, and in what sense matter is both bare and qualified.

Appendix A: Semantics for *Per Impossibile* Conditionals under Possibilism

The only impossible worlds I need are worlds in which entities (including impure sets) that are distinct in the actual (and other possible worlds) are identical. We could model this by assigning to each world w a domain of quantification D(w), with the domains of any two worlds disjoint. To capture transworld identity, we add a counterpart relation. Between any two possible worlds, the counterpart relation must be a 1-1 function. This reflects the fact that the semantics is possibilist: we quantify over all possible entities in each world. More generally, a world w2 is accessible from w1 only if the counterpart relation is a surjective function from D(w1) onto D(w2). Any two possible worlds will be mutually accessible, but a possible world need not be accessible from an impossible one, since two entities that are distinct in the possible world may have been identified in the impossible one. This means that the accessibility relation is not transitive across the whole set of worlds, and so the modal logic will lack the B axiom.

We can now define the semantics for the subjunctive conditional in the usual way, following David Lewis (Lewis 1973). If we use the conditionals to define possibility in the usual way, we would have to interpret the defined notion as ‘true in some world, whether really possible or not’. No logical or mathematical laws will be interpreted as false in any impossible world, so no paraconsistent logic, like relevance logic, will be needed. The axioms of set theory (including Extensionality) will be validated in each world, so two impure sets whose members are identical in a world will also be identical in that world. If an entity belongs to a set, then its counterpart will belong to the set’s counterpart in any world. The number of members belonging to a given

set will be interpreted as varying from one impossible world to another, depending on the structure of the counterpart relation.

Appendix B: Proofs of Theorems

Proof of Theorem 1. Suppose that x and y are conspecific, and that y and z are conspecific. We can assume without loss of generality that all three are numerically distinct. Then the class of prime-material entities M is such that the distinctness of x and y and the distinctness of y and z are both wholly grounded by the mutual distinctness of the members of M. By Axiom 1, From Grounding to Conditional, the set PM(x) of prime-material counterparts of x and the set PM(y) of prime-material counterparts of y is such that if PM(x) and PM(y) were identical, x would be identical to y. By the same axiom, the set PM(y) of prime-material counterparts of y and the set PM(z) of prime-material counterparts of z are such that if two sets were identical, y would be identical to z. By the Counterfactual Equivalence (Axiom 2), if PM(x) and PM(y) were identical, PM(y) and PM(z) might be identical, and vice versa. By Minimal Conditional Logic (Axioms 3 and 4), if PM(x) and PM(y) were identical, and PM(y) and PM(z) were identical, then x and z would be identical. If PM(x) and PM(y) were identical, and PM(y) and PM(z) were identical, then PM(x) and PM(z) would be identical. By Disjointness (Axiom 7), these two sets are disjoint. By Grounding to Distinctness (Axiom 5), the distinctness of x and z must be grounded by the distinctness of the members of M, or by some class of facts that wholly grounds this distinctness. By Fundamentality of Prime-Material Distinctness (Axiom 6), the distinctness of the members of M is ungrounded. So, the distinctness of x and z is grounded by the mutual distinctness of the members of M, and so x and z are conspecific.

Proof of Theorem 2. Assume that x and y are congeneric at level n, as are y and z. We can assume without loss of generality that all three are numerically distinct. We can also assume (by induction on n) that at least one of the pairs (we can stipulate that it be the pair x and y) are not conspecific or congeneric at any level less than n. So, there is some class A of differentiae of level n such the numerical distinctness of x and y is wholly grounded by the mutual distinctness of the members of A. There are then two cases: y and z are congeneric at some level k less than n, or y and z are not congeneric at any lower level.

Case 1. Forms y and z are congeneric at some level less than n. By the definition of differentiae of level n, the distinctness of x and z is wholly grounded by the mutual distinctness of the members of A, and so x and z are congeneric at level n.

Case 2. Forms y and z are not congeneric at any level less than n. So, there is a class B of differentiae of level n such that the distinctness of y and z is wholly grounded by the mutual distinctness of the members of B. If A and B are identical, then the distinctness of x and z is wholly grounded by the distinctness of the members of A, and so x and z are congeneric at level n. So, assume that A and B are not identical. By Grounding Distribution (Axiom 5), the distinctness of the members of A either grounds the distinctness of x and z or the distinctness of y and z, or else the distinctness of x and z and of y and z have a common weak ground.

(2a) The distinctness of the members of A grounds the distinctness of y and z. By No Double Grounding (Axiom 6), the distinctness of the members of A must ground the distinctness of the members of B. But, by the definition of differentiae of level n, the distinctness of the members of B is ungrounded. Contradiction.

(2b) The distinctness of the members of A grounds the distinctness of x and z. By definition of congenericity at level n, x and z are congeneric at level n.

(2c) The distinctness of x and z and of y and z have a common weak ground. Since the distinctness of the members of B wholly ground the distinctness of y and z, by No Double Grounding, any ground of the distinctness of y and z will be some fact F that weakly grounds the distinctness of the members of B. By the definition of differentiae of level n, the distinctness of the members of B is ungrounded. Consequently, F is identical to the distinctness of the members of B, and so the distinctness of the members of B wholly grounds the distinctness of x and z. By definition of congenericity at level n, x and z are congeneric at level n.

Proof of Theorem 3. The reflexivity and symmetry of this relation is obvious, so I will focus exclusively on transitivity. If two substantial forms are not different at the highest level, then

their difference is contingent on the numerical distinctness of some other things. If substantial forms x and y are not fundamentally different, and y and z are not fundamentally different, then there are classes A and B such that the distinctness of x and y is wholly grounded by the distinctness of the members of A, and the distinctness of y and z is wholly grounded by the distinctness of the members of B. Suppose for contradiction that the distinctness of x and z is fundamental (ungrounded). That ($x \neq z$) logically entails the disjunction [($x \neq y$) or ($y \neq z$)]. By Axiom 5, ($x \neq z$) weakly grounds either ($x \neq y$) or ($y \neq z$). It is not identical to either fact, so it must wholly ground one or the other. Assume without loss of generality that ($x \neq z$) wholly grounds ($x \neq y$). By No Double Grounding (Axiom 6), either ($x \neq z$) grounds the distinctness of the members of A, or vice versa. The second is impossible, since ($x \neq z$) is ungrounded, and the first is impossible by Axiom 7, No Substantial Grounding of Difference.

Bibliography

Aristotle (1052), *Metaphysics*, Richard Hope, ed., Ann Arbor, Michigan: Ann Arbor Paperbacks.

Armstrong, D.M. (1989), *Universals: An Opinionated Introduction*, Boulder, CO: Westview.

Brower, Jeffrey E. (2010), "Aristotelian Endurantism: A New Solution to the Problem of Temporary Intrinsics," *Mind* 119: 883–905.

_____ (2012), "Matter, Form, and Individuation," in *The Oxford Handbook of Aquinas*, Eleonore Stump and Brian Davies, ed., Oxford: Oxford University Press.

_____ (2016), "Aquinas on the Problem of Universals," *Philosophy and Phenomenological Research* 92(3):715-35.

_____ (2017). "Aquinas on the Individuation of Substances," *Oxford Studies in Medieval Philosophy* 5: 122–150.

Chisholm, Roderick (1976), *Person and Object: A Metaphysical Study*, Open Court.

Garcia, Robert K. (2015), "Two Ways to Particularize a Property," *Journal of the American Philosophical Association* 1:635-52.

_____, (2016) "Tropes as Character-Grounders," *Australasian Journal of Philosophy* 94:499-515.

Author (2014), "Staunch vs. Faint-hearted Hylomorphism: Toward an Aristotelian Account of Composition*," Res Philosophica* 91:1-27.

_____ (2018) "Forms as Simple and Individual Grounds of Things' Natures," *Metaphysics* 1(1):1–11, DOI: https://doi.org/10.5334/met.4.

Author and Timothy H. Pickavance (2017), *The Atlas of Reality: A Comprehensive Guide to Metaphysics*, London: Wiley Blackwell.

Lewis, David K. (1973), *Counterfactuals*, Cambridge, Mass.: Harvard University Press.

_____ (1983), "New Work for a Theory of Universals," *Australasian Journal of Philosophy* 61:343-77.

Loux, Michael J., trans. (1974), *Ockham's Theory of Terms: Part I of the Summa Logicae*, Notre Dame, Ind.: University of Notre Dame Press.

Loux, Michael J. (2006), "Aristotle's Constituent Ontology," in Dean Zimmerman (ed.) *Oxford Studies in Metaphysics*, vol. 2 (Oxford: Clarendon Press), pp. 207-250.

_____ (2015), "An Exercise in Constituent Ontology," in G. Galluzzo and M. Loux, eds., *The Problem of Universals in Contemporary Philosophy*, New York: Cambridge University Press, 9–45.

Oliver, Alex (1996), "The Metaphysics of Properties," *Mind* 105:1-80.

Reichenbach, Hans (1956), *The Direction of Time*, New York: Dover Publications.

Rodriguez-Pereyra, Gonzalo (2002), *Resemblance Nominalism: A Solution to the Problem of Universals* (Oxford: Clarendon Press).

Spade, Paul V. (transl.) (1994), *Five Texts on the Mediaeval Problem of Universals: Porphyry, Boethius, Abelard, Duns Scotus, Ockham*, Indianapolis, Ind./Cambridge, Mass.: Hackett.

van Inwagen, Peter (1990), *Material Beings*, Ithaca, NY: Cornell University Press.

Wolterstorff, Nicholas (1970), *On Universals*, Chicago: University of Chicago Press.