

STAUNCH VS. FAINT-HEARTED HYLOMORPHISM: TOWARD AN ARISTOTELIAN ACCOUNT OF COMPOSITION

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Abstract: A *staunch* hylomorphism involves a commitment to a sparse theory of universals and a sparse theory of composite material objects, as well as to an ontology of fundamental causal powers. *Faint-hearted* hylomorphism, in contrast, lacks one or more of these elements. On the staunch version of HM, a substantial form is not merely some structural property of a set of elements—it is rather a power conferred on those elements by that structure, a power that is the cause of the generation (by fusion) and persistence of a composite whole through time. Bernard Williams discussed (and rejected) a faint-hearted version of HM in 1986, and faint-hearted HM has been defended more recently by Mark Johnston (2006) and Kathrin Koslicki (2008). I defend the superiority of the staunch version, in spite of its heavier ontological commitments, as a way of accounting for a real distinction between living organisms and heaps of matter, without recourse to dualism or vitalism, and as a way of combining a powers ontology with the possibility of gunk.

1 Hylomorphism as a Third Way

Aristotle clearly intends his theory of the soul as the ‘form’ of the living body to be an alternative to both materialism and to Pythagorean dualism or spiritism (of the sort ostensibly defended by Plato in the *Phaedo* or *Meno*). Thus, the contemporary defender of an Aristotelian hylomorphism faces two pairs of tasks: first, to distinguish an Aristotelian position from both materialism and dualism, and, then, to argue for the superiority of that position to both of its competitors. Obviously, the defensive tasks presuppose the success of the distinguishing tasks.

Many contemporary would-be defenders of hylomorphism fail to distinguish their position from contemporary materialism. I will label the resulting theories “faint-hearted hylomorphism.” In section 2 I will discuss

several versions of faint-hearted hylomorphism, explaining both the distinctness and the superiority of a “staunch” (i.e., a clearly anti-materialist) version of hylomorphism. I will discuss two contemporary versions of staunch hylomorphism in section 3 and then turn, in section 4, to a discussion of the variety ways of distinguishing staunch hylomorphism from substance dualism. In section 5, I will develop and defend my preferred option, *parts as sustaining instruments*.

2 Faint-hearted Hylomorphism

When Aristotle describes the soul as the form of the body (e.g., in *De Anima* II.1, 412a19–21), he clearly means more than just an arrangement or relationship among the parts of the body. A *form* (*morphe*) of a body is not analogous to the harmonious relations among a set of strings (*De Anima* I.4, 407b).

Form is the first actualization of a living or organic body (*De Anima* II.1, 412a27). The acquisition of form involves a real change in the intrinsic natures of the body’s components; it is not merely a matter of their acquiring certain relations or beginning to cooperate autonomously in certain ways, as the strings of the lyre cooperate in producing harmony. In Aristotle’s terminology, when some material things acquire a new set of extrinsic relationships to each other, the result is an *accidental unity*, not a *substance*. It is this conception of form that distinguishes Aristotle’s theory from materialism.

At the same time, the form results in a substance that *is* the living body. Ultimately, it is the whole human being that thinks and feels, by virtue of having the right kind of form. The thinking and feeling is not carried out by some entity that is separate from the living body. In fact, there is no unified, material entity existing in separation from the soul, with which the soul could interact. In this way, Aristotle’s view is distinguished from substance dualism.

Aristotle’s third way requires several elements:

- (1) A sparse theory of fundamental entities. A soul is a substantial form, and only substances have substantial forms. Socrates is a substance, but sitting Socrates is only an accidental unity, and so there is no substantial form corresponding to *Socrates’s sitting* as there is to *Socrates’s living*.
- (2) A sparse theory of fundamental properties. Only substances have *essences* or *natures* in the strictest sense. An essence or nature is a fundamental property, which accounts for both the possibility and actuality of all other properties, acting as a ‘principle’ (*arche*) of motion (change) and rest.
- (3) A powers ontology. The natures of substances confer fundamental causal powers on those substances, and those powers (both active

and passive) are the ultimate grounds for explaining all change and activity.

Ignoring any of these three elements results in a collapse of the substance/accidental unity distinction and, therefore, a collapse of Aristotle's hylomorphism into a form of mere materialism. Let's call such an erroneous version of Aristotle's theory 'faint-hearted hylomorphism.' Faint-hearted hylomorphists are typically guilty of the the *statue fallacy*, that is, of taking Aristotle's statue analogy in *Physics* II.3 and *Metaphysics* V.2 as providing a literal example of material and formal causes. In these famous passages, Aristotle tells us that the shape of the statue is its form. If we take the statue's shape as a paradigm of form, we would have to think that it was a substantial form, like the soul. However, for Aristotle, artifacts like statues are not substances at all but are merely accidental unities (*Metaphysics* VIII.4, 1043b19–23). Hence, statues do not have substantial forms, and the 'form' of a statue is a form only *secundum quid*, i.e., in a loose manner of speaking.

Faint-hearted hylomorphism and similar forms of materialism give rise to an extreme ontological inflation, with large numbers of overlapping and coincident objects. This inflation in turn results in massive causal over-determination, of the kind discussed by Trenton Merricks (2001, 56–84). For example, when a baseball breaks a window, the causes of the breaking will be multiplied in proportion to the number of coincident objects and pluralities of objects associated with the material components of the baseball in motion. In addition, such versions of materialism are forced (when identifying a mind with its physical basis) to multiply coincident thinkers in a similar fashion.

2.1 Four Faint-hearted Hylomorphisms

2.1.1 Bernard Williams

Bernard Williams (1986) offered two versions of Aristotelian hylomorphism, ultimately rejecting both. On the second version, an individual soul is a psychological *type* or *universal*, which is clearly a non-starter as an interpretation of Aristotle. On the first version, the soul is identified with a particularized property of a "Body"—its "working" organically as constituting a living thing. Williams introduces the concept of *Body* to represent the material object that persists through generation and corruption (thus, Kallias's body and Kallias's corpse are the same *Body*). Williams characterizes this view as nothing more than a "polite" version of contemporary non-reductive materialism.

Williams is missing the important features of Aristotle's theory. Williams's introduction of the kind *Body* ignores the substance/non-substance distinction. For the staunch hylomorphist, the corpse is not a *thing* at all (in the strictest sense)—it is merely a *heap* or plurality of microscopic substances.

Thus, it can't possibly be identical with either Kallias or Kallias's living body. Even if we grant that the corpse is a "thing" in a suitably weak sense, it certainly isn't either a substance or an integral part of a substance, and so it cannot exist in any sense prior to Kallias's death. Thus, there is in the staunch hylomorphist's ontology no entity that corresponds to Williams's Body. Staunch hylomorphists cannot suppose *human being* to be a mere phase sortal, marking out part of the career of a persistent *Body*, since substances like organisms are fundamental entities. The persistence of any material thing is parasitic on the more fundamental persistence of substances.

A Williams-style version of faint-hearted hylomorphism would involve a double proliferation of objects. First, any collection of material particles (at least, any collection occupying a connected region of space) would constitute one of Williams's Bodies. Second, any property of any Body would correspond to an accidental unity, just as Kallias corresponds to a certain Body's having the property of being alive. For example, if Socrates is sitting, then the "sittingness" of Socrates's body would (on Williams's faint-hearted account) correspond to an entity, *sitting Socrates*, that exists just so long as Socrates is sitting. Williams's account lacks the resources to distinguish substances like Kallias from accidental unities like sitting Socrates.

2.1.2 Kit Fine

Kit Fine (1999) introduced a theory of *rigid embodiments*. If R is a relation standing among objects a, b, c , etc. then there exists a rigid embodiment $[a, b, c, \dots / R]$, which exists when and only when these objects stand together in that relation. Fine calls R the rigid embodiment's *form*, and a, b, c , and so on its *matter*. Note again, Fine's theory includes no recognition of the substance/non-substance distinction, nor any limitation of form-matter compositionality to the case of material substances.

Fine also introduced *variable embodiments*, which are mereologically incontinent (i.e., capable of gaining or losing parts). For each variable embodiment, there is what Fine calls a *principle*, where each principle F has a unique manifestation at each time t . Manifestations are all rigid embodiments. Fine offers no restrictions as to what a principle might be like. Apparently, any rule or function that yields a unique rigid embodiment for each moment of time during some interval would count as a principle, grounding the existence of an appropriate variable embodiment.

Taken as a complete account of hylomorphism, Fine's theory would lead to a double proliferation of objects, an inflation of ontology far beyond even that of Williams's. First, any relation holding among any plurality of objects would correspond to a distinct rigid embodiment. Second, every function from times to rigid embodiments would correspond to a distinct variable embodiment. Thus, Fine's universe would be inhabited by a vast

number of ontological monsters, many of which will share exactly the same material components at at least one point in time. Each relation that is realized gives rise to a distinct rigid embodiment, and every possible principle of diachronic identity, no matter how bizarre, would correspond to a distinct mereologically incontinent entity. For example, Eli Hirsch's exotic objects (Hirsch 1982), like the *incar*—an automobile that survives just as long as it remains in a garage—would be included as first-class members of Fine's ontology.

Alternatively, Fine's abstract theory could be interpreted so as to provide a framework of a *staunch* version of hylomorphism. We could interpret Fine's "principles" as substantial forms, and we could interpret the material elements of his rigid embodiments as parcels of matter. What, then, would his "forms" (the relations used to define rigid embodiments) be? We could take them to be what Aristotle calls 'second actualizations' of forms (*De Anima* II.1, 412a22). At any particular time, a person's soul actualizes the potentialities of his body and of his mind in particular ways, ways that are consistent with the specific (first) actuality of the human soul as such. On the staunch interpretation of Fine's formal theory, each principle corresponds to the fact that some real substantial form (in reality) would sustain some substance in existence through time, with the principle's value at each moment corresponding to the substance's second actualization at that time.

Fine takes as a consequence of his view that "there will be an intensional or conceptual component to the identity of many material objects" (1999, 73). This may well be true for non-substances, like artifacts and heaps. However, for staunch hylomorphists, it will not be true for substances, since substantial forms are found in reality, and not merely in our representation of it. Consequently, staunch hylomorphists won't get an ontological inflation of substances.

2.1.3 Mark Johnston

Here is Johnston's (2006) basic schema for hylomorphic theories:

HS: what it is for X to exist is for y_1, y_2, \dots to stand together in relation R .

Like Williams and Fine, Johnston does not limit his hylomorphism to substances. Consequently, he countenances many cases of coincident objects, one corresponding to each relation R that is realized by any plurality of objects.

To his credit, Johnston rightly recognizes that hylomorphism is, at the very least, consistent with the metaphysical priority of some wholes over some of their parts (Johnston 2006, 678). He even suggests that it would be possible for a whole to be prior to *all* of its parts. However, it is not clear how this is consistent with HS. How can the relatedness of certain

items be “the what it is” for the complex thing to exist, if the whole is ontologically prior to the relevant parts? If it is part of the essence of the parts to be parts of the whole, won’t HS force a problematic circularity upon us, making X ontologically prior to its own essence? It’s not clear what ‘ontologically prior’ could mean if HS doesn’t entail the ontological priority of whatever is prior to all of y_1, y_2, \dots over the complex X .

Setting this worry aside for a moment, can we adapt Johnston’s schema to a substance-only theory? Is Johnston’s schema compatible with a staunch version of hylomorphism? Here’s an attempt:

HS₁: For any *substance* X , what it is for X to exist is for certain parcels of matter y_1, y_2, \dots to stand together in the relation R .

There are two problems with this suggestion.

First, the schema does not give us a particular substantial form for each substance. This would be better:

HS₂: For any substance X of species S , what it is for X to exist is for there to be a *trope* S_F of type S that modifies certain parcels of matter y_1, y_2, \dots

Johnston argues that such particularized forms or kind-tropes are unnecessary—that we can appeal instead to origins and original parts to distinguish one individual substance from another (Johnston 2006, 659–660). But what if those original parts are themselves substances of the same kind? An infinite regress of individuation threatens, especially if we imagine a possible world that begins in a state of cosmic symmetry.

Second, Johnston (unlike Fine) faces the problem of material mereological incontinence. HS₂ implies that substance X necessarily has exactly the parcels y_1, y_2, \dots as components whenever it exists.

2.1.4 Kathrin Koslicki

In *The Structure of Objects*, Kathrin Koslicki (2008) defends a version of hylomorphism according to which every substance is literally composed of two parts: its form and its matter. The form is a relational property or arrangement, and the matter comprises a plurality of small objects that stand together in the arrangement. Such an account would, like the accounts of Williams, Fine, or Johnston, generate a plethora of ‘substances,’ one for every arrangement realized by any plurality of objects. Koslicki explicitly rejects those elements of a staunch hylomorphism that would bar such ontological proliferation: namely, the idea that form is a cause of the unity of the substance rather than literally a part of it, and the idea that the form unifies by imposing normative or teleological constraints on the arrangement of the material components of the substance.

The other oddity of Koslicki’s account of hylomorphism is that substances are weird chimeras, composed of both concrete and abstract things.

Koslicki insists that the form be a universal, since she finds the idea of an individualized form or haecceity “puzzling.”

3 Staunch Hylomorphism

To differentiate hylomorphism from materialism, staunch hylomorphists seek to identify a sparse collection of fundamental composite entities or substances, with enough sparseness to rule out coincident substances altogether. Given a powers account of causality, a sparse theory of fundamental things corresponds to a sparse theory of powers and power-bearers. The crucial question for staunch hylomorphists is this: What is the relation between the powers of a whole substance and the powers of its proper parts?

One simple proposal would be this: the powers of any substantial whole are identical to the sum of the powers of its parts. In other words, all of the powers of the whole are wholly grounded in the powers of its parts, together with their extrinsic (spatial) relations to each other. Let’s call this proposed principle the ‘wholly grounded’ conception of wholes. The wholly grounded conception of wholes has the consequence that no composite thing can have any fundamental powers. This is clearly in tension with the staunch hylomorphist’s commitment to the fundamentality of composite substances. Thus, staunch hylomorphist should reject the wholly grounded conception of wholes and should instead embrace *emergent* powers of composite substances.

However, the thesis of emergent powers threatens to push the staunch hylomorphist into the position of substance dualism. If the “whole” has emergent causal powers, in what sense can it be said to be wholly composed of its parts, as opposed to being a separate entity that interacts with those parts? Let’s look at two recent proposals for resolving this dilemma.

3.1 Michael Rea

Michael Rea (2011) identifies several “controversial commitments” of traditional interpretations of hylomorphism (Rea 2011, 341–342):

- (1) The thesis that properties are “constituents” of the particulars they characterize.
- (2) The thesis that these properties are located “in” the particulars they characterize.
- (3) The belief that these relations of *constituent-of* and *in* cannot be understood in the ordinary way but must be taken to represent new, primitive relations.

I don’t see 1–3 as being in any way essential to hylomorphism, despite the popularity (beginning with Aristotle) of *talking* this way. I think properties are “in” particulars in the straightforward sense of characterizing them. As

we shall see, Aristotelian forms are not literally *parts* of the composite substances whose unity and being they ground. Thus, no additional primitive relation of parthood is required (at least, not for this purpose).

Rea complains that the technical vocabulary of *potentiality* and *actuality* finds no place in contemporary science (Rea 2011, 342). What is it, Rea asks, in the sodium chloride molecule, that “actualizes the potentiality of its matter to be a sodium chloride molecule?” Assuming that sodium chloride molecules are true substances (which I will grant, at least for *NaCl* molecules not incorporated into living things), the answer is that a certain emergent chemical form (expressed in a characteristic quantum function) has actualized the potentiality of a certain parcel of mass-energy and charge to be a *NaCl* molecule. That seems a promising way to go, and if modern scientists don’t talk that way, so much the worse for them!

Instead of form and matter, Rea prefers to speak in terms of ‘natures’ and ‘individuators’ of those natures. Rea proposes that natures *are* fundamental powers. In fact, for Rea, all properties are merely powers. Powers should play a central role in any hylomorphist theory, but we should not go so far as to suppose that all properties are simple powers and nothing more. Hawthorne, in his paper on “Causal Structuralism” (2001), has shown that such a view has a real difficulty dealing with nomologically symmetrical worlds (the powers-analogue of the Max Black world).

Rea’s positive view is that the nature of a composite substance “unites” the powers of its parts. Here is his definition of what it is for one power (of the composite substance) to unify the powers of its proper parts (Rea 2011, 349):

- A power p_0 of an object x *unites* distinct powers $p_1, \dots,$
 p_n =_{df}
 (i) p_0 is intrinsic to x ,
 (ii) each of p_1, \dots, p_n is a nature of at least one of x ’s parts,
 (iii) p_0 is grounded in or identical to a certain sort of cooperative manifestation CM of p_1, \dots, p_n ,
 (iv) every power intrinsic to x that is at least partly grounded in CM is identical with, reducible to, or at least partly grounded in p_0 , and
 (v) there is no power intrinsic to x that is distinct from both p_0 and CM and that grounds p_0 .

Two of Rea’s claims don’t seem to cohere: on the one hand, the powers of substances are supposed to be fundamental, and yet, on the other hand, the powers of a composite substance are supposed to “unite” the powers of its parts, which entails that those united powers are *grounded in* the powers of the parts. It is better to have all (or at least some) of the powers of the parts “migrate” from those parts to the whole substance. One should at least insist that some powers had by the parts of substances are grounded

in the nature of the whole and so not fundamental. This avoids certain problems of potential causal redundancy noted by Merricks (in Merricks 2001, 147–155): If I stand on a scale, is it I (as a whole) or my parts (collectively) that cause the pointer to move? If the powers associated with weight have migrated from my proper parts to me, my weight can be the unique and non-redundant cause of the scale’s response.

There is an important gap in Rea’s account of substances: he hasn’t shown that substances have *unique* natures, as he defines ‘nature.’ A single substance could have several independent powers, each of which unites some powers of its parts through separate cases of cooperative manifestation.

Like Fine and Johnston, Rea wants to apply the matter-form schema to all material objects, and not just to substances (Rea 2011, 352–353). However, non-substances must lack ‘natures’ in his sense, since they are merely derived entities.

3.2 Anna Marmodoro

Anna Marmodoro (2013), building on Theodore Scaltsas’s interpretation of Aristotle’s *Metaphysics* (Scaltsas 1994), rightly places the distinction between actuality and potentiality at the heart of a staunch hylomorphism. The form is the *actualization* of the *potential* of the material parts to be merged into a whole (Marmodoro 2013, 18), as Aristotle explained in *Metaphysics* 1045b9–23. The proximate matter and the form are “one and the same,” the proximate matter being potentially a single substance, and the form being the actualization of that potential.

As Marmodoro puts it, Aristotelian form is not literally a part of the composite substance; it is an “operation” (Marmodoro 2013, 17)—I would prefer a “process”—with the material parts as participants, and the whole substance as the resultant. Marmodoro has explained (in private correspondence) that she takes the operation in question to be metaphysical one, since she takes form to be an abstract object. I would prefer an alternative, in which forms are concrete and the operation of the form is truly causal and diachronic. Formal and material causation are, on my view, both real, diachronic causal connections: the formal process, with its material participants, operating during each interval is the *cause* of the existence of the whole substance at the end of the interval.¹ A composite substance exists at time *t* because its material components participated in an appropriately formal process in some interval of time immediately before *t*. Marmodoro takes the form to be an abstract object embodied by these formational processes, rather than taking it (as I do) as the process itself.

In any case, thinking of form as an *operation* (whether metaphysical or causal) is fine, and a significant step forward for hylomorphism—but

¹ In thinking of the whole as diachronically emergent from its parts, I am following Timothy O’Connor’s (2000) account of emergence.

how does Marmodoro avoid the causal redundancy of the whole, or the exclusion of the whole's causal efficacy by that of its proper parts? Why isn't the whole merely epiphenomenal? The answer of Scaltsas and Marmodoro is this: the whole is not epiphenomenal because the whole's proper parts are existentially dependent on it. In other words, each proper part, no matter how small or elemental in character, is capable of existing only as a proper part of that whole or, perhaps, only as a proper part of some specifically similar whole. If this is so, then both the existence and the identity of each proper part are grounded in the nature of the whole substance. It would be natural to infer that the causal powers of the proper parts are also wholly grounded in the nature of the whole, securing the causal relevance of the whole.

Taken literally, this Scaltsas-Marmodoro thesis is quite radical in its implications. It would mean that whenever a new composite substance, such as an organism, is generated, the material components incorporated into it are literally annihilated and replaced by new elements, each of whose existence and identity are dependent on the continued existence of the whole substance. We could, following Koslicki, refer to this thesis as that of Reverse Mereological Essentialism. There are two versions of such RME, one making the existence of each part dependent on the existence of a particular whole, and the other making its existence dependent on its being part of a whole of the right kind:

Reverse Mereological Essentialism (Particular): If x is a proper part of substance y , then, necessarily, if x exists, then y exists and x is a proper part of y .

Reverse Mereological Essentialism (Kind): If x is a proper part of a substance of kind K , then, necessarily, if x exists, then x is a proper part of some substance of kind K .

Of the two, the Kind version seems more reasonable, since it would be compatible with the possibility of organ transplants: a heart could continue to exist in a new host, even though separated from its original donor.²

At times, Marmodoro suggests an even more radical thesis: namely, that in the generation of a new substance, the substance's proper material parts exist "only potentially" (Marmodoro 2013, 15). This would mean that the original components are both annihilated and replaced, not by a number of counterpart entities existentially dependent on the new substance, but instead by an atomic whole, with no concurrent proper parts at all. On such a version of hylomorphism, there would in fact be no literally composite

² What should we say about the heart when it is in transit, between the donor and the recipient? I would suggest that it remains part of the body of the host, even when physically separated from it, until it has been successfully integrated into the functioning of the recipient's body. Up to that point, it seems reasonable to suppose that it is still supposed to be contributing to the functioning of the donor's body.

substances at all: all substances would lack actual parts, having at merely potential parts. We can call this radical thesis *Aristotelian Parts-Nihilism*.³

In thinking about Aristotelian Parts-Nihilism, we have to consider an issue that has come to the forefront in modern quantified modal logic: the issue of actualism vs. possibilism. Actualists, such as Alvin Plantinga (1974, 131–163) and Robert M. Adams (1981), insist that the only things in the ultimate domain of quantification (the only possible values of singular terms or variables) are actual things, while possibilists take merely possible entities to be legitimate objects of reference and verifiers of existential generalization. Actualists affirm that absolutely everything exists in actuality, while possibilists maintain that some things are merely possibly existent. Actualists typically concede that it is possible that there exist things that don't actually exist, but they deny the validity of the converse Barcan formula—that is, they deny that from the possible existence of an *F* it should follow that *there is* something that is possibly *F*.

An actualist version of Aristotelian Parts-Nihilism entails that no substance has any proper part. We would have to deny that living organisms contain any organs, cells, molecules, or fundamental particles, although they might be capable of generating such things (through death, fission, expulsion, or excision). Singular terms referring to such apparent parts would have to be taken as simply empty or as referring to the whole substance under some specialized description. For example, 'the heart' might refer to the whole organism qua pumper of blood. All of the causal powers that we ordinarily attribute to the proper parts of an organism would have to be borne directly by the organism itself, which would involve a considerable complication to the nature of causal powers. We would have to relativize the causal powers of a substance to regions of space, so that we could distinguish the powers of the heart from those of the liver, or the powers of one internal electron from another. This would ultimately amount to treating regions of space as bearers or co-bearers of fundamental causal powers, an odd direction for a neo-Aristotelian to take.

A possibilist version of Aristotelian Parts-Nihilism could instead take 'the heart' or an 'internal electron' (of a living organism) to refer to potentially existing material entities. This would make sense in the case of atoms and elementary particles and other entities that can exist outside a living body, but it will run into a serious problem with respect to those integral parts (e.g., hands and organs), which, according to Aristotle's Homonymy Principle, cannot exist except as part of the body. A severed hand or foot is not the same kind of thing as the intact hand or foot of a living organism—they are called 'hands' or 'feet' only "homonymously." Since things cannot undergo a change of nature, the Homonymy principle would imply that such dependent parts cannot exist except as intact parts of the whole. If the

³ Alexander Pruss (2007, and in conversation) has expressed some sympathy for Parts-Nihilism.

heart does not exist as an *actual* part of the living organism, then it cannot be a merely *potential* entity either, since it (that very heart) cannot exist in isolation from the body either (see *Metaphysics* 1035b24–25).

Marmodoro's text suggests a third thesis, stronger than Reverse Mereological Essentialism but potentially weaker than Aristotelian Parts-Nihilism. She suggests that, when a new substance is generated, the material elements are "re-identified," and "they have no distinctness in the substance" (Marmodoro 2013, 15). She proposes that the form "strips the elements of their distinctness" (Marmodoro 2013, 17). Once so stripped, the elements exist "holistically" in the substance and not "separately" (Marmodoro 2013, 15). There are two ways of taking this third thesis. On the first way, it immediately entails Aristotelian Parts-Nihilism: to speak of something's "losing its distinctness" from other things is merely to speak (in a somewhat figurative way) of that thing's simply ceasing to exist. The second way of taking Marmodoro's proposal is to interpret her as proposing that the material elements continue to exist after the generation of the substance but literally become one—with each other and with the resulting whole. This would involve the denial of the eternity and necessity of distinctness, embracing the temporal relativity of identity. Such a theory would have to reject either Kripke's argument for the necessity and eternity of identity (Kripke 1972, 143–144) or reject the symmetry of temporal or modal accessibility, corresponding to the axiom *B* (if *p*, then necessarily possibly *p*) and its temporal counterparts (if *p*, then it always will be the case that it was the case that *p*, and, if *p*, then it was always the case that it will be the case that *p*). In the end, even this interpretation leads back to a possibilist version of Aristotelian Parts-Nihilism: no substance could have any *proper* parts, since every substance would be literally identical to all of its concurrent parts.

Perhaps the most charitable interpretation of Marmodoro would be to take the talk of "losing distinctness" as not referring to the acquiring of strict, Leibnizian identity with other parts and with the whole. We could take these phrases as simply a vivid way of expressing Reverse Mereological Essentialism. What really happens (on this view) to material elements in the generation of a new substance is their annihilation and replacement by new, existentially dependent parts of the substance bearing some resemblance (whether qualitative or quantitative) to the pre-existing elements.

However, there is still a serious problem with Reverse Mereological Essentialism as an account of Aristotle's hylomorphism. Aristotle introduced the notion of 'matter' ($\nu\lambda\eta$) in *Physics* I,7 as the substrate of substantial change (i.e., the generation and destruction of material substances). Aristotle's Substrate Principle demands that something, the substrate, exists both before every kind of change, including substantial change. Reverse Mereological Essentialism is inconsistent with the Substrate Principle, since RME entails that both the substance and all of its material parts begin to exist at the same moment. Just because the pre-existing elements and

the new substance contain the same quantity of material stuff (e.g., mass, charge, and so on) is not sufficient, since what Aristotle requires is some substrate that is numerically one and the same before and after substantial change.⁴

It is not enough for there to be (before and after a case of substantial change) things that are quantitatively and qualitatively similar to each other, even exactly similar. There must be some one thing that endures through the change as its ultimate subject. Why is this principle mandatory for Aristotelians? Suppose that there could be a change with no enduring subject. If such a thing could happen somewhere at some time, it could happen everywhere at all times. (This inference involves an appeal to David K. Lewis's Patchwork Principle, which every Aristotelian should endorse: what is possible in a given situation cannot depend on what actually happens in remote situations.) But a world in which there are never any enduring subjects of change is nothing more than a four-dimensional block of qualities—the sort of static block universe decried by McTaggart and endorsed by four-dimensionalists and Neo-Humeans. From an Aristotelian perspective, such a world would lack any real change or time at all. Hence, the very idea of substrateless change is incoherent.

A Parts-Nihilist might resist this argument by supposing that there are quantity tropes or particular accidents (e.g., tropes or accidents of mass, volume, or other physical quantities) that persist (with numerical identity) through substantial change, even though no material substance persists. This would require such tropes/accidents to be transferable from one substance to another, which is in some tension with the idea that an accident is merely a way that some particular substance is. Furthermore, since these enduring accidents would be the bearers of further qualities and powers, such a view would still entail that certain material entities persist.

We must, therefore, restrict the Homonymy Principle to the relatively proximate parts of the organism, such as organs and cells, excepting fundamental parts, such as elemental particles. Only then can we have material elements (the substance's independent parts) that literally endure through generation and destruction, without losing or gaining their mutual distinctness.

4 The Dilemma for Staunch Hylomorphism

We must return to the drawing board and consider again how to deal with the fundamental dilemma of staunch hylomorphism: that of ensuring the differentiation of hylomorphism from materialism by positing emergent

⁴ By 'numerical sameness' I mean strict, Leibnizian identity. I don't mean to imply that the enduring things must be countable in the strict sense, as opposed to some stuff. (I have in mind the well-known distinction between count-nouns and mass-nouns.) Even uncountable masses come in particular 'parcels' or 'parcels' of stuff that are numerically the same at different points in time—see Laycock (1975).

powers without collapsing into a version of substance dualism. Is the whole something over and above its parts? Yes, if we are to avoid faint-hearted hylomorphism, a version of materialism. But if we answer “yes,” then how can we ensure that the supposedly composite substance is truly *composed of* some smaller material elements, as opposed to being a wholly *separate* substance? In addition, an ideal solution would give us an account of parthood (as it pertains to composite substances and their elementary parts) that would validate most, if not all, of the axioms of standard formal mereology.

I’m not suggesting that we must find an answer to van Inwagen’s General Composition Question: What, in general, is the essence of to-be-part-of? Parthood is unproblematic in cases that satisfy either Mereological Essentialism or Reverse ME. If *A* is essentially a part of *B*, or *B* essentially includes *A* as a part, then either *A* or *B* (or *A* or *B* together with its essential nature) suffices as a truthmaker for the proposition that *A* is a proper part of *B*. However, in the case of living substances and their elemental parts, neither Mereological Essentialism nor Reverse Mereological Essentialism holds, forcing upon us the question: What makes it the case that this is now a proper part of that? At the very least, we should welcome an informative answer to this question.

The solution to this dilemma is to tie the “whole” substance to its material “parts” by way of a double dependency of some kind. We want the whole to be dependent on its parts in such a way that it cannot be a separate substance, while also positing that the parts are dependent on the whole in such a way that it is rendered neither redundant nor epiphenomenal.

In developing such a solution, I propose to examine seven possible ways of accounting for the relation between emergent wholes and their material parts:

- (1) Aristotelian Parts-Nihilism: Emergent substances have no actual parts at all.
- (2) Reverse Mereological Essentialism: Parts of substances cannot exist except as parts of substances of the same kind.
- (3) Downward sustenance: The persistence and operation of the whole substance *cause* the persistence of its parts.
- (4) Upward sustenance: The persistence and cooperation of the substance’s parts *cause* the persistence of the whole.
- (5) Upward power migration: Some (or all) causal powers *migrate* from parts to the whole.
- (6) Teleological subordination: The powers and activities of the parts are teleologically ordered to some end pertaining to the whole.
- (7) Parts as sustaining instruments: The constraints of options 4, 5, and 6 are all jointly realized.

We have already seen reason to reject the first two options. Both Aristotelian Parts-Nihilism and Reverse Mereological Essentialism are inconsistent with Aristotle's Substrate Principle.

There are additional problems with Parts-Nihilism. For example, there is the problem of internal locomotion, such as thought experiments involving spinning homogeneous disks. If substances have literally no parts, what sense can we make of internal locomotion (e.g., the circulation of blood)? Perhaps this can be explained in terms of tropes (particularized properties). For blood to circulate is for spatially located tropes (tropes of redness and liquidity, for example) to change their locations. But this just raises further questions, such as: What is it for a trope to have spatial location? Are there distinct bundles of tropes corresponding to the spatially disjoint subregions occupied by an extended substance? If so, wouldn't these bundles simply be the proper parts of the substance, contrary to the assumption of Parts-Nihilism?

Let's turn then to option 3, the downward sustenance account. On this view, parts of substances actually exist, but the fundamental ground of their persistence is the persistence and material powers of their encompassing substance. (I'll use 'encompasses' as a convenient abbreviation for the converse of 'is a part of': x encompasses y iff y is a part of x). If a part persists from t_1 until t_2 , this is either because the substance persists throughout that period and sustains the existence of the part, or some material power of the substance is exercised at some point in the interval, resulting in the extrusion of the part, endowing upon the part its own, autonomous substantiality.

This option is similar to Reverse Mereological Essentialism, in that both seek to ground the continued existence of the parts in the existence of the whole, but Downward Sustenance involves understanding this dependency in terms of causation, rather than understanding it modally, in terms of the impossibility of the existence of the part in the absence of a whole. On Downward Sustenance, it is possible for the part to exist before or after the existence of the composite, but, while the part is a part of the whole substance, the whole is implicated in the causal explanation of the persistence (through time) of the part.

This account does a good job of explaining the diachronic dependency of the parts on the whole, but it provides no grounds for any dependency running in the opposite direction. Consequently, it can't differentiate hylomorphism from substance dualism. The whole is really separate from its parts.

Let's turn, then, to option 4: the Upward Sustenance account. On this view, the persistence of the whole is causally or metaphysically dependent (at each moment) on the cooperation of its parts.

Option 4 involves thinking of substantial forms as *processes*. The persistence of the whole substance through time is grounded in the cooperation

of its parts in a formal or substance-forming process.⁵ For example, the persistence of a living organism is grounded in the cooperation of its part in the process of an organic life of the appropriate kind. In other words, the existence of the whole substance at any time t is a result of the cooperation of the parts in some formal process in an interval of time prior to and contiguous with t . One added advantage of the Upward Sustenance approach is that it is now no mystery how forms could be individual or particular, since processes are clearly concrete particulars.

Formal processes (to coin a term) have fundamental properties that are temporally extended—irreducible properties of motion and change. The instantaneous properties of the process and its participants are grounded in the temporally extended properties of the process. Thus, Upward Sustenance involves reversing the direction of grounding, when compared with the popular At-At theory of motion and change. The fact that motion is occurring is not grounded in the substance's being located at different places at different times. Instead, the facts of the instantaneous locations of the substance are grounded in facts about the process of motion (e.g., its intrinsic velocity and the place and time of its origin).

If we adopt such a theory of forms as processes, then the principle of Reverse Mereological Essentialism will have a new domain of application: all of the parts of a formal process—its sub-processes and constituent events—will be essentially parts of that very process. No event or process that is numerically identical to one of these parts could exist in any world in which it is not a part of that very process. There is a dependency of part-identity upon the identity of the whole process. So, for example, the very chemical reactions that make up a process of an animal's digesting a meal could not exist except as part of that process of digestion, even if qualitatively and microscopically indistinguishable reactions could.

At the same time, the qualitative features of the formal process as a whole (e.g., the processes of an individual human life) will be grounded in the qualities of and relations among its sub-processes. There is a dependency of the qualities of the whole process upon the qualities and relations of the parts. The qualities of a particular case of digestion will depend on the qualities of and relations among the various chemical reactions and cellular changes that compose it.

The Upward Sustenance account does a good job of anchoring the existence of the whole to the operation of the parts, dispelling worries about the whole's separateness from those parts. However, taken by itself, Upward Sustenance runs the danger of falling into a kind of non-reductive materialism, with the whole substance lacking causal efficacy. All of the causal

⁵ Should the grounding be thought of as causal or metaphysical? The answer to this question depends on whether a composite substance (such as a living organism) could exist for merely an instant. If so, the dependency is merely causal; if not, it must be metaphysical. I am inclined to think that it is impossible for an organism to exist for only an instant, and so I lean toward the metaphysical dependency version of upward sustenance.

work is done by the material parts, which possess all of the fundamental causal power (both active and passive).

Option 5, the Upward Power Migration account, addresses this problem of causal efficacy. On the Upward Power Migration account, proper parts of composite substances actually exist, but they lose many of their active and passive causal powers, making room for new powers that are acquired by the whole substance. Without this migration of powers, the whole would be either epiphenomal or causally redundant.

One major problem with option 5 is that it threatens to entail option 2, Reverse Mereological Essentialism. The nature of a material entity consists in a bundle of fundamental or primary causal powers. If a material part of a new substance were to lose any of its primary powers, it would undergo a change in nature, but this is impossible, given the Aristotelian's commitment to the Unchangeable Nature principle. What it is for any entity to exist is for it to instantiate a certain nature. Consequently, nothing can undergo a change or alteration in nature.

To avoid this entailment, the Power Migration account would have to suppose that the natures and primary powers of the material components do not change when the component is incorporated into or extruded by a composite substance. Instead, each elementary particle would have certain primary *material powers* (to coin another term), that is, powers that, when exercised in combination with suitable powers of other fundamental entities, result in the existence and persistence of a *composite* substance with certain causal powers. In addition, we would have to suppose that the active and passive causal powers of such elementary particles are all secondary powers, powers that result from the exercise of their primary powers in various circumstances. The elementary particle of type *E* would have one set of secondary powers corresponding to its existence as a separate substance, and distinct set of secondary powers corresponding to the status of being a proper part of a certain kind K_p in a composite substance of kind *K*, for every pair of kinds *K* and K_p , such that particles of type *E* can instantiate K_p in things of kind *K*.

For obvious reasons, we don't want Power Migration to leave the elementary parts of a composite substance powerless. We know by observation that parts of living organisms are capable of acting and being acted upon. In fact, we know on empirical grounds that the active and passive powers of the elementary parts of the body are generally close to the powers of similar particles outside of any living body ("in the wild"). This similarity can be the result of a two-way transaction between the parts and the whole: the material powers of the parts ground the primary causal powers of the whole, which in turn grounds the secondary powers of the parts. The resulting secondary powers of the parts are similar (on the microscopic scale) to the secondary powers of similar particles in the wild, but they are ontologically dependent on the primary powers of the whole. They

are, consequently, *numerically* distinct from powers possessed by the same particles when no longer part of the organism.

Powers are individuated by the character of their exercise—that is, by the character of the outcomes they naturally produce. Difference in teleological properties corresponds to such a difference in outcomes. Hence, powers are individuated by their intrinsic teleological character: the very same power cannot be intrinsically ordered (on different occasions) to different ends.

This picture clearly differentiates hylomorphism from any version of materialism, since it implies that every material element has a fundamental nature that anticipates (so to speak) all of the possible kinds of composite substance in which an element of that kind could be incorporated. For example, the powers of charge and mass would not be primary powers of the electron but only secondary ones, brought into being only when the electron's primary material powers are exercised in certain ways. The causal powers of the electron would be to comprise certain secondary powers when it is a separate substance, and a different set of secondary powers when it is incorporated as a proper part of a living organism of kind *K*. This creates the possibility of a fundamental scientific explanation of the facts of material composition.

When elementary particles do compose a living organism, the organism will not be epiphenomenal or redundant, since it will possess primary active and passive causal powers of its own. The material parts will also possess active and passive causal powers, but these will be secondary powers, partly grounded in the powers of the whole. Similarly, any exercise of these secondary powers by the parts will be grounded in an exercise of some corresponding primary power by the whole. The parts will act, but only as *instruments* of the whole.

It is possible that some of the secondary powers of the elementary parts are not at all dependent on the primary powers of the whole organism. For example, suppose that some of the particles in the human body have certain powers of interacting with ambient neutrinos. Let's also suppose that the exercise of these powers has nothing to do with the organic process of human life. If so, it may be that the particles are disposed simply to retain these powers, without any bringing about any dependency of these powers on any power of the whole organism. On the other hand, many of the powers of the parts, such as the gravitational, electromagnetic, and nuclear powers, are clearly relevant to organic functional. Without the power to attract and be attracted by the earth gravitationally, I would be unable to perform many basic activities, such as walking or lying down to sleep.

One advantage of the Powers Migration is that it is consistent with the elemental parts' having active and passive powers that are indistinguishable (at a microscopic scale) from the active and passive powers that those same substances would have when existing in separation from the living body. Empirically, this seems to be generally the case. However, one might object that it is, to say the least, peculiar for the causal powers of the parts to be

dependent on the whole, when they would have exactly similar powers on their own when “in the wild.”⁶ Electrons outside the body have the power to repel each other with a certain force—surely they exercise the very same power when they repel each other as parts of a living body? Why suppose that their powers are dependent on the presence of the whole in the second case, when they clearly exist apart from the whole in the first case?

But do fundamental particles really do the very same things when part of the organism that they do in the wild? It is only because we suffer from a kind of microscopical myopia that we are inclined to think so. Consider the following analogy. I have the power to speak, a power that I can exercise in a Hobbesian state of nature. Now suppose that I am in fact part of a political community that enables me to speak in specifically political settings, such as a jury or a town meeting. Clearly my power of speaking takes on new dimensions thanks to my incorporation into a larger whole. Similarly, electrons are enabled to do things by their inclusion that they couldn't have done in the wild.

Why should the defender of the Powers Migration account think that there is any loss of causal power on the part of the elementary material parts of the substance? Why not just suppose, as some emergentists like Timothy O'Connor have done, that the composite substance acquires powers to act directly upon the substance's elementary particles, while the particles retain their full repertoire of powers? For example, we could suppose that the organism has the power to change the trajectories of certain electrons in the synapses of its brain, with the consequent alteration in macroscopic behavior being the result of a cascade of ordinary microphysical interactions.

The main difficulty with this proposal is that it misidentifies the fundamental powers of the organism. Animals, for example, have the power to act on a macroscopic scale, as guided by sensation and (possibly) rational deliberation. The basic powers of the animal include certain motions of their limbs and head, not the motions of synaptic electrons. If the organism is to be able to move its limbs, there must be some alteration in the powers of the constituent particles of those limbs to prevent them from simply moving themselves. The Powers Migration account does not rule out the possibility that certain particles (when incorporated into the organism) might behave differently (even when judged empirically at the microscopic scale) than they would in an inorganic setting. However, it does not require such microscopic novelty in all cases of holistic action, and when it does occur, it is always a consequence of the exercise of some macroscopic causal power.

Here's another objection to Powers Migration (due to Brian Cutter). The account hypothesizes that the causal powers of the parts are grounded in the powers of the whole organism. However, the causal powers of whole organisms are quite coarse-grained: powers like the power to digest food, or

⁶Thanks to Brian Cutter for raising this objection.

to run, or to build a nest. The powers of the microscopic, elementary parts of organisms, in contrast, are quite fine-grained. The particles collectively have the power to digest particular molecules of food in highly specific ways and rates, to run through a very particular series of muscular and skeletal movements, or to build a nest from specific materials in a very specific arrangement. The latter powers cannot be grounded in the former, since grounding entails necessitation: if a set of powers S grounds a set S^* , then the possession of set S must metaphysically necessitate the possession of set S^* . A class of coarse-grained powers cannot necessitate a class of fine-grained ones.

However, it is far from obvious that the causal powers of a particular organism at a particular time are coarse-grained. It may be that the essence of the organism's species (or natural kind) entails only the possession of certain coarse-grained powers. However, the powers of a particular member of the species are produced jointly by the species-essence and the material powers of the member's actual elementary parts. The exercise of those material powers at each moment determine a set of fine-grained causal powers for the organism, which can in turn ground the secondary causal powers of the parts.

This version of the Powers Migration account does a good job of making the parts dependent on the whole, but it does a poor job of securing any dependency in the other direction. Consequently, the whole still threatens to be an entirely separate entity. A possible solution lies in combining options 4 and 5, resulting in dependency in both directions.

Option 6, teleological subordination, provides an alternative to option 5.⁷ On option 6, the parts are dependent on the whole only by virtue of a metaphysically primitive relation of teleological subordination: by being incorporated into a living organisms, the material parts acquire a teleological ordering to the natural ends or telos of the organism. On option 6, we don't need to talk about the migration of powers or the subsequent dependency of the powers of the parts on the powers of the whole. Instead, the elementary parts retain *all* of their native causal powers.

The obvious problem with option 6 is once again the threat of holistic epiphenomenalism. Can the whole act without its own, ontologically independent causal powers? Non-reductive materialists might respond by urging that we don't need for the wholes to have *independent* causal powers: all that is needed is that they have powers of some kind, even if those powers are wholly grounded in the powers of the parts.

In addition, there is an additional move that the teleological subordinationist can make here: we could suppose that the parts' incorporation into the organism and their teleological subordination to its end does produce new causal powers at the level of the elementary parts, even though these involve no loss of their physical and chemical powers. As I described in

⁷ Thanks to Brian Cutter for suggesting this option (without endorsing it).

the political speech analogy above, the organic context provides particles with new kinds of causal powers: powers to contribute to the organism's functions. These powers are real and are grounded in the nature of the whole. Thus, the whole organism is causally relevant at the ontologically fundamental level, after all.

However, option 6 is merely a sophisticated version of epiphenomenalism. The teleological properties are mere embellishments or decorations of the non-biological facts, pulling no causal weight and making no difference to the physical domain. Given that teleological properties are metaphysically fundamental, there is no reason to suppose that they supervene, even weakly, on the non-teleological properties. A set of properties that do not supervene on the physical realm and that make no causal difference to the presence of physical properties is an inert and ultimately empty addition to reality. It is not necessary that the teleological properties make an empirical difference to the non-teleological realm, but they should have metaphysically fundamental powers with purely physical events among their causal consequences (as option 5 ensures).

The ultimate solution to the set of metaphysical constraints in play is to combine options 4, 5, and 6 into a single account, the Sustaining Instruments theory. On this account, the persistence of the whole is grounded in the ongoing cooperation of the parts, and the active and passive powers of the parts are grounded in corresponding primary powers of the whole. In addition, the whole acts through the parts, as teleologically subordinate instruments.

5 Parts as Sustaining Instruments

Option 7 ties the whole and parts together in such a way that the whole is neither existentially separate from its parts nor able to act in a way that is separate from the actions of its parts. The staunch hylomorphist must accomplish two things: (1) ensure that the persistence through time of the composite whole is grounded in the cooperation of its parts, and (2) ensure that the whole cannot act or be acted upon except, at least in part, doing so "through" the powers of its parts.⁸

The first requirement could be met by supposing that every composite substance at *t* is sustained in existence at *t* by the cooperation of its proper parts. Let's call this the 'Sustenance condition':

⁸ This limitation of active and passive powers is not supposed to exclude the whole organism's potentiality for engaging in internal activities that do not involve any part of the body. For example, Aristotle argues in *De Anima* III that the soul's purely intellectual activities do not require any corporeal organ. For Aristotle, causal powers are always transeunt, rather than immanent: they always involve both an agent and a disjoint patient. An organism can act on another substance and can be acted upon by another only through the instrumentation of its material parts.

Sustenance: For any composite substance x with proper parts the yy 's and any moment t at which the substance exists, the existence of x at t is wholly grounded in the actual persistence of some process P in some interval of time beginning at some instant t_0 and ending at t , which process P is such that its participants from t_0 until and including t are exactly the yy 's (or exactly x itself and the yy 's).⁹

The second requirement could be met by supposing that for each causal power P (whether active or passive) of a composite substance, there is a power P^* of some proper part of the substance such that P^* is at least partly grounded in P . Let's call this the 'Instrumentation condition':

Instrumentation: For any composite substance x , any causal power P of x at any moment t , there is a proper part y of x at t , a power P^* of y at t , such that P^* is at least partly grounded in P , and the exercise of P^* at t would contribute to the natural end of x .

There is a sense in which the whole does interact with its parts; however, this can be distinguished from interactionist dualism because, on PASI (Parts as Sustaining Instruments) theory, the whole acts upon a part only through another part. The whole acts because it has a part capable of acting in a certain way, and the part acts or is acted upon because it plays a certain role in the constitution of the whole.

The PASI account avoids the problem of circularity that afflicts some versions of emergence. There are two kinds of dependency relations: synchronic (occurring in a single instant), and diachronic (the dependency of something at one moment on a thing or things existing at earlier moments). The synchronic dependency is top-down, with the powers of parts grounded in the powers of the whole, while the diachronic dependency is bottom-up, with the later existence of the whole dependent on the earlier activity of the parts. Hence, there is no circularity; instead, the dependency diagram is a zig-zag path, running down at each moment and up as time advances.

Is there an alternative version of hylomorphism that also avoids circularity by reversing the two dependency relations, with synchronic dependency of wholes on parts and diachronic dependency of parts on wholes? This seems to be an unattractive alternative, for two reasons. First, if the elemental parts are dependent for their existence on the past operation of the whole, then it will be difficult to explain how the parts could exist before the whole's generation or after its destruction. There will have to be at

⁹ This definition is consistent with the possibility of a rational soul's survival of the body's death—the human being's intellectual activity may be sufficient to sustain the persistence of the human substance, even in the absence of the organic processes of biological life. While the human being is alive, the substance's persistence is sustained by the process of life in which the material parts participate, but this need not be true after death.

least two different ways of causally explaining the existence of the same microphysical parts. Second, if the powers of the whole are synchronically grounded in the powers of the parts, then it seems that the whole cannot act on the parts, since this would involve some vicious causal circularity, on the plausible assumption that all transeunt action and reaction are instantaneous. The whole would have to act on other things without acting on or through its parts, which would entail that the whole is really separate from its parts.

Composite substances realize a hierarchical structure of functional parts. The secondary powers descend in a stepwise fashion, from top of the lattice structure (the whole organism) to the bottom (the elementary particles). Similarly, the material process by which the whole organism is sustained in existence (together with its accidental properties) rises from the bottom to the top through the same series of functional stages. The intermediate levels consist of dependent parts, to which the Homonymy principle applies, while the lowest level consists of independent parts, the enduring substrate of substantial change. We can define a substance as something that can exist at the top of such a structure:

Definition of substance: x is a substance iff x is unencompassed (i.e., not a proper part of anything).

For Aristotelians, all fundamental causal powers reside with substances. Proper parts of substances have no independent synchronic powers. In contrast, materialists and most substance dualists identify the substances (in this sense) with the mereologically simple.¹⁰

5.1 The PASI Account and the Nature of Composition

The two conditions (Sustenance and Instrumentation) can be built into an answer to Peter van Inwagen's General Composition Question (van Inwagen 1995, 20).

Definition of 'instrument': x is an instrument of y at t iff, for every significant active or passive power P of x , there is some power P^* of y such that P is partly grounded in P^* , and the exercise of P at t would contribute to some natural end of y .

Definition of 'sustaining instrument': x is a sustaining instrument of y at t iff x is an instrument of y at t , and there is some process P and some interval of time t_0 to t such that: (i) x is a participant in P throughout the interval from

¹⁰ As a consequence, materialists have to deny the metaphysical possibility of mereological gunk (material entities with no simple parts), while Aristotelians must deny the possibility of "junk" (material entities with no unencompassed encompassers). For Aristotelians, the existence of composite substances, especially living organisms, breaks this tie. There are clear cases of composite substances, but no clear cases of encompassed substances.

t_0 to t , and at t itself, and (ii) the existence of y at t is wholly grounded in the persistence of P from t_0 to t .

Definition of ‘proper part’: x is a proper part of y at t iff x is a sustaining instrument of y at t .

I will argue that all of the axioms of classical extensional mereology (with the exception of arbitrary sums) are validated by PASI theory. This is an important advantage of PASI theory over substance dualism.

Transitivity is easy and automatic, given the transitivity of grounding. The same is true for the asymmetry of proper parthood, since the grounding relation is also asymmetric.

Sustenance suggests that the PASI mereology will satisfy a strong condition of companionship:

Very Strong Companionship: If x is a proper part of y , then there is some z such that z is a proper part of y , z is not a part of x , and x is not a part of z .

It takes two or more mereologically independent components to sustain the existence of an emergent whole. Any elementary material entity is incapable of realizing, on its own, the sort of complex activity needed to sustain the existence of a living organism. There might be possible worlds where such a thing could happen, but it doesn’t seem that the electrons, quarks, and photons of our world are capable of solo biological activity (unless something like string theory is actually true). However, even if a single elementary entity were capable of such complex activity, it wouldn’t bring into existence a distinct living substance. The one material substrate would simply become a living thing, without undergoing any loss of secondary causal powers. A substance cannot be constituted by a single immediate proper part, since there would then be nothing to trigger that part’s primary capacity to become the mere instrument of a distinct entity. We could call this the “Two to Tango” principle.

The structure of neo-Aristotelian mereology will be treelike, satisfying Mereological Linearity:

Mereological Linearity: x is a part of y , y is a part of x , or x and y are disjoint (non-overlapping).

No entity could be capable of transferring all of its significant active and passive power simultaneously to two mutually independent entities. It is possible for this transfer to occur successively, up a single line of dependency, but nothing can be wholly an instrument of two distinct things, unless one of these is instrumentally subordinated to the other. We could call this the “No Two Masters” principle, after Jesus’s statement in Matthew 6:24: “No man can serve two masters.”

Linearity plus Very Strong Companionship entails Strong Supplementation.

Strong Supplementation: If y is not a part of x , then there is some part of y that does not overlap x .

Suppose y is not part of x . By Linearity, either (i) x is part of y or (ii) x and y are disjoint. In case (ii), y itself is the part of y that is disjoint from x . Consider case (i), and suppose x is part of y . Since parthood is transitive and antisymmetric, x is a proper part of y . By Very Strong Companionship, there is some z that is a proper part of y , z is not a part of x , and x is not a part of z . By Linearity, x and z are disjoint.

It is obvious that Strong Supplementation entails Weak Supplementation.

Weak Supplementation: If x is a proper part of y , then there is some z that is a proper part of y and that doesn't overlap x .

In addition, Strong Supplementation plus the axioms of strict partial ordering (transitivity and asymmetry) entail the Extensionality principle:

Extensionality: if x and y have proper parts, then $x = y$ if and only if they have exactly the same proper parts.

5.2 Additional Advantages of PASI

5.2.1 *The Brain Damage Problem*

Substance dualists have great difficulty in explaining why brain damage can affect the higher mental functioning of a separate soul. In PASI theory, a composite substance does everything it does through material instruments. So, we can explain why brain damage damages mental capacities. We can also explain why the non-human soul ceases to exist at death: death is always a causal consequence of the cessation of the relevant formal process (the soul).

5.2.2 *The Pairing Problem*

Jaegwon Kim (1973) posed the pairing problem for substance dualism: What connects a particular body with a particular soul, in such a way that the body interacts only with that body, and the body only that soul? The counterpart of this problem for hylomorphism is solved by the conjunction of the sustenance and the instrumentation conditions. The organism acts through its parts because they are its instruments, and the parts sustain the whole because they participate in the relevant formal process.

5.2.3 *The Interactive Gap Problem*

How can something non-physical affect something physical? This objection is closely related to the pairing problem: In the case of mind/body interaction, what serves the role of spatial contiguity? How can the non-mental be spatially located?

On the PASI version of hylomorphism, the connection between the whole organism and the parts is one of grounding, rather than causation: the causal capacities of the material parts are grounded in the causal capacities of the whole, and the actions of each part are grounded in actions of the whole. This is not a causal connection.

A certain kind of causal interaction between a whole and one of its parts is possible, but the whole always acts upon one part through some other part (acting as its instrument). So, there is no spatial or categorial ‘gap’ between cause and effect.

5.2.4 *Fission and Fusion Survival Puzzles*

The persistence of an organism is always grounded in the persistence of a formal process (typically, a process of life). Each kind of formal process has a nature or essence that dictates a certain range of possible four-dimensional “shapes.” In particular, forks and reverse forks are shapes that are excluded by these natures: one and the same process of life cannot survive a splitting into two, spatially separated sub-processes, nor can one process have existed in the past while constituted by two such separated sub-processes. Thus, there will always be, at the level of processes, a principled answer in the case of fission as to which one (if any) of the two fission products is identical to the original. Similarly, there will always be a principled answer in the case of fusion as to which one (if any) of the two original organisms survives their fusion.

5.2.5 *Limited Vagueness of Composition*

If the grounding relation and the microphysical facts are determinate, so are the facts about the composition of composite substances. Composition introduces no further dimension of vagueness. If a composite substance is vague in respect of its parts, this must be owing to vagueness at the microphysical level or in the grounding relation.

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