# NASM

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**Abstract**

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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 repaird 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.

Transitivity is problemmatic in many ways; Mbappe's left foot has th property *being a foot*, which if it is part of the foot is not part of Mbappe. And Mbappe's foot is (arguably) not part of the team. Still, we'd like to preserve parthood-transitivity as much as possible. However, it seems that no matter how narrowly a part differs from the whole, it picks up some kernl of propositional differnce that blocks transivity without some complex concptual patchwork: if we define parthood without a lot of conceptual detail *no* $y$ not identical to $x$, however modestly, can ever be a proper part of $x$ full stop.

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 to say is "part of" Mbappe in a stronger sense, or his *right side*, which seems even less independent. Indeed any picture of Mbappe shows part of him, making that part uniquely predicated as *what 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*.

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 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 of these 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. From the angle of NAM set against Classical mereology, of course, overlap and parthood have a significant difference: overlap is symmetric while parthood is not.

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 offices are in the Times's headquarters, and the Times funds, administrates, and legally controls the Consortium. But we can also say that the Times is part of the Consortium, if the Consortium includes a portfolio of papers one of which is the Times itself.

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 "includes" as "has as part", this is clearly a partonomic cycle. 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-anti-symtry is a more effective modeling assumption than anti-symetry. 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 $\triangleright$ to mean "has as proper part", giving $\triangleright$ different names in the course of debating which parthood-concepts are most appropriate. So parthood is modeled via $\triangleright$ read left-to-right. I will restrict attention to cases where both (*) $x \triangleright y$ and $y \triangleright x$. I'll assume by definition that $\triangleright$ is "proper", i.e. nothing is $\triangleright$ itself, so in (*) necessarily $x$ is not identical to $y$. By this setup $\triangleright$ is not transitive, since $x$ *nhpp* $x$, but call *chpp* the transitive closure of $\triangleright$. Then (*) exemplifies a case where $x$ *chpp* $x$.

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.

Howevere, 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 $\triangleright$ in conceptualbterms as something like: "has as proper part by all relevant criteria". In other words, $x \triangleright y$ 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 purposs, 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 $\triangleright$ hereby conceptualized could easily be symmetric. We could have both $x \triangleright y$ and $y \triangleright x$, if $x$ is part of $y$ by all criteria *relevant to* $y$. The fact that we are evaluating criteria relative to the whole allows $\triangleright$ to be inverted, since the former part then *becomes* 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 $\triangleright$-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 $x \triangleright y$ 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 $\triangleright$ just outlined "criteriological" because it depends on relevance-criteria localized to each whole. Note that $\triangleright$ 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*: $x \rhd y$ 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 cue 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 $\mathfrak{p} \mathrel{-\!\!\triangleright} y$ which I'll call (borrowing a term from Cognitive Grammar) "profiles". The relation of a $\mathfrak{p}$ 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 $\succ$ such that $x \succ \mathfrak{p}$ can read $x$ *contains* $\mathfrak{p}$*, which profiles something (other than* $x$*).* Combining $\succ$ and $\mathrel{\triangleright\!\!-}$yields a three-part double relation like $x \succ \mathfrak{p} \mathrel{-\!\!\triangleright} y$, for $x$ *contains* $\mathfrak{p}$*, a profile of* $y$. Then finally a version of $\triangleright$ can be defined as this three-part relation abstracting $\mathfrak{p}$: $x \triangleright y$ becomes $x$ *contains a profile of* $y$.

This particular version of $\triangleright$ 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 $\triangleright$ 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 $\mathfrak{p} \mathrel{-\!\!\triangleright} y$ acts as a relevance filter, the profile selecting salient parts of $y$ and excluding residual parts from mereological consideration. Then $x \succ \mathfrak{p} \mathrel{-\!\!\triangleright} y$ can be read as $x$ encompassing all parts of $y$ when filtered by $p$. Either $\mathfrak{p}$ 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 profiles are *not* in general parts of what they profile. Instead, 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. I'll call this model "Expository" mereology. The canonical idea 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 $x \rhd y$. Designate a profile for $y$ inside $x$, say, $\mathfrak{p}_x$. Then reinterpret $x \rhd y$ to mean $x \succ \mathfrak{p} \mathrel{-\!\!\triangleright} y$ where $\mathfrak{p}$ is $\mathfrak{p}_x$, 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 $x \rhd y$ 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) $x \rhd y$ 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 $x \rhd y$ 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 $\succ$, $\mathrel{-\!\!\triangleright}$, and $\rhd$ (when defined from the other two) models both mereological and overlap systems and accordingly can unify both kinds of thories.

Aside from this philosophical case, however, there is a practical benefit to the "Expository" definition of $\rhd$ 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, $\rhd$-chains can be arbitrarily long, but in Expository mereology — although $\rhd$ *conceptually* models

parthood — the relata in $x \rhd y$ are not considered to be on intrinsically different scales. The $\succ$ relation *is* across levels, but in $x \rhd y$ 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 $\mathfrak{p}$ 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 $\rhd$ relation as an "N3" model or encoding.[2]

## 2 Mereology and Externalism

One way to approach mreology as a philosophical topic is to define different mreological systems, including cases where these differences can be observed "axiomatically": the presence or absence of an anti-symmetry restriction on parthood, for example. To make this exercise worthwhile, it is then necessary to describe the philosophical or practical implications of th logical divergence: is the system with one logical form vs. another a more faithful model of thought, or a more useful directive for technology, or somehow better scientifically? After all, it's not like the rules of mereology are written in the cosmic order; mereology is not an empirical science.

A related question is whether a given mereological theory is intended to represent how we, as humans, *think about* parthood, or to represent part/whole relations which have some causative or compositional role in nature. Given a partonomic assertion — that a leaf is part of a tree, say — we can read this as a description

[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.

of conceptual attitudes: that most people (by virtue of perceptual gestalts or lexicosemantic pressures or subconscious internalization of others' enactive-conceptual habits or some other means) instictively see and comport to the leaf as part of the tree (and the tree as inclduing and encompassing its laves). We can also read this parthood as saying that *literally*, as a feature in how leaf and tree exists according to biological and physical laws, the latter encompasses the former.

Certainly these two senses are not completely independent. We probably would not entertain mereological attitudes without some pragmatic or physical sense that these attitudes are grounded in reality — that the part we ascribe to a whole does indeed behave as if under the constraints of parthood. On the other hand, insofar there are "physical" criteria of parthood, we presumably learn of them alongside other scientifizable aspects of phenomena, so that mereology becomes part of the overall package of our scientific model-building. At that point we may try to isolate partonomy as one important, recurreing facet of scientific models and specify how, or the different ways in which, parthood is thematized within scientific explanations or proto-scientific intuition.

But still, the difference between partness as a matter of concptual attitudes versus (in some sense) nomic given is consequential for how we read individual parthood assertions. Given $x \rhd y$, do we see this as matching $x$ and $y$ to physical (or at least extramental) objects? Or does it mean that in our cognitive engagements with $x$ we experienc or believe $x$ to include $y$? If we read *the leaf is part of the tree* wholly extramentrally, we have to explain the rferential logic of "the leaf" and "the tree"; i.e., what sort of entities these ar esuch that they can be compactly signified. We could be fully realistic about (mentally) external things — let's agree there really is a tree out there that many people see and therefore can be a topic of discussion. We still have to explain how there is a referential pattern which grounds use of notation like "the tree" as part of logically sensical assertions (including mereological ones). We presumably see the tree as a gestalt unifying perceptions of its trunk, branches, and leaves, but plugging this unadorned sense into the parthood assertion becomes circular, since the leaves then become *part of* the referential grounding of *the tree*, which empties the assertion of any content. Mereology would cease to be a philosophically relevant topic if its assertions were wholly on the order of, say, the number 11 being part of the set {11, 22, 33}.

Note that the problem of referential circularity does not necessarily arise in the same way when we think of mereology as a cognitive phenomenon. I don't think it is trivial to the point of meaningless to ask if our *concept* of 11 is part of our *concept* of the set {11, 22, 33}. Philosophy is a concptual activity, so it is simplest to read philosophical theories as models of other conceptual activities. Of course, however, usually our conceptual activity tries to stay oriented to extramental reality, so philosophy captures the structre of conceptualizations somehow interfaced with reality, and philosophy's own concepts and notations and quantifications to some degree represents this dual appointment: sometimes we're talking about cerebral artifacts and sometimes we're talking about real things intended by (using *intend* phenomenologically) cognitive acts. In practice, it can be hard to disentangle the cerebral and (by discursive intent and cognitive ontention) extramental artifacts as referential patterns, or quantification domains for logically-structured units that arise in the course of argumentation (like $x \rhd y$).

To clarify thse points, consider for a moment the famous Putnam Twin Earth discussion. As the scenario is describes, Twin Earth harbors an XYZ substance functionally identical (for all purposes relevant to Twin Earthers) but compositionally different from $H_2O$. We can then entertain questions about whether Twin Earthers' water-concept — which apparntly refers to a different Natural Kind — is the same as our water-concept.

This setup makes several assumptions of its own. First, it assumes that we have a canonical water-concept, and that it (either essentially or incidentally) refers to a Natural Kind which is the substance $H_2O$. This is a simplifying assumption in multiple rspects; one of which is that $H_2O$ itslf encompasses several different chemically distinguishable substances (if we consider various forms of heavy water). Second, evern our everyday water-concept is divided across different contexts: we would probably call both ocean water and tap water in a bucket a *bucket of water*, but we probably wouldn't call ocean water in a glass a *glass of water*. So our "water" is probanly a fusion of several different concepts, the stuff in oceans and saline lakes plus the stuff in freshwater lakes and rivers (including the potable stuff that by aqualogical engineering is delivered to our taps).

The water in some saline lakes is actually much less

"pure" than blood plasma in a hospital, yet we are not inclined to call plasma "water". On the other hand, exceptionally pure water — distilled water — is not even a prototypical kind of water; that's why it needs a special concept. So any trivial equation between *water* and $H_2O$ is problemmatic.

Meanwhile, the Twin Earth discussion is also noncommittal about how XYZ is supposed to differ from $H_2O$. We can imagine the XYZ components as very similar to Hydrogen and Oxygen — for instance, imagine XYZ as a relabeling of DHO, or "semi-heavy" water with one Deuterium atom. I don't think we should have trouble as accepting that XYZ is then just another kind of water (like heavy and semi-heavy water). Or perhaps Twin Earth has some new subatomic particl that can clink to Hydrogen and make it 'X'/, like the extra neutron that makes Hydrogen into Deuterium. Perhaps, that is, XYZ is functionally similar to water beause its constituent parts are similar to earthly Hydrogen and Oxygen. As with heavy water, there is alrady a precedent for expanding our earthly water-concept to accomodate more complex chemical models of the water molecule.

I think the Twin Earth disucssion only really has philosophical weight if we assume that XYZ components are *significantly* different than Hydrogen and Oxygen. Of course, we also have to assume that XYZ behaves enough like earthly water that these differencs have no practical effect for Twin Earthers. Among other things, we have to assume that they are technologically more primitive than we are. After all, among the functional characteristics of water for us is that we can derive Hydrogen and Oxygen from it; assuming XYZ are not just special kinds of Hydrogen and Oxygen, presumably this is not true of XYZ. This could easily bias our assessment of Twin Earthers' water-concept, because *we* know that there are functionally salient differencs between XYZ and $H_2O$. Perhaps we can't help but imagine that eventually Twin Earthers' knowldge may eventually reach the point where the differencs become relevant to us, just as many years passed before humanity learned about Hydrogen and Oxygen; then of course the assumption that their water is (relative to their own needs) functionally identical to ours (is we factor out the level of our practical engagement with water that surpasses their technological capabilities) breaks down.

Intuitively, no doubt, we consider both functional and physical/material criteria when circumscribing the extent and intent of concepts. If I take coffee at a vegan friend's house and ask for milk, it is not impolite for her to bring almond milk. That is, we are prepared to subsume "almond milk" under the concept "milk" in som contexts. However, we are reluctant to draw concepts based solely on functional resemblance, ihnoring obvious compositional differences such as those between milk and almond milk. Surely this is due in part because compositional differences, whilr they may be irrelavant in *some* contexts, are usually relevant in other contexts. For instance, milk and almond milk are nutritionally biologically different.

Our functional and "compositional" criteria for concepts are not usually in tension, because usually there is enough coorelation between the two kinds of differences that, over a broad set of contexts, they tend to reinforce each other. That is, there are contxts where functional resemblance seems to warrant concptual unification even pace apparent compositional differences. Thre are other contexts where functional *differences* might supercede compositional similitude: think *aluminum foil* or *copper wire* compared to blocks of aluminum or copper (or, concepts like *statue* and *pot* are different from each other and from *clay*). Of course, in these last examples, matrial form — shape and arrangement — contributes to functionally different behaior, so we can include physical morphology as properties as brute composition (consider, though, the special value accorded to statues and objects d'art of reputable creators, rooted in properties of provanence that are orthogonal to both physical constitution and material form). But, in any case, we also have linguistic and situational faculties to construct contextually "local" maps of concepts — how *in this context* concpets subsume or fit together in particular ways — without confusing these local pictures for global schema. With sufficient integration of many contexts, our intellectual and linguistic dispositions tend to (collectively as a language- or social-community) converge on a mapping of conceot's boundaries and inclusion/subsumption that reflects both functional and physical/material criteria with neither set of criteria dominating the other.

Putnam's Twin Earth experiment invites us to imagine scenarios where the approximate synergy between functional and compositional criteria breaks down. In a hypothetical case where functional resemblance persists despite (significant) compositional differences, and one a

wide scale across contexts, are we prepared to find conceptual unity (siding with the functional resemblance) or conceptual bifurcation (siding with the compositional difference)? At one level, this is hard to thematize straighton, because the very construction of the case-study seems to undermine its requisite presuppositions. As I said, I think the thought-experiment is most thought-inducing even we assume significant enough difference between XYZ and $H_2O$ as compositional substrata of water (or twater); so with chemical knowledge akin to ours, XYZ *doesn't* behave like water. So there are meaningful contexts where functional resemblance *does* break down. We have to assume however that these contexts are not relevant on Twin Earth because Twin Earthers don't have, say, equipment to separate water into Hydrogen and Oxygen (or, analogously, XYZ into X, Y, and Z).

I think what began as a disucssion about *concepts* ends up rally being a discussion about *contexts*. There are of course local contexts where non-standard concept maps are drawn (like milk/almond-milk). As I have argued, we are competent in juggling local and "global" conceptual maps ("maps" in the sense of how concepual "territory" is partitioned), exercising a mixture of linguistic and situational understanding; a partition in rational communities sharing language, norms, and the pragmatics of everyday life. Therefore we mark nonstandard conceptual maps to as *local* to given contexts, whereas we also have a sense of concepts as intellectually global resources, which adjust for local nuances in predetermined ways. Our concept "*water*", for example, is presumably a federation of narrower concepts (notably saltwater and freshwater) which we unify for both physical and functional reasons: while not pure, the primary substance in both cases is $H_2O$ (which is actually third concept *subsumed by* water), motivating the unification, plus they have functional similarities in many (albeit not all) contexts. So, by panning out from local contexts into a globally trant-contxt conceptualization that is the best compromise between global generality and local specificity, a canonical concept merges which unifies other concepts but also has some internal integrity (i.e., the identification of water with $H_2O$ grounds our conceptual norms in established science). The panning from local to global conexts is then a key semantic detail in establishing "canonical" versions of concepts.

I think the real force of Twin Earth is that it intoduces two different possibilities to "panning to global context". Global becomes relative: do we mean to generalize Twin Earth contexts only to those which ar e likely to be efficacious on Twin Earth itself? That is, should we assume that there will never be a global context affecting Twin Earthers' conceptualization of water that would establish a ground for contrasting this concept with (earthly) $H_2O$? In that case, an "internalist" might say that twater is the same concpt as water, applying the maxim that conceptual boundaries are drawn to reflect the interplay between function and composition as we pan from local to global contexts. No matter how "high" we pan out, on this argument, we will never encounter a situation where compositional difference triggers a potential functional difference that was lurking gehind local functional resemblance — analogous to how the biological difference between milk and almond milk is bound to arise in many contexts, whether or not it is locally relevant. But water/twater differs from milk/almond milk because (according to the setup) there is *no* context we can encounter when we "pan out" from local to global which makes the water/twater difference consequential.

Conversely, we can read the same scenario differently and propose that "Global" cannot be read in such a retricted sense. The global context or context-synthesis available to Twin Earthers — the level of abstraction beyond their local contexts — is not th *real* global context, since *over and above that*, by stipulation, *we* provide an encompassing global context of which Twin Earthers' global context is just a part. For *us*, the difference between XYZ and $H_2O$ is functional, not just compositional: the thought experiment stipulates (or should do so) that the two substances are compositionally different enough that functional differences would arise in contexts that depend on splitting water into its constituent parts (if X, Y, and Z are just slight variations on Hydrogen and Oxygen, or chemically transform to Hydrogen and Oxygen, I think the discussion becomes moot; on par with water/heavy water, which doesn't involve any extraterrestrial stories). What makes Twin Earth (stipulationally) unique is that *its* global context is not global enough from *our* vantage point.

We can certainly debate whether Twin Earth's context still deserves to be called "global". If it does, I think we end up with an Internalist theory, since we're saying that criteria of globalness should be measured against the cognitive resources of a rational community: if there's no context where compositional difference is practically

relevant, then we may as well use functional criteria alone to establish concept partitioning. Conversely, if we say Twin Earth's context is *not* authentically global, I think we ar eled to an Externalist theory. If two conceptual cores refer to different physical kinds, and we can range over every possible context (without regard for how cognition is groundd in the practical machinery of knowledge acquisition), the we can certainly say that compositionally different kinds represent referentially or extensionally different concepts.

But, I would argue, tjis is really a debate about Externalism and Internalism vis-à-vis *contexts*, and specifically about *globality* of context. When we pan out from local contexts, do we reach "global" when we reach the horizon of conceptualization context that is empirically possible for the relevant cognitive community? Are latent functional differences beyond this horizon factors in concept-identity? Internalists basically say that this horizon *is* the global context, so "global" is an attribute relative to the epistemological possibilities of any cognitiv community. If ther is no epistemologically possible world where a stipulated compositional difference becomes dunctional — i.e. there is no possible world where the knowledge of the difference can be reached from a community's present epistemological state — then we can say that in the "epistemologically possible horizon" there is no context which "functionalizes" the compositional difference. Then there is no point in saying that such a horizon is *not* global. But if we are allowed to imagine that any epistemological being whatsoever an "look down upon" that horizon and see beyond it — in other words, that globalness is an external to any one mind (or any one community's cognitive resources) — we end up being "contextual externalists", sassuming that the only real "global" context is the maximal context which is metaphysically possible, where everything knowable is factoreed in, such as the functional consequences of any compositional differencs. In either case, any notion of competing externalist and internalist intuitions about *concepts* appear to piggyback on corresponding intuitions about (global horizons of) *contexts*.

Perhaps my line of reasoning here feels like I am presupposing the answer: the true externalist claim is that concepts which bear (even unbeonownst to those who have the concepts) referential relations to compositionally different kinds are different concepts *irrespective of* whether functional differences can (even *potentially*) follow. However, I question whether compositional difference can be completely free of functional differences in *all contexts*; function and composition are at least somewhat interdependent, so it's hard to imagine the complete absence of contexts where this interdependence does not imply compositional difference that propagate to functional difference. One can be an Externalist in saying that concepts can be differentiated on the basis of compositional differences even outside the epistemological horizons of concept-holders; but an Internalist in the *rationale* for this Externalism — that with a sufficiently wide horizon of contexts (and sufficiently epistemologically endowed cognitive agents for whom these contexts are environing) compositional differences eventually become functionally noticeable.

In addition — more relevant to mereology — someone might react to my talking about how we *draw* conceptual boundaries; that we *choose* whether and in what circumstances to unify (e.g.) saltwater and freshwater into a canonjical water-concept. This style of argument may seem to be vaguely internalist from the get-go, because if we define conceptual architecture as a mental exercise it's hard to give due credence to concepts' potential extramental reality. There are, of course, extramental factors influencing (e.g.) our water-concept. Heavy water isotopes could potentially complicate a simplistic mapping of *water* to $H_2O$ but as a matter of empirical fact ordinary $H_2O$ is by far the most common form on $H_2O$ on our planet. Ocean water and freshwater have chemical differences, but they share the property of being predominantly $H_2O$. Moreover, they are unified by metereological cycles and behavioral similairities that supercede their chemical differences — ocean water cycles to freshwater as rain, and rivers drain into the ocean. The individuation of the concept *water* depends on these geological and metereological systms as much as by "water = $H_2O$" chemistry; this is perhaps why plasma (which is more watery than salt water) has no conceptual status as water.

These facts don't imply that we have no choice in which conceptual distinctions to recognize, or ignore; the space of *potential* concepts, as defined by whatever scientific regimes apply (chmistry, biology, geology, and so forth) may be finer-grained than our everydayconcepts. On the other hand, we also have cases like a statue whose value changd depending on whether it is believed to be the work of a great artist; social constructs like artistic

or accidental provenance (consider a baseball that, by coincidence of being hit for a historic home run, becomes a collector's item) can introduce conceptual distinctions sometime more granular than warranted by science. But while human concept-mapping may be coarser or (occasionally) finer-grained, we cannot rationally entertain conceptual systems that would deviate too radically from what is scientifically warranted. Perhaps we could say that behind every practical concept-system there is a most scientifically transparent grounding, a systm where spurious social distinctions (like artistic provenance) are bracketed, but material differencs (even ones that may seem parenthetical to even most scientific conrtexts, like water/heavy water) are reprsented. This would then be the extramental background upon which are human concepts are established, and each human concept-system can be treated as modifying this background by unifying highly granular concepts into more general canonical concepts on practical terms, or occasionally superimposing scientifically-spurious criteria to split background-concepts into finer shadings. Arguably, it is a valid philosophical exercise to uncover the scientific grounding behind the culturally reletive, socially ephemeral play of conceptual mergers and bifurcations above it.

We can develop a philosophically non-trivial theory of concept "mapping" considering only cognitive attitudes — for example, the balance between funtional and scientific considerations that shapes a community's choics (sometimes deliberate, sometimes emergent) about when to unify or to divid concpts. The fact that these choices are made against an extramental nomic order can be seen as a relevant detail but not a defining theme of the analysis. On the other hand, parallel to that, we can consider a theory of concepts that considers our relative autonomy in *choosing* concept-boundaries to be a complicating detail, and the core analysis to engage the extramental constraints. Neither theory is better than the other on any purely speculative ground that I can think of — execpt that I think we need to formulate a notion of "extramental constraints" properly.

To the degree that our theory of concepts recognizes a domain of extramental fact — as in the Externalist implication that the chemical form of water/twater *could* affect whther they ar ethe sam concept — we need to pair the analysis of concepts with analysis of the relevant empirical conditions and how our scientific understanding should guide th concept theory. After all, the very possibility that water/twater's chemical differences could make them *different concepts* — that our decision whether or not to *treat* them as the same concept does not *make* them the same concept — implies that there is at least one system of concepts whose boundaries are drawn independent of actual human conceptual acitivy. This is not a prima facie untenable paradigm, but it needs to be supported with a sufficient level of scientific backing. Which is fine, except that some analyses may seem to state simplistic referential norms as proxies for a realistic scientific analysis.

For example — leaving aside our relative autonomy and centering on empirical givens that extramentally shape the possibilities of our water concept(s) — the relevant background is not mrely that water is $H_2O$. In other words, even if we consider (or narrow analysis to the strata where) concepts are extramental, we can't just say that the concept *water* is $H_2O$ irrespective of cognitive choice (or that we could create our own human concpts adding or subtracting details but we're doing so on a foundational concept-system where water is $H_2O$). Surely even in most purely scientific contexts water is not *pure* $H_2O$. Nor can we use some sort of fuzzy logic — substances close enough to pure $H_2O$ below some threshold concentration of other compounds should be deemed water — because then plasma becomes water and some salt water becomes non-water. Nor can we say that we choose what to consider water by combining things like concentration levels with functional/behavioral criteria, because the whole point of the exercise is to analyze concepts at a layer outside intellectual *choice*.

What we *can* say is that water-criteria lie at the intersection or multiple sciences: geology, limnology, meteorology, chemistry, biology, not to mention hydrology itself. Water (unlike plasma, say) falls as rain, erodes cliffs, and flows down rivers. What makes the extramental dimension of the water-concpt viable is the synergy btween these different sciencs, or rather the natural phenomena they study. This extramentality can be philosophically lusive, perhaps, because a robust theory of water's extramental nature would seem to rely on expert testimony, and therefore to some degree on expert opinion, which seems to conflict with our effort to isolate the water-concept not that we can *choose* to reify, but that we are *compelled* to reify by empirical conditions. But at least the hypothtical scientists are testifying under the guise of reporting extramental reality to the best of our

ability, trying to cancel the autonomy (and therefore potential arbitrariness at least vis-à-vis scientific criteria) of human concptualizing as much as possible.

To the degree that this scientific process is possible, we have at least a picture of how an "extramental" thory of the water-concept could proceed. But this theory is possible because we do not consider the problem as a matter of *reference* — i.e., of determining what the signifier "water" refers to, yielding accounts like water *refers to* $H_2O$. Instad, we ar e trying to isolate the factors that make *water* a conceptually coherent phenomenon involved with different sorts of natural processes: water as a meteorological substance (a factor in weather-patterns), as a geological substance, and so forth.

I use the water-concept as a case-study because I think there are analogous trahjecrories in mereology: here also we can develop theories which either foreground or background extramental empirica. For example, a nail is part of a toe, and presumably the end of a nail which can be snipped off is (beforehand) part of the nail. But what is th status of the mreological sum of the body and the snipped-off nail-part? Is this an actual whole? Presumably in a nontrivial mereolosgical system not every combination of parts is necessarily a whole; otherwise there would be no room for a separate class of whole — the mreology would be just a set theory with some universe of members. So we can ask whether body-plus-snipped-nail-part is a nontrivial whole. Certainly there is a period of time when it was evidently non-trivial; does having been *in the past* non-trivial make the *current* whole non-trivial? It would sem on thatbtheory that very possible mereological sum involving myself and every snipped-nail-part or every cut-hair I've lost over the years then becomes non-trivial, which seems extravagant.

On the other hand, is that snipped sum *is* trivial, it onc was not trivial, so snipping the nail made some mereological sum go from being a non-trivial whole to being a "mere" trivial sum (call it $Triv$). We then need to articulate what is going on with such a change: $Triv$ is no longer physically connected, it no longer functions as a natural unit, and so forth. I juxtapose this case with the water example because I think (even though one analysis belongs to mereology and another to semantics and the theory of concepts) similar tropes come into play. We can debate whether it is mental or extramental that $Triv$ is trivial; whether the quality of triviality is our *judging* that some sums are not worth our attention, or *choosing* not to conceptualize them as wholes; or whether we are compelled to these choices by empirical fact. We can debate whether beneath ourculturally regulated mereological attituds there is an extramental mereology guiding our cognitively selective mereology, just as empirical facts compel some maps to be more realistic than others. The intersection of scientific, cognitive, and philosophical criteria in comparing $Triv$ to the nontrivial pre- and post-snip toe resonate with the relevant criteria in the water/twater distinction.

## 2.1 *So, Mereology and Externalism*

Suppose I clip a nail, and call the now-trivial sum $Triv$ as before, and the non-trivial rest of myself $Me$. We want to explain why $Triv$ is trivial and $Me$ is not. We also want to explain why my friends think of me as $Me$ and not as $Triv$ (even if they see the nail-part that belongds now to $Triv$ but not to $Me$).

Analogously, suppose I designate the conceptual sum $A$ to be a substance which is either or water or orange juice (suppose those are the two choices available on an airplane). Presumably $A$ is a trivial concptual sum, because there is no scientifically reasonable (or even functionally reasonable) conceptual unification of water and orange juice (this is different than saltwater-and-freshwater, or $H_2O$ and Deuterium Dioxide, or even milk and almond milk, or for that matter water and twater). But why is water-plus-orange-juice *trivial*?

To the extent that we are reasoning in an Internalist spirit, this is obvious: there is no enactive situation where $A$ would be usefully treated as one concept and not the logical-or of two distinct concpts. There is no compelling scientific case for $A$. There is no functional similarity between water and orange juice strong enough to make them interchangable like (sometimes) milk and almond milk. In short, there is no criterion among the functional, situational, and scientific considerations we bring to bear on concept-maps that would make us *want* to draw $A$ as an integral conceptual region.

However, if we are working in an Externalist mindset, we want to say that $A$ is not a natural *kind*; that there is no scientific basis for unifying water and orange juice.

Presumably we have no trouble making this assumption bcause there does not seem to be any scientific discipline, any nexus of sciences' topics, that would project onto $A$ with any conceptual identity. Water is a non-trivial concpt because it is a meteorological, biological, geological, limnological substance; $A$ is not any of those things. $A$ is trivial becasuse there is no "ology" that makes $A$ an "-ological" substance.

Anologously, $Triv$ is trivial as a mereological sum by a similar account of why $A$ is trivial as a conceptual sum. There is no "ology" that makes $Triv$ an "-ological" whole. By contrast $Me$ is a biological whole (and arguably psychological, sociological, and so forth). So the key factor in mereological triviality or holistic integrity would seem to be the presence or absence of an "ology" that renders the mereological sum into a concordant "-ological" whole.

I'll refer to this hypothsis as the *multiscientific* model of mereology. On this model, what distinguishes whols from trivial mereological sums is that wholes can be reasonably judged as entities in the terms of one or (in the general case) more than one science. A whole is non-trivial if it is an "-ological" whole whre we can plug in one or more sciences to get the relevant "-ologies". I'll say that such a whole is *multscientific*. So we can develop mereological thories rooted in cognition, and consider only whether we perceive some putative sum as a whole according to individual or collective cognition. In that sense any mereological expression quantifies over cognitive things: an $x \rhd y$ means that $x$ and $y$ are *my conception of* or *my cognition of* something; and in this conception I eprceive (feel, sense, whatever) $y$ to be part of (included in, circumscribed by) $x$. If we want to get outside the intramental boundary of this way of talking, I think, our alternative to *cognitive* wholes is *multiscientific* wholes: this is the kind of mereological Externalism which I think is philosophically consistent.

This partition of the philosophical options — cognitive vs. multscientific wholeness — may seem reasonable, but it imposes a discipline on philosophical discussions that can seem to complicate our intuitive discussions about mereology. For example, if I perceive a statue preserving its identity after losing a small piece, I don't think of the mereological integrity of the now slightly-smaller statue (but not the statue plues the broken-off piece) as merely a conceptual choice, or an artifact of cognitiv framing: that the piece *looks* detached from the whole, but if the gestalt were a little perceptually different — say, the broken-off piece were resting on the statue — I could go back to thinking of the larger sum as the relevant whole. I feel that my cognitive-mereological attitudes are constrained by physical conditions and situations.

So we probably hav a sense — generalizing from "my" impressions just noted — that, while mereology has an important cognitive dimension, a complete theory of mereology has to address how we experience mereology inbthe cognitive realm as constrained by some extramental mereological order. That would sem to tak us, in the case of a sculpture/clay example, to look at the sculpture not just through the lens of its cognitive stature — not just as a cognitive (viz., cultural, asthetic, intellectual) artifact — but as a material object whose nature is subject to extramental norms. It is qua material thing — qua lump of clay, say — that the sculpture carries out an extramental existence that make some mereological formulae concerning the statue more permissible than others, in a way we cannot fully command by the rlative autonomy of our drawing concptual boundaries. There is, in short, something extramental about the statue and therefore something subject to norms outside the play of cognitive frames. So we get disucssions about the statue as lump-of-clay as well as archaeological artifact, or the lump as a proper part of the statue, or both lump and statue as proper parts of some social-physical hybrid object. However the argument runs the "lump of clay" motif sems to svre as proxy for the extramental self-sufficience of the statue.

Elsewhere we may have language about objects as collections of molecules or atoms, or "material extents", or some other way to signify extra-mentality. That is, to disucss the etramental dimnsion of mereology we have to signify the extramental dimension of cognized *things*, and this sems to involve some languag to the effect that "extramental" means *physical* according to a particular image of physicality: extension in space(time), composition of smaller physical parts, possessing geomtric shape, and so forth. This general language of physicality — more a connected group of philosophical tropes perhaps than an explicit theory — is different in tenor than the formulation I have given here: namely, *multiscientific*. In its extramentality the sculpture is not (at least in the crucial details) a "lump of clay" or a collection of atoms or any other proxy designation of "physicalness". Rather

the sculpture is an archaeological object, perhaps also mineralogical, morphological, and so forth — its own "ologies" — and the mereological controversies about the sculpture's essence or nontriviality are really questions about what it means to be (say) an archaeological whole; a whole qua archaeological object.

I think questions about "multiscientific" stature or integralness sometimes get camouflaged by referential or quantificational issues. Next sction I will clarify what I have in mind here and what are I think the consequnces.