Towards a Neo-Aristotelian Mereology

Abstract:

This paper provides a detailed examination of Kit Fine's sizeable contribution to the development of a neo-Aristotelian alternative to standard mereology; I focus especially on the theory of *"rigid"* and *"variable embodiments"*, as defended in (Fine, 1999). Section II briefly describes the system I call "standard mereology". Section III lays out some of the main principles and consequences of Aristotle's own mereology, in order to be able to compare Fine's system with its historical precursor. Section IV gives an exposition of Fine's theory of embodiments and goes on to isolate a number of potential concerns to which this account gives rise. In particular, I argue that (i) Fine's theory threatens to proliferate primitive *sui generis* relations of parthood and composition, whose characteristics must be stipulatively imposed on them, relative to particular domains; (ii) given its "superabundance" of objects, Fine's system far outstrips the (arguably) already inflated ontological commitments of standard mereology; and (iii) there is a legitimate question as to why we should consider Fine's primitive and *sui generis* relations of parthood and composition to be genuinely mereological at all, given their formal profile. These three objections lead me to conclude that we ought to explore other avenues which preserve the highly desirable, hylomorphic, features of Fine's mereology, while avoiding its methodological and ontological excesses.

I. Introductory Remarks

For more than a quarter of a century,[1] Kit Fine has been engaged in the project of providing a satisfying account of "the general nature of material things", and in particular a response to the question of "how [material things] are capable of having the parts that they do" or "[w]hat in their nature accounts for their division into parts" (Fine 1999, p.61). In an age dominated by the idea that standard mereology in conjunction with a possible worlds analysis of modality yields the metaphysical apparatus necessary to give such an account, Fine's work has stood out as one of the

[1] In a note to "Acts, Events and Things" (Fine, 1982), Fine mentions that the ideas developed there are drawn from a longer manuscript on which he began working in 1976.

lone voices opposing this trend.[2] Through a rich and prolific body of work, Fine urges us instead in a variety of ways and from many different angles to take seriously again the idea of a *structure*-based conception of parthood and composition, which takes its inspiration in particular from the metaphysical systems of Aristotle and Husserl; this mereology is to be embedded within a larger ontological framework incorporating such metaphysically substantive notions familiar to us from these older traditions as *definition*, *dependence* and *essence*, which are conceived of by Fine in not purely modal terms.[3]

The following four strands within Fine's work are thus particularly relevant to the present discussion. First, we observe Fine's gradual movement away from standard mereology and towards a neo-Aristotelian system, beginning especially with the theory of *"qua-objects"* in "Acts, Events and Things" (Fine, 1982), continuing with "Compounds and Aggregates" (Fine, 1994a), and culminating, finally, with Fine's most recent and systematic contribution to non-standard mereology in "Things and Their Parts" (Fine, 1999), whose theory of *"rigid"* and *"variable embodiments"* will constitute the main focus of this essay. "Locke's Thesis" (Fine, 2000) and "The Non-Identity of a Material Thing and Its Matter" (Fine, 2003) develop themes which are subsidiary, but nevertheless central, to the construction of Fine's mereological and metaphysical framework as developed in these essays; in particular the question of whether and in what circumstances numerically distinct objects

[2] A brief synopsis of what I mean by "standard mereology" will be provided in the next section.

[3] In what follows, I will focus on the Aristotelian themes in Fine's work, rather than those that can be traced to the works of Husserl; this emphasis, however, is due only to my own competence and is not intended to reflect any sort of value-judgement on my part concerning the relative importance and fruitfulness of these historical influences on Fine's philosophical evolution. (See for example (Mulligan, 2006) for helpful discussion in this respect.)

can coincide spatiotemporally.

Secondly, we find Fine's simultaneous deep engagement with the historical precursors of his contributions to contemporary metaphysics. Fine's reading of Aristotle is developed in "Aristotle on Substance" (Fine, 1983), "Aristotle on Matter" (Fine, 1992), "A Puzzle Concerning Matter and Form" (Fine, 1994c), "The Problem of Mixture" (Fine, 1995c) and "Mixing Matters" (Fine, 1998), an abridged version of Fine's conception of Aristotelian mixtures; "Part-Whole", Fine's entry in the *Cambridge Companion to Husserl* (Fine, 1995b), for example provides a sample of his take on Husserl.

Thirdly, the construction (and the investigation of the central principles underlying the construction) of a larger ontological framework which incorporates Aristotelian and Husserlian influences by embracing particular conceptions of such metaphysically substantive, and arguably not purely modal, notions as *definition*, *dependence* and *essence*, is pursued especially in "The Study of Ontology" (Fine, 1991), "Essence and Modality" (Fine, 1994b), "Ontological Dependence" (Fine, 1995a) and "The Question of Realism" (Fine, 2001).

Finally, however, as I will try to bring out below, there is also recognizable within Fine's broader metaphysical stance what one might characterize as a more deflationary and possibly relativistic strand, which might seem to take the bite out of the substantive Aristotelian and Husserlian notions introduced and developed in the remaining body of work; this trend is foreshadowed for example in some remarks towards the end of "Acts, Events and Things", and is taken up again in "Things and Their Parts", where the possibility is entertained that the formal component of a hylomorphic whole is *conceptual* in nature (see Fine 1982, 103ff) and (Fine 1999, 73ff)). Fine's current work on postulation, I take it, is intended to address the potential conflicts

between this seemingly more permissive ontological stance and the emphasis on the development of a metaphysically rich and constrained perspective in the remainder of his work; of relevance in this context are for example "Our Knowledge of Mathematical Objects" (Fine, 2005) and "Relatively Unrestricted Quantification" (Fine, 2006).

The structure of this paper will be as follows. I begin in Section II with a brief exposition of the main tenets of standard mereology, insofar as they are relevant to the purposes of contrasting more mainstream approaches to mereology with Fine's own conception. Next, in Section III, I present some of the highlights of (my own take on) Aristotle's mereology; the primary goal of this section is to provide just the necessary background required to appreciate the ways in which Fine's own mereology adheres to and diverges from the Aristotelian model. Finally, in Section IV, I turn to a detailed examination of Fine's theory of embodiments, as presented in (Fine, 1999), and indicate what I take to be the strengths and weaknesses of this proposal.

II. Standard Mereology

One prominent answer to the question of what the correct theory of parthood and composition is for material objects, which has been embraced by *three-dimensionalists* and *four-dimensionalists* alike,[4]

[4] *Three-dimensionalism* (also known as *"endurantism"*) and *four-dimensionalism* (also known as *"perdurantism"* or *"the doctrine of temporal parts"*) are competing theories concerning the *persistence* of ordinary material objects over time. (According to the four-dimensionalist, objects persist over time by *perduring*, i.e., by having temporal parts, in addition to their ordinary spatial parts, at all those times at which they exist. The three-dimensionalist, on the other hand, holds that ordinary material objects persist by *enduring*, i.e., by being, as they say, "wholly present" at each time at which the object exists. For detailed discussion and references, see (Sider, 2001).) From a three-dimensionalist perspective, perhaps the most well-known defense of the thesis that material objects are standard mereological sums can be found in Judith Jarvis Thomson's influential article, "Parthood and Identity Across Time" (Thomson, 1983); see also (Thomson, 1998)); among the main representatives of this approach within the four-dimensionalist tradition are David Lewis (see

is that these objects are best viewed as *"mereological sums", "fusions"* or *"aggregates"*, according to a particular, standard, conception of mereology, viz., the family of systems referred to in (Simons, 1987) as *"Classical Extensional Mereology"* or (CEM).[5]

(CEM) is a very simple, elegant and surprisingly powerful theory. It requires only a single primitive notion in terms of which the remainder of the mereological concepts utilized by the theory can be defined. In its standard formulations, (CEM) consists of a mere three axioms; all other statements of the theory follow as theorems from the definitions and axioms of the system. The single primitive can be chosen to be proper parthood, proper or improper parthood, overlap, disjointness or sum; the other notions are definable in terms of whichever one is taken as primitive. Identity is either assumed as given or (more controversially) as definable in terms of the primitive mereological notion. Algebraically speaking, while parthood is a mere partial ordering, (CEM) has the strength of a complete Boolean algebra, with the zero element deleted.

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especially (Lewis, 1986) and (Lewis, 1991)) and, more recently, (Sider, 2001). The dispute between three-dimensionalists and four-dimensionalists will not be pursued directly within the present inquiry; Fine's discussion is conducted within a three-dimensionalist framework (see also (Koslicki, 2003) for discussion).

[5] The first formulation of (CEM) appears to have been given by Stanislaw Leśniewski, informally in (Leśniewski, 1916) and formally in (Leśniewski, 1927-1930), though Simons speculates, based on some remarks by Russell in 1914, that Whitehead's mereology may actually have been developed not only independently of Leśniewski's but may also have preceded it (cf. (Russell, 1914), (Simons 1987, 82)). The classical statement of (CEM) in English, using the language of first-order predicate-logic, is Henry Leonard and Nelson Goodman's *"Calculus of Individuals"* (Leonard & Goodman, 1940). The first version of the Calculus of Individuals appeared in 1930 in Leonard's doctoral dissertation. The (Leonard & Goodman, 1940) Calculus of Individuals is formulated with appeal to set-theory, as is Tarski's version of (CEM) in (Tarski, 1937) and (Tarski, 1956); but a nominalistic formulation of the same theory, in which reference to sets is replaced by reference to predicates, is given in (Goodman, 1977). Mereology can also be formulated by means of plural quantification, as illustrated for example in (Lewis, 1991) or (van Inwagen, 1990) and (van Inwagen, 1994).

In terms of parthood and overlap, the notion of a mereological sum (aggregate/fusion) for example can be defined as follows:

Definition of "Mereological Sum": s is a *mereological sum* of some objects, $x_1 \ldots x_n$, just in case s has all of $x_1 \ldots x_n$ as parts and has no part that does not overlap any of $x_1 \ldots x_n$.

A very accessible formulation of (CEM), which is slightly different from, but formally equivalent to, that of (Leonard & Goodman, 1940), is given in (Lewis, 1991), where the three basic axioms of standard mereology are stated informally as follows:

Axiom 1 (Unrestricted Composition): Whenever there are some objects, then there exists a mereological sum of those objects.

Axiom 2 (Uniqueness of Composition): It never happens that the same objects have two different mereological sums.

Axiom 3 (Transitivity): If x is part of some part of y, then x is part of y.

Given Unrestricted Composition and the Uniqueness of Composition, we can now see that mereological sums are in certain respects analogous to sets: by Unrestricted Composition, there is a sum whenever there is a plurality of objects (*any* plurality), just as there is a set for any plurality of objects (modulo the paradoxes); and by the Uniqueness of Composition, the identity of a sum depends on nothing more than the identity of its parts, just as (by the Axiom of Extensionality) the identity of a set depends on nothing more than the identity of its members. However, sums and sets are not obviously alike in all respects, since standard mereology makes no room for a distinction analogous to that between subset and membership, given that all the entities quantified over in standard mereology are of the same ontological type, viz., the type, *individual*; thus, standard mereology only recognizes a single sum that can be formed from any given plurality of individuals.

As will become apparent in what follows, among Fine's main motivations in developing alternative approaches to parthood and composition is to endow our mereological vocabulary with the capacity to represent structural differences analogous to those between, say, the sets $\{a, b\}$ and $\{\{a\}, \{b\}\}$, which are numerically distinct despite the fact that they are in some sense formed from the same basic constituents; parthood, on Fine's conception, is thus to be likened more to the relation of set-*membership*, than to the *subset*-relation, to which it is formally analogous according to standard mereology.[6]

III. Aristotle's Mereology

Aristotle's works do not include a separate treatise devoted exclusively to the discussion of mereology as such. However, applications of the notions of "part", "whole", and related mereological concepts are ubiquitous throughout the Aristotelian corpus: witness for example the mereological technical vocabulary Aristotle employs in the *Prior Analytics* and the *Posterior Analytics* to distinguish *particular* statements from *universal* statements (viz., "κατὰ μέρος" or, literally, "with respect to the part" and "ἐπὶ μέρους", or, literally, "over" or "by the part", are his technical terms for "particular"; "καθόλου" or, literally, "according to the whole", is his technical term for "universal"). With the exception of a few scattered remarks here and there (e.g., in the *Categories*, *Topics*, and *Physics*), the only extended examination of the concepts, "part", "whole" and related notions as such is confined to the *Metaphysics*; and, within the *Metaphysics*, especially

[6] However, the analogy between parthood and the membership-relation is, in Fine's view, only that, an analogy; thus, we should not read Fine as believing that the membership-relation can be defined in terms of parthood; rather, if anything, the direction of analysis, in his view, is reversed: parthood for set-theoretic objects can be defined as the ancestral of the membership-relation.

to Book Δ, the "Philosophical Lexicon". Assuming that the "Philosophical Lexicon" in Book Δ collects together concepts which occupy some sort of privileged role in an understanding of Aristotle's views (on any subject), it is a good indication of the centrality of mereological concepts to Aristotle's philosophy that the entries on "part" and "whole", in Δ.25 and Δ.26 respectively, implicitly or explicitly rely upon almost every single other entry in Book Δ (e.g., those in Δ.1, 2, 3, 4, 6 and 8, on "one", "principle", "cause", "element", "nature" and "substance"). The notions, "part" and "whole", are also listed by Aristotle in *Met*. Γ.2 as among the attributes of *being qua being* (along with the different senses of "same" and "other", "prior" and "posterior", "genus" and "species", and the like). Since both of the concepts, "part" and "whole", are, in Aristotle's view, intimately tied up with that of *"one"* ("τὸ ἕν", also translated as "unity"), it is not surprising that the study of parthood and composition would be included among the responsibilities of those who are concerned with the study of being qua being, given the close connection Aristotle draws in Book Γ between being and unity.

Despite the relative brevity and density of Aristotle's remarks in *Met*. Δ.25 and Δ.26 on mereology proper, the resulting system is remarkably subtle and wide-ranging in its application. In what follows, I focus primarily on those features of Aristotle's mereology which will help us discern the Aristotelian influences within Fine's conception of parthood and composition as well as the ways in which Fine departs from the Aristotelian model and aligns himself at times more closely with a Platonic approach. In some cases, as I will suggest below, Fine's departures from Aristotle are in fact detrimental to his system, while in other cases Fine in effect remains overly faithful to his Aristotelian roots and thereby opens himself up to difficulties to which Aristotle's system is also susceptible; a judicious approach therefore recommends itself in choosing our allegiance to these

ancient mereologies. In particular, I want to isolate the following four features with respect to which the Aristotelian influence, or the absence thereof, within Fine's work on mereology is especially significant.[7]

First, like Aristotle, Fine develops a conception of mereological and related notions, such as that of constitution, which is extremely widely applicable across domains of both material and abstract objects; in Fine's case, for example, the theory of embodiments is at least in principle suitable not only for an analysis of material objects, such as ham sandwiches, but also for that of acts and events, such as Oswald's killing of Kennedy, as well as abstract objects, such as the "law of the land". The range of entities to be covered by Aristotle's mereology is similarly broad and includes within its scope, among other things, numbers, universals, definitions, liquids, bundles of wood, as well as shoes and human beings.

Secondly, like Aristotle's, Fine's conception of parthood and composition is "sparse" and hierarchical, in the sense that not every arbitrary dividing up an entity can be expected to result in a division into *parts*; correspondingly, both systems make room for a distinction between *"vertical"* and *"horizontal"* parts, according to which for example the trunk, branches and leaves of a tree might count as horizontal (but not vertical) parts of the tree, while the wood which composes the tree might count as a vertical (but not a horizontal) part of the tree; this second feature is of course closely related to the likening of parthood to the relation of set-membership, rather than the subset-

[7] The very condensed statement of the main features of Aristotle's mereology given in the remainder of this section represents my own take on the relevant texts, rather than Fine's (see especially (Fine, 1983, 1992, 1994c, 1995c, 1998). Since our present focus is primarily on Fine's theory of embodiments, as developed in (Fine, 1999), I unfortunately cannot now take up the question of where our respective readings of Aristotle differ and converge with one another. (See also (Smith & Mulligan, 1982) for useful discussion of Aristotle's mereology, especially in view of its influences on more recent mereologies.)

relation, mentioned above.

Thirdly, in contrast to standard mereology, both systems emphasize the need to take into consideration not only the question of whether the parts of a given whole are *spatiotemporally proximate* to one another, but also how they are *arranged*: in fact, not only do both systems analyze material objects as compounds of matter and form, but both take the matter as well as the form to be literally *part* of the compound in which they are present; Fine emphasizes in several of his works that he finds the *mereological* aspect of Aristotle's hylomorphism to be generally underappreciated.

Finally, however, we find Fine in effect adopting a conception of structure which is closer to the Platonic, rather than the Aristotelian, model: as has recently been helpfully brought out in Verity Harte's excellent study of Plato's mereology, *Plato on Parts and Wholes: The Metaphysics of Structure* (Harte, 2002), structure tends to be characterized by Plato as something that is *mathematically expressible* (e.g., number, measure, ratio, proportion and the like), which Harte associates for example with "limit" in the *Philebus* as well as with geometrical proportions in the *Timaeus*; content (or that which is being configured in these mathematically expressible ways), on Harte's reading, is represented by the "unlimited" in the *Philebus* as well as the "receptacle" and the four elements in the *Timaeus*. Since *any* plurality of objects whatsoever can be viewed as standing in *some* mathematically expressible relation to one another, any restriction on composition within Plato's system must be derived from the centralized, and at times explicitly theological, teleology to which he commits himself in the form of the divine demiurge. In contrast, Aristotelian forms, unlike Platonic structure, in most cases cannot be captured in purely mathematical terms; rather, Aristotelian forms have built into them their own localized teleological content, tailored to the particular kind of object at issue and its characteristic activity. In this vein, for example, a house is

defined in *Met*. H.2 as bricks, stones and timbers (the matter) arranged in such a way as to provide a covering for bodies and chattels (the form and end). It is the Platonic, rather than Aristotelian model of structure (minus the teleology), which is on my reading of Fine to a large extent responsible for the ontological permissiveness associated with the fourth, and potentially relativistic, aspect of Fine's broader metaphysical stance, mentioned in Section I above.

Without going into the kind of detail that would be required to give a proper justification and a detailed development of my reading of these texts,[8] I take the main results of Aristotle's entries on "part" and "whole" in *Met*. Δ.25-26 to be the following. Δ.25 tells us that "part", in typical Aristotelian manner, is spoken of in many ways, namely in particular in the following five ways. (1) The sense in which a given quantity has among its parts all of the subquantities into which it can be *arbitrarily* divided; according to this sense of "part", for example, two, in Aristotle's view, is part of three.[9] (2) The sense in which a given quantity has among its parts all of the subquantities into which it can be *non-arbitrarily* divided; according to this second sense of "part", two is not part of three, but might instead by considered to be part of four. (3) The sense in which kinds have as parts the further subdivisions that fall under them; thus, the species, human being, for example is part of the genus, animal, according to this third sense of "part". (4) The sense in which the matter (e.g., the bronze) as well as the form (e.g., the characteristic angle) are both said to be part of a

[8] The current discussion is drawn from Chapter V of (Koslicki, 2006a), where the requisite detail and elaboration is provided.

[9] I take this first sense of "part" to be the closest analogue to a (CEM)-style notion of parthood within Aristotle's system.

matter/form-compound (e.g., a bronze sphere);[10] this fourth sense of "part" brings out the *mereological* aspect of Aristotle's hylomorphism, which is taken very seriously in Fine's work.[11] (5) The sense in which the parts of form are the parts of definition (viz., genus and differentiae); in this sense, for example, the genus, animal, is part of the species, human being, which is defined in Aristotelian manner for example as rational animal.

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[10] Among Aristotle's gravest complaints against Platonic forms is that they are incapable of playing the explanatory and causal roles they are intended to play, since they are too far removed, so to speak, from the objects which they are supposed to reach; moreover, the relation by means of which the connection between Platonic forms and sensible particulars is supposed to be established, viz., that of "participation", in Aristotle's mind, remains too obscure to accomplish this task. As a result, Aristotle has a particular interest in locating the principles that are causally and explanatorily active *"in"* the objects whose behavior and characteristics they are intended to explain. Aristotle's anti-Platonist strategy is generally aided by a *mereological* analysis of the relevant senses of "in", wherever possible, since he otherwise implicitly or explicitly opens himself up to a need for his very own population of primitive mysterious "participation"-relations.

[11] Even though Aristotle explicitly says in Δ.25 that a matter/form-compound has both its matter and its form among its parts, this commitment to an explicitly mereological form of hylomorphism nevertheless seems to conflict with some of Aristotle's pronouncements in other passages; in particular, it depends on a reading of the regress-argument in *Met*. Z.17 (1041b11-33) which does not conflate "part" with "element". According to this reading of Z.17, Aristotle only cautions us, on pain of regress, not to view form as an *element* in the compound, alongside the matter, as this would eliminate the desired contrast between matter/form-compounds and heaps. Rather, form, as the regress-argument seeks to establish, belongs to a distinct ontological category (viz., that of *principle*, rather than element); this move in itself, however, does not preclude taking form to be *part* of the compound. Moreover, I also read Aristotle as being committed to the view that form and matter are part of a matter/form-compound, according to the *same* sense of "part"; I infer this aspect of Aristotle's mereological hylomorphism not only from his formulation of the fourth sense of "part" in Δ.25 cited above, but also from what I take to be his endorsement, in Z.17 and other places, of what (Simons, 1987) calls the *"Weak Supplementation Principle"* or (WSP), according to which a whole cannot have just a single proper part: for example, at Z.17, 1041b22-23, Aristotle says, "while if it [the unified whole] is a compound, clearly it will be a compound not of one but of many (or else it will itself be that one), ...". If the sense of "part", according to which the matter is part of a compound, were distinct from the sense of "part", according to which form is part of the compound, Aristotle would be committed to a double violation of (WSP), viz., a compound which is twice around composed of only a single proper part, viz., of matter in one sense of "part" and of form in another. (WSP) will figure importantly in our discussion of Fine's theory of embodiments below. I offer a detailed reading of *Met*. Z.17 in (Koslicki, 2006b).

Δ.26, similarly, specifies different ways in which "whole" may be spoken of, namely in particular as "that from which is *absent* none of the parts of which it is said to be naturally a whole" and as "that which so contains the things it contains that they naturally form a *unity*" (1023b26ff; my emphasis).[12] Moreover, as Aristotle points out in the second half of Δ.26, some mereologically complex entities are such that the *position* of their parts makes a difference to their existence and identity, while others can have their parts shuffled around and rearranged without thereby ceasing to exist: the former are identified by Aristotle as wholes, the latter as "totals".[13]

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[12] The direct quotations from the text come from W.D. Ross' translation (see (Barnes, 1984). As (Harte, 2002) makes clear, Aristotle already had a very rich tradition of mereological ideas to rely on in Plato's writings, particularly in the *Theaetetus*, *Parmenides*, *Sophist*, *Philebus* and *Timaeus*. Among the many suggestions on parts and wholes entertained and elaborated by Plato, which Aristotle must have found attractive, are, first, the close connection Plato discerns between "part" and "measure" (especially in the *Theaetetus*); and, secondly, the characterization of wholes, suggested by the adjectival use of of the term (as in "Save the *whole* cake for me!"), as "that from which no part is lacking" or "that from which nothing is absent" (see, e.g., *Tht*. 205a4-7 and *Parm*. 137c7-8; Harte's translations). Both of these ideas are taken up, expanded and incorporated into Aristotle's mereology. Plato ascribes to wholes the following characteristics: they are (i) genuinely *unified* or *one*, despite their many parts; (ii) ontologically *loaded*, i.e., in no sense numerically identical to their parts; (iii) governed by a *restricted* sense of composition; (iv) comprised of the two components of *"structure"* and *"content"*; (v) ontologically *"prior"* to or more *"basic"* than their parts; and (vi) inherently *intelligible* and the *proper objects of science*. Aristotle is generally sympathetic to the Platonic outlook, especially with regards to matter/form-compounds and especially with respect to features (i)-(v); but he differs with Plato over many of the details. In some cases, Aristotle's more nuanced approach avoids certain of the downfalls of Plato's theory; in other cases, however, the added complexities introduced by Aristotle actually lead to further complications of their own. For a detailed discussion of Plato's and Aristotle's mereology, see (Koslicki, 2006a); see also (Koslicki, 2004b) for a condensed statement of my take on Harte's reading of Plato.

[13] I take totals to be the closest equivalent within Aristotle's system of (CEM)-style mereological sums; he cites as examples for totals water, and all liquids, as well as number. What underlies these examples is, first, Aristotle's non-atomic conception of the so-called "simple bodies" (i.e., earth, air, fire and water) and everything that is made out of them on the next higher level of composition (i.e., the so-called "homoiomerous substances", e.g., flesh, bone, marrow, blood, etc., as well as what he calls here the "liquids", i.e., wine, oil, and the like), which he views as being actually divisible only into parts of the same kind; since the elements of which these substances are made are present in the mixture only potentially, every actual division of, say, flesh will yield more

I extract from Δ.26 the following three criteria governing Aristotelian wholes. (1) *Completeness*: Paradigmatic Aristotelian wholes are *complete* or *unmutilated* specimens of a kind, i.e., they do not lack any of the *important* parts, by some standard of importance, required for the characteristic activity performed by wholes of the kind in question; thus, Aristotelian wholes are normatively and teleologically loaded. (2) *Unity*: The parts of a whole must be held together and made *one* by some principle of unity, though principles of unity may come in many different varieties and strengths, ranging from something as pedestrian as a bit of glue to something as ephemeral as a mathematical ratio or a measure of qualitative similarity; in this way, since they furnish us with a mechanism of collecting together many objects under a single qualitative heading, even universals (no doubt at least in part due to the etymological connection brought up earlier between the Greek word for "whole", "ὅλος", and Aristotle's technical term for "universal", "καθόλου") are considered by Aristotle to be wholes, though arguably in a merely derivative sense. (3) *Position*: Finally, a mereologically complex object qualifies as a whole, rather than a total, if the *position* of its parts, i.e., which part goes where in the arrangement of parts, makes a difference to its existence and identity.

Since Aristotle takes the notions of "one" and "many", and hence those of "part" and "whole" as well, to be implicitly *relativized*, as is characteristic of the central notions of Aristotle's metaphysics, a single object can, without contradiction, be both one (or indivisible into parts) according to one measure and many (or divisible into parts) according to a different measure: thus, "ab", for example, would be taken by Aristotle to be one with respect to the measure, syllable, but

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flesh. Secondly, Aristotle conceives of number, in characteristic Greek manner, as an aggregate of discrete "ones" or "units", each of which in itself is not a number.

many with respect to the measure, letter. Moreover, wholeness in Aristotle's view turns out to be a notion of *degree*, depending on the strength of the particular principle of unity which is at work in holding together the parts of an object, "wholeness being in fact a sort of oneness" (1023b35). The strongest principles of unity are those which result in wholes that are *continuous* (in the sense that their parts share boundaries) and, among those, the champion is *form*: wholes that are unified by a single form achieve such a high degree of unity that, in a particularly radical turn of Aristotle's theory, they in fact do not have any parts at all *actually*, but do so only *potentially*. His distinction between potentiality and actuality is among the main innovations Aristotle brings to bear on the Platonic theory of parthood and composition; along with the closely associated Homonymy Principle (according to which, say, a severed hand is a hand "in name alone"), this powerful device accounts for much of the teleological and normative content that characterizes high-level Aristotelian wholes, i.e., matter/form-compounds.

Thus, given the five senses of "part" outlined in Δ.25 and the three criteria for wholeness derived from Δ.26, I read Aristotle as in effect proposing the following ranking of mereologically complex objects according to the degree of unity (or lack thereof) exhibited by them:[14]

(1) **Wholes as Forms** (Definition = genus + differentia)

(2) **Wholes as Matter/form-compounds:** (high-level wholes)

(2.1) Continuous Compounds:

[14] The examples given in the following figure are, wherever possible, drawn directly from the text (though not necessarily just from Δ.25-26); some (viz., ivy growing around a tree trunk) are supplied by me; in the case of the category I call "natural discrete compounds", I am unsure , as indicated by the question-marks, of what would constitute a suitable case in point.

(2.1.1) Natural (Socrates)

(2.2.1) Artificial (shoe)

(2.2) Discrete Compounds:

(2.2.1) Natural (???)

(2.2.2) Artificial (music, language)

(3) **Wholes as Heaps:**[15] (lower-level wholes)

(3.1) Natural Heaps (ivy growing around tree trunk)

(3.2) Artificial Heaps (bundle of wood)

(3) **Wholes as Universals** (human being, animal, living thing)

(4) **Totals** (numbers, liquids)

The preceding remarks have shown Aristotle's ontology to be mereologically nested in multiple complex ways and to extend over an enormous range of entities. In view of the detailed discussion of Fine's theory of embodiments which is to follow below, it will be instructive to point to a particular difficulty to which the ambitious scope and sheer complexity of Aristotle's system gives rise, since we will encounter a similar difficulty resurfacing again with respect to Fine's mereology.

According to Aristotle's account of parthood and composition, we know that high-level wholes, i.e., matter/form-compounds such as Socrates and Coriscus, have among their proper parts

[15] Even heaps, on my reading of Aristotle, count as wholes to *some* degree, though wholes which exhibit a decidedly lesser degree of unity than those which precede them in the ranking proposed above: for even heaps are mereologically complex objects which exhibit some measure of unity (e.g., the sharing of spatial boundaries among their parts), though not of course the kind of high-level unity that is induced by the presence of form in matter/form-compounds. (Thus, the contrast Aristotle has in mind in the regress-argument in Z.17, on my reading, is that between heaps and *high-level* wholes, i.e., matter/form-compounds; not that between heaps and wholes *tout court*.)

their form and their matter. Form, in the guise of definition, in turn is said to be composed of a genus and a differentia; in this case, rational and animal. Thus, by the transitivity of parthood, Socrates and Coriscus apparently have among their proper parts the genus, animal, and the differentia, rational. However, Socrates and Coriscus, as individual human beings, are also themselves proper parts of the species, human being, which in turn is a proper part of the genus, animal. Thus, it appears to follow from Aristotle's account not only that the genus, animal, turns out to be a proper part of Socrates and Coriscus, but also, contra the *asymmetry* of the proper part-relation, that Socrates and Coriscus turn out to be proper parts of the genus, animal, as well. At the same time, of course, Aristotle would not want to *identify* Socrates and Coriscus with each other or with the genus, animal, which after all also has among its parts lots of other individual human beings, along with all the other living things that are animals, i.e., the dogs, birds, horses, and the like. Nor should it turn out, by the transitivity of parthood, that Socrates is a *proper part* of Coriscus or, vice versa, that Coriscus is a proper part of Socrates. Something clearly has to give.

Aristotle has several options at this juncture. First, he could reject certain of the formal properties of the part-relation, such as the *transitivity* of parthood or the *asymmetry* of proper parthood. Since I take it to be highly plausible, following (Simons, 1987), that these properties are among the non-negotiable minimal formal core of the part-relation, I consider this first option to be quite unattractive.

Secondly, Aristotle could argue that the above line of reasoning turns on *mis-identifying* some of the members of the purported chain of mereologically nested entities, which eventually leads to trouble with the formal properties of parthood. For example, he could propose in this connection that form, in the sense in which it is a proper part of any matter/form-compound, is *not* to be

identified with definition. Given that, for other reasons, the mereological status of form within Aristotle's system is in fact extremely problematic,[16] I take this second option to be Aristotle's best bet, though it is not one he could endorse lightly, given the epistemic and other pressures he feels, in many contexts (such as *Met*. Z), to identify form with definition.

Thirdly, Aristotle could resolve the above difficulty by suggesting that the sense of "part" in which, say, form is part of an individual human being is not the same sense as that in which, say, Socrates is part of the species, human being: in other words, according to this proposal, Aristotle might reject the claim that the purported chain of mereologically nested entities identified above is in fact chained together by a single relation of parthood. Although this is a live option, it ultimately leads to a proliferation of primitive, *sui generis* relations of parthood and composition, whose formal characteristics must be explicitly imposed on them, and related to one another, by means of distinct bodies of postulates; our discussion of Fine's theory of embodiments below will illustrate the potential costs associated with this sort of strategy.

IV. Fine's Theory of Embodiments

I now turn to a detailed examination of Fine's theory of embodiments. In Fine's view, an adequate analysis of ordinary material objects calls for new, *sui generis*, relations of composition;

[16] The status of form within Aristotle's mereology is problematic, due mainly to the following apparent regress. If form (in the guise of definition) itself has parts and all mereologically complex objects that are genuinely unified must have their parts held together by some principle of unity (as Aristotle seems to assume), then what, if anything, could act as the *further* principle of unity holding together the parts of form? Unless this quandary can be put to rest in some way, either by meeting it head-on or by rejecting some of its presuppositions, the unity of form is called into question and, with it, also that of matter/form-compounds, and possibly other entities within Aristotle's ontology, which depend on form as their source of unity.

it cannot be couched in terms of the more mainstream, (CEM)-style conception, according to his conception, because the conditions of existence, spatiotemporal location, and part-whole structure of ordinary material objects simply do not match those of standard mereological sums. In fact, once Fine brings to our attention just how blatantly ordinary material objects diverge from standard mereological sums with respect to their conditions of existence, location and part-whole structure, one wonders how the standard conception could ever have had such a powerful hold on the minds of so many philosophers. Whatever the psychological, historical and sociological reasons for this curious preference for austerity, it is high time that we follow Fine's lead and look towards alternative conceptions of composition which are not blind to certain obvious features exhibited by ordinary material objects; such alternative conceptions will turn out to have much closer affinity to those developed more than two-thousand years ago by Plato and Aristotle than they do to those which enjoyed popularity in the twentieth century (see also (Johnston, 2002) and (Koslicki, 2006a) for related frameworks). Below, I lay out Fine's reasons for parting ways with the standard conception; I consider these reasons to be utterly persuasive and fatal to the standard conception. In the later sections of this essay, I turn to a detailed discussion of Fine's own positive proposal and point out some possible trouble-spots.

IV.1 Parting Ways With the Standard Conception

Fine's main motivation for the introduction of new primitives is that he believes extant conceptions of parthood to suffer from the following two shortcomings: (i) they are committed, first, to an *"aggregative"* or *"disjunctive"* conception of parthood, which assigns the wrong conditions of existence and spatiotemporal location to ordinary material objects; and (ii) secondly, even when

patched up in certain obvious ways, they misrepresent the part-whole structure of ordinary material objects, as brought out by what Fine calls the *"monster-objection"*. (The second, but not the first, objection applies to Fine's earlier conception of parthood, as developed in (Fine, 1994a), as well.)

IV.1.1 The "Aggregative Objection"

Fine's first objection is stated in the following passage:

> ...[O]n [the standard, "aggregative"] understanding, a sum of material things is regarded as being spread through time in much the same way as a material thing is ordinarily regarded as spread out in space. Thus the sum a+b+c+... will exist *whenever* any of its components, a,b,c,..., exists (just as it is located, at any time, *wherever* any of its components are located). It follows that under the proposed analysis of the ham sandwich, it will exist as soon as the piece of ham or either slice of bread exists. Yet surely this is not so. Surely the ham sandwich will not exist until the ham is actually placed between the two slices of bread. After all, one *makes* a ham sandwich; and to make something is to bring into existence something that formerly did not exist. (Fine 1999, 62))

Fine has in mind the following problem. Suppose, for example, the ham sandwich is analyzed as a standard mereological sum, $s=s_1+s_2+h$, consisting of two slices of bread, s_1 and s_2, and a slice of ham, h. Given the standard conception of parthood and mereological composition, it seems that we will thereby have assigned to the ham sandwich simply the wrong conditions of existence and spatiotemporal location, at least if we take our ordinary beliefs and utterances about such objects as ham sandwiches as a guide. For a mereological sum, according to the standard conception, exists wherever and whenever *at least one* of its parts does. Thus, if the slice of ham, h, comes into existence at time, t, before the two slices of bread, s_1 and s_2, have come into existence, and h is

located at t in the spatiotemporal region, p, then the mereological sum, $s=s_1+s_2+h$, also exists at t, in the region, p, occupied by h, and has as parts all and only the parts of h: for the mereological sum, s_1+s_2+h, according to the standard conception, is that object, s, which has as parts all and only the parts of s_1, s_2 and h; since only h exists at t, the parts of s at t simply are the parts of h at t. But we would not ordinarily say that the ham sandwich has already come into existence at t, when the two slices of bread have not yet come into existence. Of course, we would ordinarily also not say that the ham sandwich has come into existence, even when all of s_1, s_2 and h already exist, unless s_1, s_2 and h were *arranged* in a characteristically sandwich-like manner, with h being between s_1 and s_2. Thus, as far as ordinary material objects are concerned, it is not enough simply to tack onto the standard conception of parthood the requirement that the parts of a sum must all exist at the same time in spatiotemporal proximity to one another; the parts must also be arranged in certain specific ways, depending on the kind of object at hand.

IV.1.2 The "Monster Objection"

Fine's second objection, the "monster-objection", is precisely a way of bringing out why simply tacking on an additional requirement of spatiotemporal cohabitation is not sufficient to turn the standard conception of parthood into one that becomes useful for an analysis of ordinary material objects. The problem Fine points to in this objection is the following. Consider an *extended* sense of parthood, according to which, for any two objects, o_1 and o_2, o_1 is (in the extended sense) part of o_2 if the *restriction*, $o_{1\text{-restr}}$, of o_1 to the times at which o_2 exists is (in the unextended sense) a part of o_2, i.e., $o_1 <_{ext} o_2$, if $o_{1\text{-restr}} < o_2$. The extended notion of parthood provides a way, so to speak, of cutting out, by brute force, the spatiotemporally non-cohabiting parts of an object from the

mereological sum it helps to compose. We may thus wonder what the merits of such a notion are for the analysis of ordinary material objects, since a proponent of what I have been calling "the standard conception" may well take this extended notion of parthood to be sufficiently close to the original one to feel that his approach can salvaged after all. Fine's "monster-objection" shows why this won't work:

> In any case, the proposed sense of part will not deliver the correct results. Consider the sum of the ham and Cleopatra or, more dramatically, the sum of the ham and all objects that existed only before or after the ham sandwich existed. Then the restriction of this sum to the time the sandwich exists is the same as the restriction of just the ham and hence must also be a part of the sandwich. But it is ludicrous to suppose that this monstrous object –of which Cleopatra and all merely past and future galaxies are parts-- is itself a part of the ham sandwich. (Fine 1999, 63)

Consider the restriction of the mereological sum, $s=s_1+s_2+h$, to those times at which the ham sandwich exists; the result of this restriction is another mereological sum, s_{restr}, which exists at all and only those times and places at which the ham sandwich exists and which has at those times all and only the parts of s. Now consider the restriction, h_{restr}, of the ham to those times at which the ham sandwich exists. According to the new notion of parthood, the ham, h, is a part in the extended sense of the restricted sum, s_{restr}, (even though it exceeds s_{restr}'s spatiotemporal boundaries) because the restriction, h_{restr}, of h to the times at which s_{restr} exists is a part in the unextended sense of s_{restr}: i.e., $h <_{ext} s_{restr}$, since $h_{restr} < s_{restr}$. This, of course, is a welcome consequence, since we would like to be able to say that the ham is part of the ham sandwich, even though the ham already existed before the ham sandwich did; we just don't want it to follow from this claim that the ham sandwich therefore *also* already exists as soon as the ham comes into existence.

So far so good. But now, as brought out by the "monster-objection", it turns out that, according to the same modified notion of parthood, various "monster-objects" also count as parts in the extended sense of the restricted sum, s_{restr}, e.g., the object that has as parts the ham along with *all* objects *whatsoever* that ever have existed or will exist at times at which the ham sandwich doesn't exist (since these will be "cut out" in the restriction). And why, so Fine rightly asks, should we consider a relation which has these consequences to be a relation of parthood at all? It is certainly not one that holds much promise for an analysis of ordinary material objects.

The "aggregative" objection and the "monster-objection" evidently provide strong motivation for abandoning the standard conception of parthood and composition. The lesson we learn from these two objections is that an analysis of ordinary material objects requires a notion of parthood which is sensitive not only to the *spatiotemporal proximity* of objects but also to their *manner of arrangement*; the conditions of existence, identity, spatiotemporal location and part-whole structure that are assigned to ordinary material objects by the standard conception retain too much of the original analogy between sums and sets, which the founders of mereology found to be congenial to their nominalist leanings, to make room for both of these crucial elements. Fine's first objection brings out that ordinary material objects simply do not exhibit the "aggregative" conditions of existence and spatiotemporal location of mereological sums according to the standard conception, since ordinary material objects exist and are located at those times and places at which *all* of their parts *together* are located. Thus, as (Fine, 1994a) already urged us, an adequate analysis of ordinary material objects evidently requires *"conjunctive"* conditions of existence and spatiotemporal location. But the "monster-objection" shows that the standard conception of mereology cannot be saved merely by means of tacking onto the standard notion of parthood and composition a

"conjunctive" requirement of spatiotemporal cohabitation, because the result is still missing a crucial feature: it fails to represent the *manner of arrangement* which the parts of ordinary material objects must exhibit in order for the object in question to exist.

I take these two considerations to be fatal for the standard conception of mereology as it applies to ordinary material objects. And while I of course have no interest in quibbling over terminology, I assume that any conception of parthood and composition that is rich enough to represent explicitly the *manner of arrangement* of an object's parts is too far removed from the original incarnations of (CEM) to be regarded as an extension of the standard conception. Such an alternative model may of course take over certain minimal requirements on parthood and composition from the standard conception; but it will impose further, richer, conditions which must be satisfied in order for one object to compose or be part of another. These richer conditions no longer make it possible to hold on to the original analogy between wholes and sets: for the existence and identity of a set of course in no way depends on the *spatiotemporal proximity* of its members; nor does it impose any special requirements on the *manner of arrangement* which its members must exhibit.

IV.2 A Different Kind of Whole

I now want to turn to Fine's own alternative conception of parthood and composition in some detail and indicate what I take to be its strengths and weaknesses. The theory of embodiments is broadly divided into the following two components: (i) the first part, the theory of *rigid embodiments*, is intended to apply to objects which have their parts *timelessly*; (ii) the second part, the theory of *variable embodiments*, is intended to apply to objects whose parts can vary over time. As examples

of the former, we are given such objects as ham sandwiches, bouquets of flowers, molecules, suits, nuts and qua-objects (e.g., "personages" such as airline passengers, mayors, and the like; see (Fine, 1982). As examples of the latter, Fine cites such objects as the water in a particular river (where this phrase is to be understood not as denoting a particular quantity of water, but as denoting a variable quantity of water, one about which it could be meaningfully said, for example, that it is rising) as well as artifacts such as cars.

IV.2.1 Rigid Embodiments

The theory of rigid embodiments analyzes such composite objects as the ham sandwich as having the constituent-structure, '<a,b,c,.../R>', where a,b,c,... are objects, R is a property or relation, and '/' denotes a *sui generis* relation of rigid embodiment, a particular way in which wholes may be formed out of parts.[17] Even though the relation, '/', of rigid embodiment is taken as primitive, we may nevertheless derive an implicit understanding of it from the following six postulates, which specify conditions for the existence, location, identity and part-whole structure of rigid embodiments:[18]

(R1) *Existence-Postulate:*

The rigid embodiment, <a,b,c,.../R>, exists at a time t iff R holds of a,b,c,... at t.

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[17] I add the brackets merely as a device of notational convenience, not to be confused with the notation used for ordered pairs.

[18] About the character of rigid embodiments, i.e., the properties they have and how these properties are related to those of the their constituents, nothing of a general nature can be said, according to Fine. In contrast, the earlier theory of "qua-objects" proposed in (Fine, 1982) contained a principle to this effect called the "Inheritance-Principle", according to which a qua-object inherits a certain class of properties (the so-called "normal" properties) from its objectual component (see (Koslicki, 2004a) and (Koslicki, 2005) for criticisms of Fine's "Inheritance Principle") .

(R2) *Location-Postulate:*

If the rigid embodiment, e=<a,b,c,.../R>, exists at a time t, then e is located at the point p at t iff at least one of a,b,c,... is located at p at t.[19]

(R3) *Identity-Postulate:*

The rigid embodiments, <a,b,c,.../R> and <a',b',c',.../R'>, are the same iff a=a', b=b', c=c',..., and R=R'.

(R4) *1st (Timeless) Part-Whole Postulate:*

The objects, a,b,c,..., are (timeless) parts of <a,b,c,.../R>.

(R5) *2nd (Timeless) Part-Whole Postulate:*

The relation R is a (timeless) part of <a,b,c,.../R>.

(R6) *3rd (Timeless) Part-Whole Postulate:*

Any timeless part of <a,b,c,.../R> is a timeless part of one of a,b,c,... or of R.

Postulate (R1) requires that in order for a rigid embodiment, e, to exist at a certain time, all of e's object-components must exist at that time and be arranged in the manner specified by e's intensional component, R. (Following Fine's usage, I refer to the property- or relation-component of a rigid embodiment as its "intensional component"; I shall have more to say about the nature of this component below.) Postulate (R2) ties the location of the rigid embodiment to the location of its object-components, since presumably the intensional component doesn't have spatiotemporal location, at least in the same straightforward sense as the object-components. The identity-postulate (R3) places very strict conditions on the identity of rigid embodiments and results in what Fine

[19] By (R2), the location *in space* of a rigid embodiment still retains the "aggregative" character of standard mereological sums, since the objectual components of a rigid embodiment may of course occupy non-overlapping regions of space. However, its location *in time* is required to be *"conjunctive"* by force of (R1): I take it that the property- or relation-component, R, can only hold of the objectual components, a,b,c,..., at t, if all of a,b,c,..., *exist* at t.

himself admits is an "embarrassing diversity" of rigid embodiments. To illustrate, the region of spacetime which we would ordinarily say is occupied by a ham sandwich, will be inhabited by multiple rigid embodiments composed of the same object-components, depending on how the intensional component is specified: the rigid embodiment composed of the two slices of bread, the slice of ham, and the relation of being between, for example, is distinct from the rigid embodiment composed of the two slices of bread, the slice of ham, and the relation of being surrounded, since the relation of being between is distinct from the relation of being surrounded.

Given this "embarrassing diversity" of rigid embodiments, Fine offers an alternative formulation of (R3) (and, correspondingly, (R4)) which delineates the identity-conditions and mereology of rigid embodiments on the basis of the identity-conditions of the *states* into which their components enter:

(R3') *Alternative Existence-Postulate*:

The rigid embodiments, <a,b,c,.../R> and <a',b',c',.../R'>, are the same iff the state of a,b,c,..., standing in the relation R is the same as the state of a',b',c',... standing in the relation R'.

(R4') *Alternative 1st (Timeless) Part-Whole Postulate:*

The rigid embodiment, <a,b,c,.../R>, is a (timeless) part of the rigid embodiment, <a',b',c',.../R'>, if the state of a,b,c,... standing in the relation R is a part of the state a',b',c',... standing in the relation R'.

Of course, these alternative formulations are only helpful if we can somehow get a handle on the identity-conditions of states independently of those of the objects, properties and relations that participate in them.

Postulate (R5) brings out what is perhaps the most Aristotelian aspect of Fine's theory, viz.,

its *mereological hylomorphism*: the intensional component is here identified literally as *part* of the rigid embodiment to which it belongs; moreover, the theory of rigid embodiments takes the intensional component to be part of the rigid embodiment to which it belongs in the *same* sense of parthood according to which its objectual components are parts of a rigid embodiment. Postulate (R6) states that all of the parts of a rigid embodiment derive from their objectual and intensional components. And while the theory of rigid embodiments itself doesn't contain an explicit postulate to the effect that *every* timeless part of a timeless part of a given whole is itself a timeless part of the whole, the transitivity of timeless parthood (and parthood in general), I take it, is simply presupposed by Fine.[20]

IV.2.2 Variable Embodiments

The theory of variable embodiments analyzes such objects as the water in a particular river or a particular car as having the following more complex constituent-structure. A variable embodiment, f=/F/, is an object consisting of a principle, F, of variable embodiment as well as a series of "manifestations", f_t, determined by F at the times, t, at which /F/ exists. The principle, F, of a variable embodiment, /F/, is described by Fine as a "function" from times to objects (ibid., 69); however, we are to understand the term, "function", in this context in a neutral, non-committal, way, and not (necessarily) according to its strict, mathematical usage. The manifestation, f_t, of /F/ determined by F at t may itself be a rigid embodiment or a variable embodiment.

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[20] Professor Fine has assured me (personal communication, October 9th, 2003) that this was his intention. All of my comments within the present discussion which go beyond what Fine explicitly says in his written work are based on his verbal remarks on this occasion; I hope that I have represented his views with accuracy.

Metaphorically speaking, variable embodiments may be thought of along the lines of containers and their contents: the principle, F, of variable embodiment plays the role of the container (which is to be understood not as yet another physical object alongside the content; and not as merely a passive holding-device, but rather as an active participant in determining its content); the manifestations, f_t, are likened to the content (which may vary over time); and the variable embodiment, /F/, itself may be compared to the container together with its content.[21]

Although the operation, /.../, of variable embodiment is again taken as a primitive, *sui generis* way of forming wholes out of parts, we gain an implicit understanding of this notion by means of the following postulates governing the existence, location, identity, part-whole structure, and character of variable embodiments:

(V1) *Existence-Postulate:*

The variable embodiment, f=/F/, exists at a time t iff it has a manifestation at t.

(V2) *Location-Postulate:*

If the variable embodiment, f=/F/, exists at t, then its location is that of its manifestation, f_t (assuming that f_t has a location).

(V3) *Identity-Postulate:*

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[21] Unlike the theory of rigid embodiments, the theory of variable embodiments does not explicitly state that the intensional component of an object, its principle of variable embodiment, is a genuine *part* of the object. In order to turn the theory of variable embodiments into an explicitly mereological form of hylomorphism, as I believe Fine's intent to be, however, the intensional component of a variable embodiment cannot simply be viewed as a part of the variable embodiment in the same sense of parthood as that which applies to its manifestations, since these latter entities are *temporary* parts of the variable embodiment. It must therefore be taken as a *timeless* part of the variable embodiment; to state this explicitly, the theory would need to be supplemented with a postulate corresponding to postulate (R5) from the theory of rigid embodiments. Unless a postulate to this effect is added to the theory, the nature of the relation which holds between a variable embodiment and its principle remains mysterious, since it would otherwise make no pronouncements as to how each such object has its very own principle "attached" to it.

The variable embodiments, /F/ and /G/, are the same iff their principles, F and G, are the same.

(V4) *1st (Temporary) Part-Whole Postulate:*

Any manifestation of a variable embodiment at a given time is a temporary part of the variable embodiment at that time (in symbols: $f_t \leq_t f$).

(V5a) *2nd (Temporary) Part-Whole Postulate:*

If a is a timeless part of b that exists at t and if b is a part of c at t, then a is a part of c at t.

(V5b) *3rd (Temporary) Part-Whole Postulate:*

If a is a part of b at t and if b is a timeless part of an object c that exists at t, then a is a part of c at t.

(V6) *4th (Temporary) Part-Whole Postulate:*

If a is a temporary part of b at t, then there is a mereological chain at t connecting a to b.

(V7) *Character Postulate:*

The pro tem properties of a variable embodiment, f, at a given time t are the same as those of its manifestation f_t.

The last two postulates involve the technical terms, 'mereological chain' and 'pro tem property', which are defined as follows:

(D6a) *Definition of 'Fundamental Link':*

A link between two objects is a fundamental link at t if it holds between the manifestation, f_t, of a variable embodiment and the variable embodiment itself.

(D6b) *Definition of 'Auxiliary Link':*

A link between two objects is an auxiliary link at t if it holds between two objects,

a and b, where a and b both exist at t and a is a timeless part of b.

(D6c) *Definition of 'Mereological Chain':*

A sequence, (a_1,a_2), (a_2,a_3), ..., (a_{n-1}, a_n), of connected links is a mereological chain at t if (i) each link in the sequence is either a fundamental link or auxiliary link at t, and (ii) at least one link in the sequence is fundamental.

(D7) *Definition of 'Pro Tem Property':*

A property of an object is a pro tem property if its holding at a time depends only upon how the object is at that time.

Postulates (V1) and (V2) tie the existence and location of a variable embodiment, /F/, at a time t to the existence and location of its manifestation, f_t, at t. Postulate (V3) ties the identity of a variable embodiment, /F/, to the identity of its principle, F, of variable embodiment: two variable embodiments, /F/ and /G/, are the same just in case their principles, F and G, are the same, i.e., just in case they determine for each time for which they are defined the same manifestation.

Postulates (V4), (V5a), (V5b) and (V6) tell us about the part-whole structure of variable embodiments: they serve to relate the two notions of parthood, timeless part and temporary part, which correspond to the (at least) two sorts of wholes, rigid embodiments and variable embodiments; moreover, they also serve to reconstruct a restricted form of transitivity across the two notions of parthood. (V4) states that variable embodiments have their manifestations as temporary parts;[22] this

[22] Is the manifestation, f_t, selected by F at t a *proper* temporary part of the variable embodiment, /F/? If so, we may wonder, what (if any) are its *other*, non-overlapping, proper temporary parts? (I am appealing here to the Weak Supplementation Principle, which in the view of (Simons, 1987) is partially constitutive of the notion of parthood. Recall that this principle states that nothing can have just a single proper part (excluding the overlapping ones); for any proper part of a whole, there must be at least one other, non-overlapping proper part that makes up the remainder of the whole.) The variable embodiment, /F/, cannot be *identical* to its manifestation, f_t, at t, since this would turn numerical identity into a temporalized relation. What exactly, then, is the object to

link, between variable embodiments and their manifestations, as brought out by Postulate (V6), is also the fundamental mereological link which grounds all other relations of temporary part. Postulates (V5a) and (V5b) state that timeless parts of temporary parts are themselves temporary parts, and that temporary parts of timeless parts are themselves temporary parts; thus, chaining temporary with timeless parts itself results in temporary parts.

Finally, Postulate (V7) connects the character of a variable embodiment to that of its manifestations: a variable embodiment inherits those properties from its manifestations which depend only on "how the object is at that time" (whatever exactly that means).[23] Thus, Postulate (V7) is the successor of the principle that was called "Inheritance" in (Fine, 1981) (see (Koslicki, 2004a) and (Koslicki, 2005) for critical discussion of Fine's "Inheritance" principle). In general, the theory of (Fine, 1999) extends the theory of (Fine, 1982) by allowing for variation of parts over time; the qua-objects of (Fine, 1982) are all, in the language of (Fine, 1999), rigid embodiments.

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which the variable embodiment, /F/, is identical at each time at which it exists? In the case of rigid embodiments, the theory explicitly answers this question: a rigid embodiment is an object which is composed, by means of the primitive *sui generis* relation, '/', out of other objects, along with an intensional component; the objectual components are arranged in the manner required by the intensional component; the intensional component is itself a genuine part of the resulting composite object; the object in question has its parts timelessly. But the nature of variable embodiments is not settled to the same extent by Fine's theory as that of rigid embodiments. (See also the previous note for a similar complaint; we will return to these issues below.)

[23] Presumably, a principle of this sort does not apply to rigid embodiments, because what a rigid embodiment is like at each time at which it exists depends not only on what each of its objectual components is like individually at that time, but also on how the objectual and the intensional components interact when combined; and about this (so Fine seems to think) nothing general can be said beyond the fact that the objectual components must instantiate R (Postulate (R1)). For example, even though having a temperature of 100°F presumably counts as a "pro tem property" of an object, one cannot infer from the fact that an objectual component, a, has this property that the rigid embodiment, <a,b,c,.../R> it helps to compose also has this property; for its other objectual components, b,c,..., may have different temperatures, so that it would be wrong to say the rigid embodiment as a whole has the temperature 100°F.

Since the theory of variable embodiments, with its hierarchical part-structure, is difficult to comprehend, let's consider how it applies, first, to the (variable) water in the river and, then, to the car. The (variable) water in the river, according to Fine, is to be analyzed as a variable embodiment, /F/, whose principle, F, selects at each time, t, at which the river exists a particular quantity of water, the manifestation, f_t, of /F/ at t. We are not explicitly told whether the particular quantities of water selected by F at the different times at which the river exists are themselves rigid embodiments or whether they are objects that lack an intensional component altogether (if there are such objects). I assume that Fine takes the particular quantities of water not to be capable of changing their parts over time, and thus not to be variable embodiments; but whether they are themselves rigid embodiments or objects of another kind is left open.

The car, on the other hand, is analyzed as a variable embodiment, /F'/, whose manifestations, f'_t, are rigid embodiments of the form, <a,b,c,.../R>. We are to think of the objectual components, a,b,c,..., of these rigid embodiments as the "major" parts that are characteristically associated with cars, e.g., the engine, the chassis, the wheels, etc.; the relation, R, reflects the fact that these "major" parts must be arranged in a characteristically "automotive" fashion. The objects which are part of each of these rigid embodiments, on the other hand, i.e., the engine, chassis, wheels, etc., are themselves variable embodiments, i.e., objects whose parts may vary over time. The resulting car is thus a hierarchical arrangement of variable and rigid embodiments.

IV.3 Discussion

As we saw earlier, Fine's two main objections against standard mereology, the "aggregative" objection and the "monster-objection", certainly provide strong motivation for abandoning a

traditional, (CEM)-style analysis of ordinary material objects. However, once this realization is granted as a starting-point, there are of course various directions in which one can go to seek such an alternative conception of parthood and composition. The question now at hand is therefore whether the particular alternative conception developed by Fine yields the most attractive analysis of ordinary material objects.

IV.3.1 The Proliferation of *Sui Generis* Relations

From a methodological point of view, Fine's analysis raises the worry that it leads to a proliferation of primitive, *sui generis* relations of parthood and composition. Fine's general strategy seems to be to presuppose standard mereology and to impose on it further, more stringent conditions, in the form of postulates specifically tailored to the demands of a particular domain of objects.[24] As we saw in the preceding sections, the domain of ordinary material objects alone, in Fine's view, already calls

[24] Fine doesn't actually say in writing which principles of standard mereology he presupposes. Since, as will become clear shortly, he rejects the Weak Supplementation Principle, the version of standard mereology accepted by Fine must be exceedingly weak: for, as is developed in detail in (Simons, 1987), (WSP) is entailed by the full-strength version of (CEM); in fact, even systems which are much weaker than the full-strength (CEM), in that they do not make provisions for the conditional or unconditional existence of arbitrary products and sums, already entail (WSP). Presumably, Fine accepts Unrestricted Composition for *his own* relations of composition; i.e., those governing the formation of rigid and variable embodiments. But since these relations of composition have placed upon them a system of postulates, composition in the sense of embodiment of course only takes places when these postulates are satisfied. Uniqueness of Composition would seem to be inert in the case of Fine's *sui generis* relations; for while we have a superabundance of coinciding objects which occupy the same region of spacetime, quite possibly in *every* possible world, I presume that even these necessary coincidents would not share the same part-structure. Arbitrary sums, according to the standard conception, on the other hand, can be taken to be *postulated* entities (according to the "method of postulation", to which I will return shortly below); and while Fine would presumably not be opposed to the existence of arbitrary sums in the standard sense as such, when conceived of in this way as postulated entities, I assume that he would insist that none of these mereological sums in the standard sense serve to represent ordinary material objects.

for two distinct, primitive, *sui generis* relations of parthood and composition: the relations of composition by which rigid embodiments and variable embodiments are formed out of their respective components; as well as the relations of timeless part and temporary part that go along with these. Rigid embodiments have only timeless parts; variable embodiments have both timeless and temporary parts. Since the two sorts of embodiments can enter into hierarchical arrangements with one another, various postulates are required in order to connect the two notions of parthood, to reconstruct a restricted form of transitivity. Whatever connections there are between the two notions of composition and parthood thus do not follow from the general formal properties of the basic mereological vocabulary, independently of the domain of objects to which this vocabulary is currently applied; rather, they are explicitly imposed on these relations via postulates specifically tailored to the realm of ordinary material objects. Thus, even within this single domain of objects, Fine's strategy already leads on a (comparatively) small scale to a proliferation of distinct, primitive relations, which are not obviously needed in order to capture the conditions of existence, identity, location, character and part-whole structure of ordinary material objects. Since mereological vocabulary also applies outside of the realm of ordinary material objects, however, Fine's strategy would appear to lead to further distinct, primitive, *sui generis* relations of composition and parthood for each such domain of objects, accompanied by a system of postulates specifically tailored to the particular kinds of objects at issue. Such an approach takes on an overly stipulative and fractured air.[25]

[25] The concern brought up in this section is reminiscent of the difficulty which we saw arising earlier within the context of Aristotle's system: a difficulty of this kind is bound to surface for any approach which (i) makes room for distinct notions of parthood and composition and (ii) allows these distinct notions to apply within a single domain of mereologically nested entities.

IV.3.2 The Superabundance of Objects

Fine's strategy of solving long-standing metaphysical problems by introducing new primitive notions thus raises *methodological* concerns; but there are also serious *ontological* reasons for wanting to resist Fine's theory. (For an insightful discussion, among other things, of the problematic ontology of the earlier theory of qua-objects in (Fine, 1982), see (Ray, 2000).) As Fine himself admits, the ontology to which his theory of embodiments is committed far outstrips that of traditional mereology, which many of us, with its endorsement of arbitrary sums, already find troubling. We saw earlier that each occupied region of spacetime is inhabited by numerous rigid embodiments which share their objectual components and only differ in how their intensional component is specified. (Exactly *how* numerous the rigid embodiments occupying a given region of spacetime are depends on how finely properties, relations or states are individuated.) But now, with the addition of variable embodiments, each such region of spacetime is even more densely populated, with both rigid and variable embodiments, whose current manifestations again share many of their parts with each other and with their rigid cohabitants. And although the theory does not spell out the *modal* character of these coincident objects, it seems that many of them will turn out to be *necessarily* coincident, and yet numerically distinct (Fine 1999, 73).

To illustrate, consider again the region of spacetime occupied by a car. (To recall, a car is analyzed as a variable embodiment, /F'/, whose manifestation, f_t, at a time t is itself a rigid embodiment, of the form, <a,b,c,.../R>; the objectual components, a,b,c,..., of f_t, are variable embodiments, viz., the "major" parts of a car, its chassis, engine, etc., arranged in a characteristically "automotive" fashion indicated by R.) The same region of spacetime that is occupied by the car, /F'/, is also occupied, for example, by the variable embodiment, /G/, the (variable) quantity of metal,

plastic, rubber, etc. of which the car consists throughout its lifetime. The manifestations of /F'/ and /G/ share some, but not all, of their objectual components; /F'/, for example, has a chassis as temporary part, while /G/ merely has as temporary part the quantity of matter that constitutes the chassis.

But the car, /F'/, and the variable quantity of matter, /G/, that constitutes the car throughout its career, are only the tip of the iceberg, so to speak. To get a sense of just how densely the single region of spacetime in question is populated, consider the existence-principle endorsed by Fine: "In general, we will suppose, *given any suitable function or principle F* (taking times into things), that *there is a corresponding object* standing in the same relationship to F as the variable water of the river stands to its principle." (Fine 1999, 69; my italics).[26] What makes a principle *suitable*? No boundaries are set, other than a type-restriction on the entities to which the principles apply: the principles must take times as arguments and determine objects as values. Perhaps, Fine is pessimistic that any principled line can be drawn between those principles (which relate times to objects) that select ordinary material objects and those that don't, and so decides to accept the whole lot. Without any further restriction on which principles are "suitable", however, the single region of spacetime will be occupied by a dizzying array of objects, many of which determine objects with persistence-conditions that strike us, from an ordinary point of view, as quite bizarre. For example, there is also in the particular region of spacetime under discussion an object, /H/, whose principle, H, divides up cars like sandwiches: it selects at time t a manifestation, h_t, which is a rigid

[26] Here we come to the place within the theory of embodiments where we find Fine siding with a Platonic conception of structure (minus the centralized teleology), rather than with the more restricted Aristotelian model; relatedly, the unrestricted nature of Fine's principle of embodiments is to a large extent responsible for the ontologically permissive fourth strand within Fine's broader metaphysical stance identified in Section I above.

embodiment, <d,e,f/S>, whose objectual components, d, e and f are (the quantity of matter constituting) the left half of the car, a thin middle "slice" and (the quantity of matter constituting) the right half of the car, respectively, and whose intensional component, S, requires that the thin middle "slice", e, be between the left half, d, and the right half, f. Since this principle, H, takes times to objects, it constitutes, for all we know, a "suitable" way of selecting an object which occupies the region of spacetime inhabited by the car, /F'/, and the variable quantity of matter, /G/; and who knows how H behaves at other times: it might, for all we know, select at the next time a flower bouquet on a different continent. It thus seems that Fine's theory of embodiments, with its exceedingly tolerant existence-principle, generates plenty of "monsters" of its own.

We can also appreciate now how Fine answers the original questions he sets himself, "How are objects capable of having the parts that they do?" or "What in an object's nature accounts for its division into parts?". Fine's answer is that an object has the parts that it does because its intensional component yields this particular way of partitioning the occupied region of spacetime in question. However, talk of "nature", in this context, is misleading at best, since the theory predicts that, given our apparently never-ending supply of principles, for any imaginable way of partitioning an occupied region of spacetime, there is an object whose intensional component yields this particular division into parts.

To make his "vast superstructure" of objects somewhat more palatable, Fine suggests that we might take the intensional component of an object (i.e., the properties, relations and functions) to be of a *conceptual* nature, and that the commitment to these objects need not be regarded as *"ultimate"* (see (Fine 1982, 103ff) and (Fine 1999, 73ff)). However, from the point of view of those who believe that ordinary material objects deserve a privileged ontological status, this suggestion

will be no less disconcerting; for, in that case, trees, houses and people will of course suffer the same fate as "car-sandwich-flower-bouquets".[27]

IV.3.3 The Mysterious Nature of Variable Embodiments

Several central questions concerning the nature of variable embodiments, their principles and their manifestations are not explicitly settled by the theory of variable embodiments. Let's think first about the principles of variable embodiment themselves. We know that they are principles or functions (in a neutral sense) from times to objects. But what are these principles and how is it that

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[27] Fine's current work on postulation (see especially (Fine, 2005) and (Fine, 2006)) may help address the worries raised in the last two sections concerning the proliferation of primitive *sui generis* relations as well as the superabundance of objects. According to Fine's "method of postulation", what there is (in the unrestricted sense) is relative to postulation. Postulation is a means of extending one's ontology, but it is not a method by which objects are merely "created"; it is an interpretative act, by which existing quantifiers are interpreted as ranging over new objects. Only some relations can be used for the postulation of objects; relations which are legitimate for this purpose must satisfy certain constraints. Some of these constraints are general, others are specific to particular domains. For example, within the confines of set-theory, set-formation is an acceptable method of postulating objects; but this operation must satisfy the following formal constraints: (i) extensionality: one cannot postulate a set that is distinct from and has the same members as an already existing set; (ii) new set-theoretic objects may only be postulated on the basis of already existing objects, but not vice versa; and (iii) any object which has a member must be taken to be a set. While Fine's "method of postulation" may indeed make the proliferation of objects and relations less burdensome, it may also in the end lead to a certain form of ontological relativism. (Fine's remarks concerning the "conceptual" nature of intensional components and the non-ultimate commitment to the resulting compounds already foreshadow a certain skeptical attitude to ontology; (Fine, 2001), which explicitly debates the question of realism in ontology, remains surprisingly neutral in its commitments and, instead, supplies us with mechanisms, such as the notion of *ground*, by means of which to make progress in ontological debates *without* explicitly incurring a commitment with respect to the question of realism in ontology.) For those of us who are not attracted to relativism in ontology, Fine's "method of postulation" therefore seems to provide little comfort. Instead of letting a zillion entities bloom and then potentially dealing with this fantastic multiplicity by invoking a relativistic stance, the absolutist thus may be better served by opting for a different strategy from the outset, which prevents the proliferation of objects and relations from even getting off the ground.

each object has such a principle associated with it? Some of Fine's remarks suggest that the answer to this question might ultimately refer back to us, if the intensional components of embodiments are to be thought of as being of a conceptual nature and commitment to them is not "ultimate". I take it, however, that these remarks are not intended to touch on the ontological status of the principles themselves, only perhaps the mechanism by which specific principles are selected in particular contexts.

The principles which play the role of associating each variable embodiment with its current manifestation cannot be thought of along the lines of Aristotelian forms, at least as long as these are conceived of as *universals*. For variable embodiments are identical just in case their principles of variable embodiment are identical. Thus, no two distinct variable embodiments can have the same principle; but this is precisely not what Aristotelian forms, as universals, are like: all members of the same species, according to this conception, have the same form. (See (Fine, 1994c) for discussion of some puzzles which arise in connection with the Aristotelian conception of matter and form.)

Thus, the principles of variable embodiment may be likened more plausibly to Aristotelian forms, thought of as *individuals*, perhaps something along the lines of *individual essences*. However, the individual essences at work in this context cannot be thought of, as they would be according to a more mainstream conception, as collections of *de re* modal properties, since the essences in question must be so specific that they select exactly one current manifestation (barring issues of vagueness) for each time at which the variable embodiment exists; certainly, such non-trivial *de re* modal properties as those concerning origin for example will not be nearly finegrained enough to accomplish this task. Thus, the question arises of what sort of conception of individual

essences would be suitable to fulfil the role played by principles of variable embodiment.[28]

Moreover, think again in this context of the "monster-objects" to which Fine's theory gives rise. To illustrate, consider a function, f, which selects an object with roughly the persistence-conditions of what we ordinarily refer to as a car. Suppose further the car in question comes into existence in the year 1957 and goes out of existence in the year 2000; then, f is not defined before 1957 and after 2000. However, given the never-ending supply of principles from times to objects, there are of course other principles, $g_1,..., g_n$, which agree with f in their 1957-to-2000 portion but which are defined before the year 1957 or after the year 2000; these principles, $g_1,..., g_n$, combine their 1957-to-2000 car-portion with all sorts of other objects (umbrellas, sunflowers, rain drops, what have you) in every way imaginable. If the principles of variable embodiment are thought of as individual essences, then each of these principles, $g_1,..., g_n$, counts as the individual essence of some object; in fact, in general, since no restrictions have been placed on which principles (from times to objects) are "suitable" for selecting objects, *every* such principle which takes times to objects, as far as we know, is the individual essence of some object. I take it that this outcome would make most essentialists uncomfortable.

My second comment concerns the nature of the connection between a variable embodiment, its principle and its manifestations. We know that the relation between a variable embodiment and its manifestations is that of temporary parthood; we know furthermore that the relation between a principle of variable embodiment and a manifestation at a time is something resembling function-

[28] We find Fine's work in mereology here connecting with the not purely modal approach to such metaphysically substantive Aristotelian and Husserlian notions as *definition*, *dependence* and *essence* that was isolated as characteristic of Fine's larger ontological approach in the third strand cited in Section I above. However, the more permissive fourth aspect is also relevant again in this context, as I am about to suggest in the next paragraph.

application. But what is the relation between a variable embodiment and its principle? The variable embodiment presumably is not *identical* to its principle, since this principle is something like a function, i.e., an abstract object, and variable embodiments are (often) material objects. A natural candidate for the relation that holds between a variable embodiment and its principle is of course that of *timeless parthood*. But, in that case, we face the analogue of the worry raised already in note 6 for manifestations and temporary parthood: if a variable embodiment has its principle as a *proper* timeless part, then what are its other, non-overlapping proper timeless parts? According to Simons' Weak Supplementation Principle (WSP), an object cannot have just a single proper part; every object that has a proper part must have at least another proper part disjoint from the first. If, on the other hand, the principle is a timeless part of the variable embodiment, but not a proper part, then (assuming (WSP) holds) it is identical to the variable embodiment and we are back to the worry that material objects have been identified with abstract principles. Finally, if the relation between a variable embodiment and its principle is neither that of identity nor that of timeless parthood, then the nature of this relation has been left mysterious by the theory. In that case, however, Fine's goal of providing a "theory of the general nature of material things" has not been met in a crucial way, as long as we are left in the dark on this question. The worry is, of course, that the theory might at this point be forced to appeal to yet another primitive, *sui generis* relation of composition.

As a matter of fact, although this is not explicitly stated in (Fine, 1999), Fine's position appears to be that each variable embodiment has both its principle as a *proper timeless* part and its current manifestation as a *proper temporary* part. Fine would thus opt to resolve the dilemma just raised by rejecting (WSP); this rejection, in his view, is in any case independently motivated. Consider, for example, a domain of time-intervals which are not to be thought of as composed of

instants. Now, a particular closed interval, T, may be a proper part of an open interval of time, T', without there being at least one further interval that is both a proper part of T' and disjoint from T. Moreover, in Fine's view, even when (WSP) is satisfied, the question of what the whole is over and above the parts remains: this mystery is not resolved by pointing to additional parts; rather, it is addressed only by means of elucidating the particular relation of composition at work in the context at hand. The work of elucidating a particular composition-relation is accomplished by providing a system of postulates, of the kind Fine develops for rigid and variable embodiments. This latter point can be illustrated by means of the following set-theoretic example. Assume for the moment that the members of a set are, at least in some sense, part of the set (even though this assumption is of course not beyond challenge and contradicts, for example, assumptions made in (Lewis, 1991)). Now consider the relation between Socrates and his singleton set. In this case, (WSP) appears not to be satisfied: the singleton set containing nothing but Socrates is distinct from its only proper part, Socrates; but it has no other proper parts, disjoint from Socrates. If we now consider instead a set containing as members two sets, Socrates' singleton set and any other set, the presence of the additional proper part, in Fine's view, in no way makes it easier to understand the original mystery, namely how a whole –in this case, a set-- is related to its proper parts, even though (WSP) is satisfied in the latter case. Examples of this kind illustrate why Fine believes that his rejection of (WSP) as a necessary constituent of any genuine parthood-relation is independently justified.[29]

[29] Recall again my reading of Aristotle's regress argument in *Met*. Z.17. Fine's point here turns on the fact that the additional parts with which the first part is imagined to be supplemented are, by the standards relevant to the case at hand, objects of the *same kind*, viz., they are both sets which are *members* of a given set. I agree with Fine that adding more objects of the same kind does not help to elucidate the relation between a whole and its parts; this is exactly Aristotle's point in the regress-argument of *Met*. Z.17. The relation between a whole and its remaining proper parts can only be elucidated by invoking additional parts, viz., formal components, which belong to a *different*

IV.3.4 The Formal Properties of Parthood

Fine's conception of parthood and composition no doubt has many attractive features, in particular those with respect to which it is reminiscent of the Aristotelian model: (i) its in principle wide applicability across diverse ontological domains; (ii) its "sparse" and hierarchical conception of parthood, which opens up the possibility for a distinction between a *"vertical"* and a *"horizontal"* sense of parthood; and (iii) its serious consideration not only of the hylomorphic aspect of Aristotle's theory, but of the *mereological* manifestation thereof. However, despite these highly attractive features, there is I think a legitimate worry as to whether this theory preserves to a sufficient extent the formal properties that have at least a strong claim to being considered constitutive of any genuine relation of parthood. We have seen already that, despite the fact that Fine accepts unrestricted transitivity for each parthood-relation individually, due to the proliferation of distinct parthood-relation, transitivity *across* the different notions of parthood cannot in general be presupposed but must be reconstructed, where it holds at all, by means of separate postulates. Moreover, we have also observed that Fine's theory leads to the rejection of (WSP), which has at least a plausible claim at being a mark of any genuine relation of parthood and which forms the distinctive formal core of Simons' most minimal mereology. Thus, in addition to the methodological and ontological worries I have raised in the preceding sections, Fine's theory might legitimately make us wonder why its so-

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kind and hence play a different role within the compound from that played by the material components. Thus, if a mereological hylomorphism of this kind were to be extended to the domain of set-theory, it would predict that Socrates' singleton-set does not violate (WSP), since it has additional parts (though not additional *members*) besides Socrates, viz., its formal components, whose nature is presumably spelled out in some fashion by reference to the axioms of set-theory. Whether this kind of account does in fact properly characterize the mereological properties of sets is of course a difficult question, which I cannot currently pursue; an approach of this sort does, however, at least in principle promise to avoid having to take the formation of singletons as an utterly mysterious primitive process (see (Lewis, 1991)).

called relations of parthood and composition should in fact be considered to be genuinely mereological at all, given their formal profile.[30]

V. Concluding Remarks

Given the methodological and ontological consequences of Fine's theory of embodiments, the question thus arises as to whether such commitments are in fact needed to accomplish the tasks Fine sets himself: to give an analysis of the "general nature of material things", which answers the question of why material things are divided into parts in the particular ways that they are. Unless one is already accustomed to the outlook of standard mereology, it is not obvious that the theory of rigid embodiments is really required for an analysis of *material* objects (as opposed to, say, abstract objects which have their parts essentially), since the objects of our scientifically informed common-sense ontology (even, arguably, such things as ham sandwiches, flower bouquets, suits, and nuts) generally seem to be capable of surviving the gain and loss of parts. Whether there are material objects (such as, possibly, very small subatomic particles) which are counterexamples to this claim is, I take it, an empirical question; and even if there turn out to be such objects, it is not clear that their analysis requires the introduction of an additional timeless notion of parthood into the domain of material objects, since such objects otherwise exist in time and may be capable of persisting through changes with respect to some of their remaining characteristics; thus, using the same, time-relative, notion of parthood that applies to such objects as trees, which can change their parts over time, we may simply say of these mereologically inflexible objects that they must have the same

[30] Here, again, we see Fine's theory of embodiments being potentially subject to a variant of the kind of difficulty which was raised with respect to Aristotle's mereology in Section III.

parts at all times at which they exist.

Thus, from the point of view of those not yet in the grip of the mereological rigidity of traditional sums, it would seem that the material world in general is composed, in the terminology of Fine's theory, of variable embodiments, which are in turn hierarchically composed of further variable embodiments. But in order to reflect an object's ability to survive change of parts over time, all that is required is that the part-relation be relativized to time, just as property-instantiation in general (according to the three-dimensionalist picture) is relativized to time. Thus, the considerations which seem to favor Fine's theory of variable embodiments over standard alternatives are those features with respect to which it is most reminiscent of the Aristotelian model: its widely applicable, "sparse" and hierarchical, hylomorphic conception of parthood and composition, which allows for a response to the "monster-objection" by taking into account not only the spatiotemporal proximity of an object's parts but also their *manner of arrangement*. But we have encountered reasons to be doubtful of the success of this alternative mereology. For we have seen that Fine's theory gives rise, first, to a proliferation of primitive *sui generis* relations of parthood and composition, whose characteristics must be imposed on them stipulatively by means of distinct systems of postulates, tailored to different domains of objects. Secondly, we noted that, given its "superabundance" of objects, Fine's theory is committed to its very own population of "monsters". Thirdly, once rigid embodiments are abandoned, the explicitly mereological aspect of Fine's hylomorphic theory is preserved only at the cost of abandoning the Weak Supplementation Principle. This, in turn, along with the other formal properties of Fine's system, makes us wonder why one should consider the primitive, *sui generis* operations introduced by Fine's theory to be genuinely mereological at all. Despite the great debt we owe to Fine's work for moving us beyond the standard

conception and towards a structure-based mereology, there is thus still room to look for alternative analyses of material objects which preserve the neo-Aristotelian flavor of Fine's embodiments, but avoid their methodological and ontological excesses.

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