# NASM

March 15, 2019

**Abstract**

NASM

Several authors have recently proposed "non-well-founded" or "non-anti-symmetric" mereologies. This terminology is relatively new, but at least some of the motivations behing their alternative systems derive from dilemmas that have inspired extensive commentary in the past. For example, is the clay out of which a sculpture is made a proper part of the statue? Most commentators seem to frame their intuitions in the intuitive parameters of part/whole hierarchies, and find some mechanism to reconcile the parts of their intuitions that don't fit simple accounts of parthood. The more radical possibility, which is the subject of this paper, is to re-engineer our conceptual of parthood from the ground up. In particalar, we can drop the assumption that parthood is assymtric or acyclic. Doing so results in a Non-Asymmetric Mereology, or NAM. In NAM, $x$ can be part of but different from $y$ *and vice versa*.

As far as I can tell, most arguments for NAM derive from statue/clay-like cases where two things seem deeply, metaphysically intertined by not identical. It is said that the statue (call it $S$) is not identical to the lump of clay (call it $C$) because $C$ could be altered in ways $S$ cannot — if a fire melts $C$ down to a blob, $C$ is still itself but $S$ disappears. Ergo, an event can destroy $S$ but not destroy $C$. Conversely, a small piece could fall out of $C$, leaving a hole then repair with fresh clay, yielding a new lump $C'$. So $S$ could end up being $C'$ instead of $C$. But if we define $C$ as just that exact lump of clay, $C$ can't be $C'$ instead of $C$.[1] Ergo, as Aaoron Cotnoir says, "it is natural to think that a lump of clay and a

statue made from it have all the same proper parts [but not] everything true of the clay [is, arguably] also true of the statue" (p. 397). In sum, Cotnoir and others who have thought about NAM highlight cases where two non-identical things have all the same proper parts. Such examples then lead toward the possibility of parthood being cyclical in some sense (which I'll try to pin down later).

I think statue/clay-like cases, while they do raise important issues, are less than idea as primes for NAM because they seem to invite numerous non-mereological resolutions. For instance, we can say (drawing from Jubien again) that $C$ *instantiats the property* of *being S*; $C$ is $S$'s physical instantiation or realization. We have cognitive attitudes toward $C$ that involve its phyiscal form and nature; we also have cognitive attitudes toward $S$ that thematizes its aesthetic and social facets (qua artwork crafted for public appreciation). Our agreement that $C$ designates $S$'s physical substrate — as described by terminology like $C$ *is a material body instantiating the property of being S* — binds these two cognitive assmblies together, but not in a manner that readily propagates $C$-parthood to $S$-parthood or vice-versa. In other words, mereology itself is not a useful philosophical abstraction when too many divergent cognitive registers are involved. Or at least this is an escape hatch which brings us back to conventional mereology via the metaphilosophical claim that there are *other* analyses where the classical mereological models *do* fit our cognitive engagements. Statue/clay-like problems are not problems of mereology

---

[1] Another issue: Michael Jubien imagines that the sculptor could just have built $S$ from another lump of clay in his studio, call it $D$. So, modally, $S$ *could have been* $D$, but $C$ could not have been $D$. If we use possible world talk, we can posit a possible world where $S$ id $D$, but we can't imagine a possible world where $C$ is $D$. This assumes that a hunk of

matter just is the matter that it is; we're not talking about essential or inessential parts or any object that may be *constituted* by some matter, like Tibbles the cat and his later-amputated tail. In other words, we're assuming that the self-identity of matter, once we ignore any logical properties inhering in its form, is immune from counterfactuals. Matter can be arranged differently, but it can't be different matter. This seem plausible but not self-evident, but in any case it may be a terminological rule in how philosophers often use the word "matter" — and by extnsion phrases like "lump of clay" — especially in discussions like statue/clay (non)identity.

as a theory but problemes of where the theory should be applied.

This won't be my final word on statues an clay, but I will pivot to other examples suggesting how NAM is more pervasive than people realize. The literature seeems to treat NAM as an exotic, corner-case, enigmatic exception to partonomic common sense: it seems to require special philosophical concentration to conceive of cases where parthood is really symmetric: $x$ is part of $y$ which is part of $x$. My goal is to argue the opposite: I think *assymetric* mereology is really the special case. Of course, I understand that there's *some* notion of parthood which renders partonomic chains paradoxical. But I think in most common-sense cases where people think they are talking/reasoning about parthood, the kind of mereology they intuitively use has at last the potential to be NAM.

As my first exhibit, I'll mention several plausible and everyday-like sentences:

- ▼ (1) Mbappe was a big part of the 2018 World Cup.
- ▼ (2) Mbappe's footballing career is a big part of who Mbappe is.
- ▼ (3) The 2018 World Cup was a big part of Mbappe's footballing career.

Taken at face value, acqiescing to these sentences and to mereological transivity, the 2018 World Cup is part of Mbappe, and Mbappe is part of the 2018 World Cup; but of course Mbappe is not metaphyiscally identical to the 2018 World Cup. Granted, sometimes part-talk in natural language is metaphorical: we don't hear *my religion is part of me* as megalomaniacal, or *you are part of my life* as prima facie possessive. But if this seemingly metaphorical way of talking is *more* common than our seemingly commonsensical mereology, maybe we need to reconsider whether classical mereology is really the base rather than derived notion.

Indeed, when we talk of $y$ being part of $x$ we rarely seem to talk as if $y$ is *completely* part of $x$. Perhaps *total* parthood is a degenerate case. In fact, I could make an argument that classical mereology is paradoxical, like this: an intrinsic part of $y$ is *being y*. If $y$ is a proper part of $x$, by transitivity, *being y* is part of $x$. But if $x$ is not $y$, it sounds absurd to say that *being y* is part of $x$. Now, I'm not actually raising this as an argument, because it can be countered: *being y* is not really "part" of $y$ in the sense technically covered by mereology. Some of the more "philosophical" interpretations of parthood need to be quarantined from the mereological explanantia. Fair enough. But I think this excecise shows that preserving clasical mereology requires filtering out a lot of notions of parthood based on a prior commitment to assymetry, which becomes circular unless we have a good analysis that the apocryphal "notions of parthood" are in some definable sense atypical or deflationary.

That $y$ is part of $x$ does not seem to preclude $y$ bearing predicative details that $x$ lacks: for instance, if the camera zooms in on Mbappe it is not picturing the whole team, so although Mbappe is part of the team Mbappe, but not the team, is covered by the predicate "being at the focus of the camera angle" at some moment. Of course, we already know that Mbappe is not *entirely* inside the team, so the proposect of Mbappe having propositional attributes which the team lacks is not concerting. But a camera angle can show Mbappe's *head*, which we might think tonsay is "part of" Mbappe, in a stronger sense, or hos *right side*, which seems even less independent. Indeed any picture of Mbappe shows part of him, making that part uniquely predicated as *that shown in this picture*. I cite these as further examples of conceptual subtleties that can trip up strictly "subsuming" mereologies — where an axiomatic distinction is made between *proper parthood* and *overlap*.

Returning to cases for NAM itself, I'll give another example set on the lost continent of Atlantis, to be concrete in a hypothetical way. Suppose the continent's largest newspaper, the Atlantis Times, creates a consortium of semi-autonomous local newspapers in smaller Atlantian towns. We can then consider the Consortium to be part of the Atlantis Times: perhaps its offics are in the Times's headquarters, the Times funds, administrates, and legally controls the Consortium, etc. But we can also say that the Times is part of the Consortium, if the Consortium includes a portfolio of paprs one of which is the Times itself.

Usually when we hear part-like talk, we seem to instinctively look for overlap-style relations rather than subsuming inclusion of something smaller into something larger. That's why we don't hear it as odd or metaphorical if something apparently larger is presented as a part rather than a whole:

- ▼ (4) Phenomenology is only part of Merleau-Ponty's ouevre.
- ▼ (5) Iraq and Afghanistan are only part of CENTCOMM's

2

responsibility.

▼ (6) Tomorrow's chicken soup (with the leftover chicken in it) is my favorite part of the chicken.

If we're doing formal semantics, we might want to say that the propositional form ofvthese examples is a matter of overlap rather than proper parthood. But something like *Phenomenology overlapped with Merleau-Ponty's ouvre*, or vice-versa, sounds awkward in comparison. At the very least we have an apparent datum that semantic structures involving overlap often seem to invite surface articulations involving explicit parthood.

For a final introductory example, consider a web portal which includes a collection of resources. Suppose one of those resources is another web portals which in turn includes a collection of resources — one of which is th original portal! Reading "includs" as "has as part", this is clearly a partonomic circle. Indeed the whole "web" ideology is that resources link up in complex and dense (and often circular) ways.

I think these kinds of examples are both representative of "folk" mereology and structures where non-assymtry is a more effective modeling assumption than assymetry. In that case NAM is not the theory of a few ersatz cases but rather a general framework from which, if desired, classical mereology could be recoverd as, so to speak, a proper part.

So here I will present my thoughts on what a "generalized" non-anti-symmetric mereology can look like and how it might be practically — i.e., technologically — applied. Then I'll revisit philosophical terrain like the sculpture/clay conundrum.

# 1 "Criteriological" and "Expository" Mereology

In order to demonstrate a pragmatic, common-sensical NAM proposal, I will consider logical or conceptual relations which *seem* like mereological relations but which *also* seem like they involve a "cyclical" notion of parthood. To facilitate discussion I will use the symbol *hpp* to mean "has as proper part", giving *hpp* different names in the course of debating which parthood-concepts are most appropriate. So parthood is modeled via *hpp* read left-to-right. I will restrict attention to cases where both

(*) *x hpp y* and *y hpp x*. I'll assume by definition that *hpp* is "proper", i.e. nothing is *hpp* itself, so in (*) necessarily *x* is not identical to *y*. By this setup *hpp* is not transitive, since *x nhpp x*, but call  th transitive closure of *hpp*. Then (*) exemplifies a case where *x  x*.

Consider the Atlantis example. I posed that as in effect the Consortium is an *administrative part* of the Atlantis Times, but the Times is a "constituant" part of the Consortium: if list th papers in the consortium, this list would include the Times. Granted, these are not exactly the same notion of mereology, so we could treat this kind of case as an anomaly due to two different mereological relations which happen to conflict. Of course, *y* can be part of *x* on some criteria but not others: French Guyana is part of Europe politically but part of South America geographically.

However, there are millions of notions of parthood, and mereology is not very semantically useful if we can only very rarely mix such notions together to form complex ideas. Problems like the violinist's arm — which is not part of the orchestra — suggest that transitivity between two *conceptually different* kinds of parthood needs be somehow restricted, but we should leave open the possibility that concptually different mereologies can still find *some* propositional connections. This means trying to build in to the mereological thory a sense of the conceptual structure of the parhood relations thereby theorized.

I'll start by defining *hpp* in conceptualbterms as something like: "has as proper part by all relevant criteria". In other words, *x hpp y* means *y is part of x by all criteria relevant to x*. This does not exclude the mere Ontological possibility that some part of *y* may be outside *x*; but any such parts are of no importance for *x* — i.e., for any propositions of practical significance for people engaged with *x* insofar and duing the time that they are engaged with *x*. On Atlantis, the Consortium is an "administrative" part of the Times, and let's imagine that for all practical purpos, for everyone working for or otherwise engaged with the Times, the Consortium is just "part" of the times (no conceptual qualification needed).

But notice that *hpp* hereby conceptualized could easily be symmetric. We could have both *x hpp y* and *y hpp x*, if *x* is part of *y* by all criteria *relevant to y*. The fact that we are evaluating criteria relative to the whole allows

to be inverted, since the formr part then *bcomes* the whole and relevance-criteria are assessed on *its* terms. For employees of the Consortium — those who promote, deliver, index, or represent the papers, or whatever — the Times may be just one of several papers in the portfolio. By *their* criteria, the Times is part of the Consortium, not the other way around.

Someone looking from outsie might prefer to say that neither institution is truly a proper part of the other. Their vantage point compels them to consider *both* parts' criteria, and in this holistic sense there may be parts of the Consortium that are not practically speaking parts of the Times, and vice-versa. It might seem then that the "real" picture involves no proper parthood on either side — and therefore no NAM.

That analysis is not wrong *per se*, but it may pare down parthood relations unacceptably. After all, when are the occasions where we say that $y$ is part of $x$ *completely*, in every sense? An institute inside an acadmic department may be spatially and administratively part — its offices inside the building; its staff demed departmental staff. But the institute might develop curricula, plan events, embrace intellectual paradigms, and form a social circle somewhat autonomous from and tanegential to the department. A specialized imprint of a publishing house may prioritize disciplines different from the larger company. Usually parthood implies some level of autonomy, in real situations, because we usually don't expend the conceptual and bureaucratic effort to keep track of some mere part if the part's behavior or properties is fully predictable from the whole. A semi-autonomous part can still be a part — mereology can permit autonomy; indeed this is a defining characteristic of complex systems — but once we allow parts' autonomy it is easy to soon realize aspects of those parts that make them no longer seem *completely* part of their wholes. We do jot have to abandon mereology completely if we argue that those residual parts are not *relevant* to the whole, and therefore do not interfere with propositional attitudes concerning the relationship of th whole's terms.

This definition of mereology is arguably more robust, because it allows conceptually different mereological relations to be unified. The administrative nature of the Times including the Consortium can coexist with the "compositional" nature of the Consortium including the Times, as part of one mereological system. The key detail here is that we allow *hpp*-rlations to exclude "irrelvant" parts — which of course means we introduce a criteria of relevance, which can "filter" the Universe. If any $x$ is a whole, it can consider $y$s as its parts on the basis of filtering away irrelevant details. Therefore $x$ *hpp* $y$ does not force all $y$-parts to also be $x$-parts (like, say, *being y* qua metaphysical part of $y$), but just that any stray $z$ not be a *potentially relevant* part of $x$.

I'll call the version of *hpp* just outlined "criteriological" because it depends on relevance-criteria localized to each whole. Note that *hpp* decays to "Classical" mereology if we stipulat that there is only one global set of relevance criteria across all wholes in the analysis. Thus classical mereology is a restricted form of this "criteriological" mereology.

Next, I'll generalize further. As I said, things are not usually *completely part* of other things. Usually the appearance of complete parthood is an illusion conjured by how parthood relations are disclosed. For example, surely Kyrian Mbappe is part of les Bleus. But how do we know this? Presumably we see his name on a list of les Bleu's roster, or perhaps see him on the pitch with the squad. But the former case is not actually a warrant (with no further logic) for Mbappe being *part of* les Bleus; it is rather *Mbappe's name* being listed as *a member of les Bleus' roster*. We use the referntial relation between his *name* and Mbappe himself to project to the idea of the player being part of the team.

But this referential indirection carries all the potential for criteriological criteria I have discussed. There is a sense of Mbappe being part of les Bleus relevant to les Bleus — their training, formation, taticts, marketing, popularity, etc. Obviously not every part of Mbappe is relevant to the team; he does not train with them every minute. He has a whole other career at Paris St.-Germain. But aside from the cognitive complxity of tracing in what sense he is part of les Bleus, there is a nagging problem of defining what *Mbappe is part of les Bleus* actually *means*. Maybe this is simpler in well-defined contexts: surely he is part of the squad when he lines up in the starting eleven and the ball is kicked off. But surely also Mbappe being part of les Bleus is a more general phenomenon than just those moments on the pitch.

In real life, a concept like an athlete being part of a team can actually involve complex legal, financial,

and procedural criteria, so it may require a detailed contract to state rather precisely what *being part of a team* actually means. However, supporters know the players on their teams without knowing the requisite contractual minutiae; in short, a fan's acquaintance with their team's history enables them to summon a list of current or past players on demand. Ask a fan who is part of the team, and they will rattle off a list of names. In this sense, they are conceiving a kind of parthood which we might call *enumerative*: $x$ *hpp* $y$ if we would (under ordinary circumstances) include $y$ when enumerating a list of $x$'s parts.

Technically, though, an "enumerative" mereology is "indirect": we use, say, $y$'s *name* on a *list* of $x$'s parts as proxy for $y$ being part of $x$. Presumably $y$'s name is on the list because it *is* part of $x$, at least on some criteria. But as such criteriological relevance is built in to the list construction. To enumerate the parts of $x$ we are not committed to those parts being wholly subsumed under $x$; just that they are *members of* $x$ in some salient context. An $x$ *taking* mereological rlations is then a matter of $x$ bing concptually figured as a collection, aggregate, or set. Of course, wholes can be conceived as multiples in different ways: all players in a sports franchise's history is one kind of plurality; the current roster is another; all the team's employees is a third.

I would argue that the most common kinds of mereologies in paractice are some variations on this theme: to conceive $x$ as a *whole* means to conceive it as a *plurality*, which introducs the posibility of numerating its members, which thereby become its *parts*. But rarely are part/whol relations thereby conceived where the whole "surrounds" the part, absorbing it so that mereological partiality vs. totality can be readily resolved, like a room being part of a house. Usually the members of $x$ qua plurality bear instead some functional and integrative relation to $x$ in some context.

In that sense "enumerative" mereology may seem to be incomplete, because the very act of conceiving a $y$ in its functional role as a member of $x$ seems to color how we are disposed to $y$; we seem interested in $y$ as member of $x$ rather than on its own terms. In practice, however, conceptualizing many things — as least initially — as members of some multiple seems epistemologically unavoidable. Most people would never know of Kylian Mbappe *except* as a forward for les Bleus. Usually we

are introduced to things viareference to a containing whole, and usually that whole is figured as a plurality, collection, or type (rather thanb as a physical or spatial part, say): we are introduced to a friend's cousin as a member of her family; we learn of a new young athlete when he is drafted by a team; we learn about our friend's dog by first being told his breed. Epistemologically the aggregate-whole gives us an entré which we can then follow up by learning about the part/member on its own terms.

Merology in this kind of situation then models a kind of epistemological sequencing, tracing how our cognitive attention can migrate from whole to part. It is asy to see how parthood in this context can come out circular, because the pursuit of knowldge often circles back on itself. We learn about Mbappe because of our interest in les Bleus; then we learn about Mbappe's carrer, of which the 2018 World Cup was an important part; but then we circle back to les Bleus. Mbappe is part of an "epistemological" whole in the sense of our desiring to learn a relatively complete picture of French international fotball. Mbappe is part of any encyclopediac treatment of les Bleus; likewise, les Bleus is part of any encyclopediac treatment of Mbappe. I might call this *encyclopediac* mereology. Encyclopedias, indeed, are almost essentially cyclical in how references link back and forth. But everyday language suggests that these information networks can be undersrood as a mereology; we can readily accept sentences like:

▾ (7) Husserl is part of that Encyclopedia's article on Matheamtical Foundations.

▾ (8) That Encyclopedia of Analytic Philosophy includes Husserl but not Brentano.

▾ (9) Iraq is a big part of Bush's legacy.

Of course, Iraq is not literally part of Bush's legacy or of CENTCOM, as if these were geographic territories. But the *idea* of Iraq, or in some sense "reponsibility for" Iraq, finds a place there conceptually.

Granted that only a hard-core idealist would equate the mereological relations of the *idea* of somthing with that thing's own mereological rlations. Surely the *idea* of Iraq is part of many things that Iraq itself is not part of. But in fact many practical applications of mereological theories depend on tracing mereological relations in a network of *ideas*, or at least something cerebral and/or

computational rather than physical: Web Ontologies, Information Systems, and so forth. Consider the case of a web portal $W$ whose reasources include a portal $W'$ which links back to $W$. In general, web portals *contain* resources in the sense that they link to or provide access to web resources — resources that are not necessarily "part of" the entry-point in the enginering sense of being on the same servers, or being URL subdomains. So *to be part of* in an Information Space $I$ (I'll use this as a generic word for database, portal, Information System, etc.) generally means that $I$ provides access to, provides a kind of structrued entryway to (e.g. a searchable front-end), or "exposes" some affiliatd resource $R$. Here saying $R$ is part of $I$ also means that $I$ *links to $R$*, which suggests $R$ and $I$ are peers rather than granularly mismatched.

In short, in structures that might be conceived as Information Spaces, the commensense picture that mereology implies a difference in scale — parts are at least somewhat smaller than wholes — seems readily contradicted. It might be argued that this is a eccentric feature of mereology in "Information Spaces" which, as essentially cognitive domains (albeit somwhat deperesonalized and mchanized technologically) don't obey the usual laws of mreology. But Information Technology is atly where many philosophers are now trying to embed mereology (or mereotopology) as a technical artifact, so the kind of mereological relation germane to IT should be taken seriously as a candidate for mereology in general.

Taking a cus from the "linked data" nature of Information Spaces, the underlying model of parthood in this kind of theory might involve some kind of epistemological linkage, where access to or information about parts is part of the epistemological interface afforded to their wholes. Mbappe as part of les Blues means, for instance, that an information-source profiling les Blues should link or provide entry to a comparable source profiling Mbappe. As a notion of parthood, this contains an extra layer of indirection, since we can distinguish a *link to $y$* from $y$: an encyclopedia entry on les Blues which Mbappe is a part ot actually contains a *link* to Mbappe. And we get informed of Mbappe being part of les Bleus' roster by seeing his *name* on a list. Thus mereological relations often involve an intermediary name, link, or designation which stands in for an actually autonomous part in partonomic contexts.

To make this somewhat formal, we need two relations:

first, a notation like  which I'll call (borriwing a term from Cognitive Grammar) "profiles". The relation of a profiling a $y$ could be read, according to context, as the conceptual tie between a web address, computer pointer, or other technological reference-artifact and its target; or the designatory relation between a proper names and their objects; or a more cognitive form of reference. Then I'll introduce a whole-to-profile relation  such that  can read *$x$ contains , which profiles something (other than $x$)*. Combining  and  yields a three-part double relation like , for *$x$ contains , a profile of $y$*. Then finally a version of *hpp* can be defined as this three-part relation abstracting :  becomes *$x$ contains a profile of $y$*.

This particular version of *hpp* may be useful because it is adaptable. It accomodates systems where profiles of $y$ either are or aren't *parts* of $y$, according to familiar mereological criteria. Dependeing on how that goes, this latest *hpp* could model "croteriological" mereology: suppose the profile of $y$ in $x$ is the only part or aspect of $y$ which is relevant to $x$. Then  acts as a relevance filter, the profile selecting salient parts of $y$ and excluding residual parts from mereological consideration. Then  can be read as $x$ encompassing all parts of $y$ when filtered by $p$. Either  expressly operates to isolate $x$-relevant aspects, or $x$-relevance is derived from a filtering according to more general criteria, like the properties of a restaurant being subdivided into culinary, operational, nutritional, and architectural dimensions — i.e., a restaurant has architecturally relevant parts, operationally relevant parts, etc.

I will do further analysis however of the alternative model where profile are *not* in general parts of what they profile. Instad, a profile is like an epistemological or technological device that "exposes" or permits access to something else, like a pointer to a region of computer memory. So I'll call this model "expository" mereology. The canonical ida of parthood is now that $y$ is a *proper part of $x$* if and insofar as $x$ "exposes" or provides an information link to $y$.

## 1.1    *Normalizing Arbtitraily Granular Mereologies*

One potential benefit of the Expository model is that it may be applicable to and/or reflective of how technology concretely implements ereologucal systems. I contend

that any classical mereology can be directly mapped to an Expository mereology: take any classical parthood instance . Designate a profile for $y$ inside $x$, say, . Then reinterpret to mean where is , along with a restriction that any $y$ can have at most one profile, and has *exactly one* profile if it has a (classical) whole — actually this one profile is part of the whole *in lieu of y*.

So expository mereology includes Classical mereology as a special case, but it allows for generalizations which patch over conceptual objections that may be raised to Classical mereology in its unadulturated form. In practice the maxim that each $y$ has only on profile may be too restrictive. Instead, multiple divergent wholes may overlap with $y$ in different ways and contexts. For instanc, Mbappe is part of les Blus, and also PSG, the Afro-French community, the Mbappe family, etc. Granted, this may be changing the subject somewhat: "overlap-systems" charactrized by generally complex entities that overklap in different modes and contexts are a different area of philosophy that mereology. But in reality thse two theories are intertwined: many conceptual phenomena can be approached both from a mereological perspective and an "overlap" perspective. The two kinds of thories may be viewed on a spectrum, with mereology merging as we attend more to the filtering effects of parthood, the relation either witnessing or effectuating our disposition to ignore non-$x$ parts of $y$.

To put it differently, arguably any mereological system is an overlap-system which we are able to filter or simplify to reduce cases of practically inconsequential externality that would otherwise block proper parthood. If almost always $y$ is *never* an *completely subsumed* part of $x$ then (classical) has to reference some kind of theory that $y$'s non-$x$ parts are inconsequential. So "relevance" can be like a knob tuning in mereological or overlap theories depending on whether we are more or less sympathetic of filtering: mereologies emerge when we tolerate filtering non-$x$ $y$-parts in as practically appropriate, and overlap theories arise from merologies when we realize that filtering skirts around legitimate Ontological, cognitive, conceptual, or natural-language/pragmatic concerns. I think that the system of operators , , and *hpp* (when defined from the other two) models both mereological and overlap systems and accordingly can unify both kinds of thories. 'p'

Aside from this philosophical case, however, there is a practical benefit to the "Expository" definition of *hpp*

which applies to Classical as well as non-antisymmetric mereologies. Note that according to Classical measures of parthood, Expository mereology only has parthood relations between wholes and *profiles*, and moreover we can assert with no loss of generality that [rofiles themselves do not *contain* (as opposed to "point to") other parts. I assume a semantics where profiles are not themselves organized data structures, but rather referential atoms leading to (arbitrarily complex) structures outside themselves. Proper reference in, say, natural language is not quite so simple — consider first and last names — but we crtainly do seem to have a conceptual ability to coalesce cognitive quanta with almost no internal structuration, save for designating intellectually complex structures; and with this mechanism build up arbitrarily complex cognitive models. Analogouslt, computer software uses pointers to build up arbitrarily complex data structures without unworkable amounts of memory manipulation. Our ability to designate complex wholes with simpler icons — consider cities as dots on a map, or facial portraits as links to bibliographies — sure is a key enabler of complxity in our conceptual and semiotic systems.

In short, we los no complexity when we envision "profiles" as intellectual quanta whose only signification is as a rational bridge to something else; i.e., in a mereological system, profiles ned notbhave their own parts. Accordingly, on Classical terms, we have only one "wholes" layer and only one "parts" layer: there are wholes whose parts are profiles, and profiles refer to other wholes. This two-layer architecture takes the plac of a classical system where partonomic nesting may be arbitrarily deep. Of course, *hpp*-chains can be arbitrarily long, but in Expository mereology — although *hpp conceptually* models parthood — the relata in are not considered to be on intrinsically different scales. The relation *is* across levels, but in we go from a whole $x$ to a *profile* and then back to another whole. This is not to rule out some scale of size within the order of wholes, but that detail is not intrinsic to the system.

I contend this kind of model with limited granular levels is a more accurate representation of how Information System actually work, consiering the design of resource networks (like the World Wide wen) and software systems (with objects and pointers) or (relational) database architcture (with tables and primary keys). It is technologically simpler to have only two or three levels of organization and model complex structures via

some kind of pointer or indirect (e.g., foreign-key) reference. Internally, technology that interacts direcly with multi-level, hierarchical information — consider an XML database — transforms this structure into something more like an object-graph (consider an XML Document Object Model).

I will generalize the two-level model a small bit, with the following rationale: on occasion the intuition that profiles point toward *one* target may be too restrictive. Suppose  profiles a *set*, *s*. We could treat *s* as a whole and models its members via their own profiles in *s*, but then we hav an extra layer of indirection that may serve no modeling purpose. For this reason I allow that there may be a level higher-scale than wholes, which I'll call *frames*. This results in a three-level system: a higher level with frames, a lower level with profiles, and an intermdiary level which contains most of the primary objects of investagtion or conceptualization. Profiles can target multiple objects at this mid-level by targeting a frame rather than a single object. The significance of frames emerges in some semantic and technological contexts where we want to distinguish between relatively dispersed collections and complx wholes with some organizational oherence, such that we are inclined in many contexts to treat them as singular. That is, arbitrarily collating any collection into a whole may dilute a model's ability to distincguish between intgrated whols that often function as singles, from fiat wholes that arrant encircling in a specific context but do not on most criteria cohere as individuals. So as not to bias "wholeness" toward either coherent or fiat aggregates, I propose a "frame" level for "fiat" wholes distinguished, as a system feature, from intermdiate wholes with significant *individual coherence*.

With this addendum, Expository mereology then becomes a three-level system. Arbitrarily complex scales of granularity can be modeled *within* the levels, particularly at the intermediate level, but the formal model can express a technological design where only those three levels need to be implemented as computational primitives.

A consequence of this design is that arbitrarily complex mereological systems can be encoded in hierarchy with only three levels, a process I'll call "normalization". This process is philosophically analogous to normalizing a hierarchical document database to a computationally more malleable graph database. Moreover, I will close

this section by noting that the Expository mereology relation is quite naturally non-anti-symmtric: if $x$ contains a profile of $y$ there is no restriction against $y$ containing a profile of $x$. With that in mind I'll refer to an Expository mereology using the general three-level model and its associated non-anti-symmtric *hpp* relation as an "N3" model or encoding.[2]

## 2   N3 Mereology and Hypergraphs

---

[2]I don't propose this term outside the present writing because it conflicts with N3 in the Semantic Web — a notation for graph structures. N3 mereologies are actually a superset of N3-expressible data structures, where the second N3 is the Semantic Web term.