Expansionism and Mereological Universalism

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Abstract

Mereological universalists, according to whom every plurality of entities has a fusion, usually claim that most quantifications are restricted to ordinary entities. However, there is no evidence that our usual quantifications over ordinary objects are restricted. In this paper I explore an alternative way of reconciling Mereological Universalism with our usual quantifications. I resort to a modest form of ontological expansionism and to so-called interpretational modalities. Quantifications over ordinary objects are the initial stages of the expansion. From these initial stages, expansions can proceed upwards (fusions of entities in the domain of quantification are added), downwards (parts of entities in the domain are added), and sidewards (entities which are mereologically disjoint from the entities in the domain are added). These expansions are driven by a variety of epistemic and pragmatic reasons and raise different kinds of problems. At each stage, a modalized version of Mereological Universalism is true. By contrast, only at some especially rich stages, standard, non-modalized Mereological Universalism is true as well. Among these especially rich stages, there is a final, metaphysically preeminent stage of mereological plenitude. In the last part of the paper I discuss some problems and limitations of expansionism.

Keywords: mereology, unrestricted composition, compatibilism, metaontology, expansionism

1 Introduction

The purpose of this paper is to explore a new way in which the metaphysical doctrine of *Mereological Universalism* (henceforth, MU), according to which every plurality of entities has a fusion, can be made semantically compatible with our propensity to quantify only over ordinary objects, or over limited enrichments of the domain of ordinary objects. The compatibility of MU with quantifications over ordinary objects has been affirmed by many advocates of MU in the past, but the way in which they have explained this compatibility (nicely summarized by David Lewis's motto "Restrict quantifiers, not composition", Lewis (1986b, p. 213)) is unconvincing.

According to the alternative I am going to explore in this paper, there is a sort of ideal path which goes from usual quantifications over ordinary objects to MU: an articulate series of *expansions* of the domain of quantification. The initial stage is highly dependent on the contingent, subjective standing of the speaker, without any commitment to an objectively or even intersubjectively delimited set of ordinary objects. The series of expansions terminates at a final stage, at which we quantify over a *mereological plenitude* of entities and at which MU holds in its full strength. I will suggest that, at each stage of this expansion, a weakened, modalized version of MU holds, according to which, given some entities, it is *possible* that there is something which is their fusion. The possibilities at stake are instances of *interpretational modality*, a notion which I borrow from the works of Kit Fine and Øystein Linnebo on the metaphysics of abstract entities,[1] and I adapt to a different purpose.[2]

Before motivating my dissatisfaction with the current, *restrictionist* forms of compatibilism and introducing the *expansionist* alternative, let me narrate a partially fictitious story in which I (as the main character) indeed proceed from quantifications over a subjectively delimited domain of ordinary objects to a form of quantification for which MU holds. The story will offer a preliminary glimpse into the kinds of expansions I aim to characterize and serve as a source of examples to draw upon throughout the paper.

On my desk, there are at present three books and a table lamp. A colleague of mine (say Ernest, a Professor in English Literature) enters my room and asks whether there is anything else. I reply that no, there is nothing else on my desk.

However, I could later be motivated, by pragmatical concerns, to consider something else which is on my desk, such as the light bulb fitted on the lamp, or the single pages and the covers of each books. For example, I could begin to consider the bulb if and when it burns out and I need to replace it, or I could begin to consider the pages, if and when I need to make a time plan to finish reading the books before a deadline (so that it begins to matter how many pages

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[1] In particular Fine (2005, 2006) and Linnebo (2018).

[2] Interpretational modalities and expansionism have been previously applied to mereology (for the first time in an articulate and systematic form), and in particular to the so-called thesis of Composition as Identity, in Botti (2019).

the three books have). Moreover, if I think about it, I could also apply some rough and confused information about chemistry and physics I learnt at school to the lamp and to the books (as well as to the bulb and to the pages). Based on this information, I could begin to consider also the molecules, physical atoms, or even subatomic particles which are parts of the books or of the lamp.

I could also notice, at a certain point (perhaps when I am bored and I start looking at the desk more closely than usual), that there is a fan-shaped shaving from a pencil sharpener I used a week ago. After noticing it, I begin to consider it and now, should Ernest stubbornly reiterate the question whether there is anything else on my desk, I would change my previous answer, and admit that there is indeed something else: namely, a pencil shaving.

Then, I could go on reading the books (I have to meet my deadline). One of the books is *On the Plurality of Worlds* by Lewis (OTPW), and at pages 211-213 I meet a surprising philosophical argument for the following claim: "Any old class of things has a mereological sum" (Lewis, 1986b, p. 211). This is indeed Lewis's formulation of MU, which might be expressed as follows in plural logic (Σ expresses mereological fusion):

$$\forall xx \exists y (y \; \Sigma \; xx) \qquad \text{(Mereological Universalism)}$$

Lewis's argument for MU proceeds roughly in the following way.[3] Any desirable criterion for restricting the domain of things which have a fusion is *vague*, and for this reason cannot be satisfied: the claim that some things have a fusion is an existential claim, and no expression in this existential claim is vague. Lewis concludes:

> So no restriction on composition can serve the intuitions that motivate it. So restriction would be gratuitous. Composition is unrestricted [...]. (Lewis, 1986b, p. 213)

This argument immediately strikes me as compelling. I go to the library and check out the more recent literature: some works develop and integrate the argument,[4] while others try to show that the argument can be blocked, or argue independently against MU.[5] At the end of my readings, I come to agree with Lewis and subscribe MU: every plurality of entities has a mereological fusion. I am now convinced that there are tons of other entities on my desk: any plurality of – say – books, molecules in the lamp and/or physical atoms in the pencil shaving (any plurality of entities already considered at the previous stages of this story) *has* a fusion.

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[3] In §§ 5 and 6.1 I will distinguish two different components in the argument (namely, the *argument from arbitrariness* and the *argument from vagueness*).

[4] Rea (1998), Sider (2001, §3.1), Varzi (2006) and Van Cleve (2008) among others.

[5] Markosian (1998), Koslicki (2003), Tahko (2009), Korman (2010) and Korman (2015, chs. 8-9) among others.

At this moment, Ernest comes back to me and again asks me whether there is anything else on the desk, besides the book, the lamp, the pages, the bulb, the pencil shaving, the molecules, the physical atoms and the microphysical particles. In answering him I have at least the following two options:

a. **The Philosophical Yes Answer**. I could explain to Ernest MU and the arguments for it, and why I have become convinced, in force of these arguments, that yes, on the desk there are also the mereological fusions of all these things (including – say – the fusion of the light bulb plus p. 213 of my copy of OTPW).

b. **The Unphilosophical No Answer**. I could refrain from bothering Ernest with my philosophical speculations (I know that Ernest hates metaphysics) and I restrict my attention to the kinds of entities which Ernest too is ready to admit. I tell him that no, there isn't anything else on my desk, thereby excluding from my quantification some entities which I believe to exist.

According to the proposal for the compatibility of MU with ordinary quantifications which I am going to explore, this story is characterized by a series of domain expansions. Only at the last step, and only if I opt for the Unphilosophical No Answer to Ernest, is there a *restriction* of the quantifiers.

This last passage concerns a very specific case: the case in which I have already accepted the truth of MU, and I want to speak and be cooperative with a person who does not accept or is not aware of MU (Ernest). Thus, I restrict my quantifiers to what this person is ready to countenance. At all the other previous stages of the story no restriction is at stake: the quantification is unrestricted, and, at each intermediate stage, there is the *possibility* of expanding our quantification domains, a possibility which is exploited in various ways throughout the story.

What possibilities are at stake? These possibilities *do not* consist in alternative ways in which things are not, but could be. When these possibilities are actualized (when the possible expansions are made), no possible circumstance concerning the piece of reality at stake (the table and its surroundings) becomes actual. *No change* occurs on the table during the story. This is because the possibilities at stake do not concern how reality could be.

The possibilities at stake only concern how our language *can be interpreted*: given a certain stage of the story, the language is interpreted in a certain way and could be interpreted in a certain other way, namely by means of an expanded domain of quantification. When the story goes from one stage to another, some of these possibilities of changing the interpretation of our language are exploited, in the sense that the interpretation changes in a way in which it could

have changed at the previous stage. This is why the possibilities at stake are not *circumstantial modalities*, but *interpretational modalities*: they do not concern reality, but the interpretation of our language.

I am going to argue in this paper that *expansionist compatibilism* for MU is preferable to *restrictionist compatibilism* for MU. *Expansionist compatibilism* is the thesis that *most* our quantifications over ordinary objects or limited enrichments of the domain of ordinary objects are true, but are not restricted: they happen at a certain stage of a sequence of expansions of the domain. Expansionist compatibilism admits that there are exceptions – such as the Unphilosophical No Answer to Ernest – in which a true quantification is indeed restricted. On the other hand, *restrictionist compatibilism* is the thesis that all the cases in which we do not quantify over all the fusions which – given MU – exist are cases of true restricted quantification.

I will take MU for granted, and I do not aim to set forth new arguments for it. I am comparing two varieties of compatibilism *for MU*, and neither of them would be interesting, if MU were false. Moreover, both the varieties I am comparing are varieties of *compatibilism*: thus, I also take it for granted that *all* the quantifications in the above story – and in general all the quantifications which are in apparent contrast with MU and seem adequately justified from any other point of view – are true. I will not address the issue whether compatibilism is preferable to *incompatibilism* or error theory, according to which – for example – all the quantifications at the intermediate stages of the above story are false. I hope that the development of a *better* form of compatibilism for MU (expansionist compatibilism) will make the temptation of incompatibilism weaker, but I will not attempt to draw any balance on this matter.

Moreover, it is also useful to anticipate[6] that the compatibility at stake holds between MU and ordinary quantifications, and not between MU and alternative metaphysical theses, such as mereological nihilism, or any doctrine of restricted composition. In assuming MU, I also assume that the metaphysical alternatives to MU are false metaphysical theses, and make no attempt to reconcile them with MU.

I will proceed as follows. In §2 I explain why restrictive compatibilism is unsatisfying. In §3 I introduce expansionism and interpretational modalities. In §4 I analyse three kinds of domain expansions (*upward expansions*, *downward expansions* and *sideward expansions*), which depart from an initial, subjectively delimited domain of ordinary objects, and the problems raised by each of them. In §5 I consider the final stage of the expansions (*mereological plenitude*), at which MU holds in its standard, non-modalized form, and I develop an argument from arbitrariness in support of its metaphysical preeminence. Finally, in §6, I anticipate three objections – of varying degrees of severity – which might be raised against expansionist compatibilism.

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[6] This remark about the kind of compatibilism I pursue will be expanded and exemplified in §4.1.

2 Restrictionism

According to Lewis, we usually ignore fusions of disparate entities, such as "the mereological sum of the right half of my left shoe plus the Moon plus the sum of all Her Majesty's earrings" (Lewis, 1986a, p. 213): we lack a short proper name for it, there is no interesting predicate under which it falls (only philosophical or generic predicates such as "entity") and – Lewis writes – "we seldom admit it to our domains of restricted quantification".

Let us consider the "seldom", and ask to whom the "we" pronoun, which is the subject of "seldom admit", refers: who does in most cases exclude bizarre mereological fusions from the domains, but in a few cases ("seldom") includes them? Lewis seems to be characterizing an intentional, or at least conscious shift: he is speaking about a group of persons who deliberately countenance some entities – such as the sum of the right half of my left shoe plus the Moon plus the sum of all Her Majesty's earrings – in a few cases, while deciding to ignore them in most circumstances.

The only candidate for this role is a philosopher who believes that the strange sum exists, but refrains from quantifying over it in the majority of cases. In this sense, Lewis is right in using the first person plural pronoun "we", because he is actually speaking of a group of persons – of philosophers – to which he himself belongs. If I compare his account with my story in §1, Lewis is speaking about what I do when I give the Unphilosophical No Answer to Ernest.

It seems to me quite plausible that, when I give the Unphilosophical No Answer to Ernest in the story or when Lewis (a staunch supporter of MU) is not dealing with one of the rare occasions on which heterogeneous fusions are relevant, our quantifiers are indeed restricted. What happens is that Lewis and I are aware that there are certain entities, and we *decide* to exclude them from the domain of what might count as an exception to our generalizations. We take these decisions either because we want to facilitate the communication with our interlocutors (this is my purpose with respect to Ernest), or because we are, in a certain context, frankly uninterested in certain entities.

However, I contend that these are relatively uncommon cases. In order to see why there is no restriction in many other cases, let us identify some features of restricted quantification which are present in the special cases above, and lacking in many others.[7] The debate about restricted quantification in philosophy of language is rather complex:[8] given our limited purposes, let us

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[7] A much longer and detailed critical analysis of the standard, restrictivist compatibilist strategy for MU is provided in Korman (2008) and Korman (2015, ch. 5). Korman shows that this strategy ends up misinterpreting as restricted quantifications that are in fact unrestricted. Korman's analysis of restricted quantification and unrestricted composition is to my mind completely convincing. Please note that my general objective is different from his: I aim to explore an alternative, non-restrictionist form of compatibilism for MU, while Korman rejects any form of compatibilism for MU and thinks that MU is false.

[8] The debate concerns in particular the problem whether restricted quantification is a grammatical, pragmatical

extract from it two features, usually attributed to restricted quantification: *deliberateness* and *retractability*.

As regards *deliberateness*, there are some reasons why I do not want to quantify over hetero-geneous sums in the context of the Unphilosophical No Answer to Ernest. These motivations lead me – for example – to take a certain decision: the decision to exclude certain entities from our domain. The decision does not need to be explicitly declared or theorized at any level. It is something we do often and without much reflection in simple cases, for example when we utter "there is no student", implicitly restricting our quantification to entities located in the room we are in. Nonetheless, it is an option which we choose, and which is not forced upon us. We might have made the different choice of quantifying unrestrictedly, at least if the language at our disposal includes a suitable predicate. In this case, we might have continued to express the same truth-conditional contents by using unrestricted quantifiers and by explicitly adding in the sentence a predicate, which is satisfied exactly by those entities which we want to speak about. This would make our sentences longer and possibly less clear to our interlocutors, but we are free to make this often *unwise* choice.

In some cases, there might be no simple predicate for expressing the limitation: in my dialogue with Ernest the limitation corresponds to my evaluations of the epistemic limitations of Ernest (his degree of interest and competence in philosophy), and there is plausibly no simple predicate expressing all this in my current language. I might also be practically unable to introduce such a predicate. Thus, it might happen that implicitly restricted quantification is the only tool I have at my disposal in a certain language in order to express a certain content. However, this does not make the restriction less deliberate. I might decide not to express that content at all. By contrast, I decide to express it by excluding from my quantifications some entities of which I am aware.

As regards *retractability* (the second feature of genuine restricted quantification I am focusing on), suppose that I initially opt for the Unphilosophical No Answer to Ernest. Then the conver-sation goes on, and Ernest – contrary to my expectations – displays some familiarity with the philosophical debate about composition and the conversation comes to concern mereological principles. I am now likely to switch from the Unphilosophical No Answer to the Philosophical Yes Answer: I can manifest to Ernest my adhesion to MU by quantifying over some examples of the entities to which the doctrine is committed; I tell him that there are other entities on the table, such as the sum of the bulb and of p. 213 of OTPW.

To have a different case of retraction of a genuine restricted quantification, imagine that someone, in the face of my claim that "there are no students" (restricted to entities located in

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or semantic phenomenon. See Stanley and Szabo (2000) for a comprehensive picture of the debate and for an influential defence of the semantic account of quantifier restriction.

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the room where I am), objects that the world's student population is actually quite big. I would be led to suspect, quite reasonably, that my claim has been misinterpreted, and I would retract my restricted quantification by replacing it with an unrestricted quantification, integrated with a predicate satisfied by entities in that room, e.g. by saying: "there are no student in this room".

Now, consider what happens at the initial stage of my story, when I have not yet noticed the bulb on the lamp, I have not seen the pencil shaving, I have not applied my rough competence in physics and chemistry to the entities on the table, and I have not endorsed MU. At that stage I am in a rather common condition, in which I am simply considering some so-called *ordinary objects* on the table. Am I *restricting* my quantifications to these ordinary objects, to the expense of the bulb, the pencil shaving, molecules, microphysical particles and heterogeneous mereological sums?

No, at least if restricted quantification has the two distinctive features discussed above: deliberateness and retractability. As concerns deliberateness, there is no deliberate exclusion of something: I am not disregarding something which I might instead choose to consider. I am unaware of the pencil shaving and of the sum of the bulb and of the page. For this reason, these entities are not at disposal in the domain of quantification, and I take no optional, deliberate decision of excluding them.

Moreover, there is no scenario in which I retract the alleged restriction, and reformulate the same content through an unrestricted quantification, as happens in the genuine cases of restricted quantification discussed above. What can happen (and should not be confused with retractability) is that I begin to quantify over the pencil shaving and over the sum of the bulb and of the page. This change *does not* consist in lifting a previous restriction, but in becoming aware of entities of which I was previously unaware, and for this reason were not available for being included in (or excluded from) the domain.

Before moving to consider the alternative form of compatibilism (*expansionist compatibilism*) in §§ 4 and 5, it is important to anticipate that the advocates of standard, *restrictivist compatibilism* for MU might protest that the restrictions which exclude fusions such as that of the right half of my left shoe plus the Moon plus the fusion of all Her Majesty's earrings are of a different kind, and for this reason are neither deliberate not retractable.

They might insist that these restrictions are *objective*. The fusion of the bulb and of p. 213 exists, inasmuch as the fused entities exist and MU is true. As a matter of fact, we do not include this fusion in our usual domains of quantification. Thus, our usual domains of quantification are *objectively restricted*, no matter what we know, what we want to do and what retractions we are willing to make. Whenever we do not include in our domains some entities which exist, we are quantifying restrictedly, full stop.

A weakness of this *objective* sub-variety of restrictionist compatibilism for MU is precisely that

it makes the alleged restricted quantifications different from independently attested phenomena, and is thereby exposed to a charge of *adhocness*. However, I think that this charge will be better assessed once the expansionist alternative has been put on the table. The rest of the paper is an exploration of this expansionist alternative and I will come back to objective restrictionism in §6.3.

3 Expansionism and Interpretational Modalities

Consider the initial stage of our story in §1. At that stage, I have the following *possibilities*: the possibility of paying attention to the parts of the books and of the lamp; the possibility of looking more closely at the surface of the desk; the possibility of reading the books and what they say about mereology. These possibilities are rather underspecified: at that stage, it is not precisely clear to me *what* I could add to the domain. Nonetheless, I am *open* to the idea that *parts*, *wholes* and also mereologically *disjoint*, still unnoticed entities could be added. Later in the story, I exploit some specifications of these possibilities, by adding in the domain some parts (such as the bulb or the microphysical particles), some fusions (such as the fusion of the bulb and of p. 213 of OTPW) and some mereological disjoints entities (such as the pencil shaving).

These possibilities *are not* correctly characterized as possibilities of retracting or lifting a previous restriction: there is no condition which *before* exploiting the possibility restricts the domain and *after* exploiting the possibility stops restricting it. By contrast, there are *practical* reasons and *epistemic* processes which lead me to quantify over entities which were not in my domain previously, in spite of the fact that the domain *was not* previously restricted.

Which kinds of possibilities are at play here? The modalities most commonly discussed in philosophy concern ways in which the circumstances might be. Logical modality, metaphysical modality, nomological modality are *circumstantial modalities*. The precise characterization of these varieties of circumstantial modalities is controversial, but it is undisputed that the possibilities at stake should not be confused with alternative interpretations of our language. By contrast, when counterfactually considering these alternative, circumstantial possibilities, the interpretation of our language should not be varied at all.

Now, consider this other example, and the *non-circumstantial* possibilities in it: you are in front of a bookshelf, and you see 27 books in it. You can pay attention to their pages, or to the molecules, physical atoms or microphysical particles in them. You can notice a very small book which is completely hidden within the pages of one among the immediately visible 27 books. You can also read the texts printed on the spines of the books, and notice that three of the 27 books have the same title ("*Principia Mathematica*"), followed by the three Latin numerals "I", "II", and "III".

By exploiting these possibilities, you become ready to quantify over new entities, such as the *Principia Mathematica*, a multi-volume work. The possibilities at stake *do not concern* ways in which circumstances might be: the pages of the books, the small book hidden in the larger one and the multi-volume work are not alternative circumstances. They belong to the actual circumstances (to the actual world, in the jargon of possible worlds), and the possibilities at stake are indeed *constrained* by how the actual world is.

I have no *analogous* possibility to include in my quantification domain a book which has not been written in the actual world, or a talking donkey. The unwritten book and the talking donkey are possible entities (*possibilia*), and the possibilities concerning their existence are circumstantial modalities. The circumstances might be different: entities which do not exist might exist in these different circumstances. I might quantify over them in my *circumstantial modal talk*, that is when I am talking, more or less directly, about these possibilities of existing in different circumstances.

The circumstances (the actual world) already include – by contrast – the multi-volume work, the hidden small book, and the pages. But, due to my epistemic condition, my domain of quantification does not include them. My epistemic condition could nonetheless change, and with it the limits of the domain. Those entities could be later included. In general the domain could come to include parts of already included entities, sums of already included entities, and also other, previously non-countenanced entities. None of these entities is a mere *possibile*, as unwritten books and talking donkeys, by contrast, are.

These modalities, which are not circumstantial and concern the expansions of the domain, have been called by Fine and Linnebo "*interpretational modalities*". They are interpretational inasmuch as they concern the interpretation of our language. What *varies* when an interpretational possibility becomes actual is – first of all – the domain. For an interpretational possibility to become actual is to be exploited by someone: someone decides to expand the domain in that way, and to interpret a language accordingly. The expansions are exploitations of interpretational possibilities.

The expansions of the domain can bring with themselves other changes in the interpretation. In particular, the interpretation of *predicates* is allowed to change. Some of the entities added in the expansions will satisfy the existing predicates: for example, the small book will satisfy the predicate "is a book", and the *Principia Mathematica* will satisfy the predicates "is a mathematical treatise" and "is a multi-volume work".

The focus of Fine and Linnebo *is not* mereology, in spite of the fact that – as we will see in §4.1 – Fine (2007) suggests that Fine's ontological expansionism might be applied to mereology.[9]

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[9] A deep connection between Fine's expansionism about abstract entities and Fine's works about parthood and composition has also been hypothesized in Koslicki (2007). Fine (2007) is indeed a reply by Fine to Koslicki's

Their focus is the metaphysics of abstract objects, and, in the canonical case, the domain is expanded through *abstraction principles*. Abstraction principles provide identity conditions for some "new" abstract objects in terms of a partial equivalence relation among objects which are already in the domain. Thus, in the archetypical Fregean example, lines are already in the domain, and an abstraction principle claims that the directions of two lines are identical if and only if the lines are parallel. The fact that we have identity conditions for directions legitimizes the expansion of the domain to directions. The same happens when sets or numbers are added to the domain of quantification: these expansions typically happens in various stages, going upward in a hierarchical structure.

Until an expansion adds them in the domain, directions are not in the domain. The expansion is interpretationally possible: this does not mean that directions are mere *possibilia*. As Linnebo underlines, abstract entities such as directions, numbers or sets maintain their traditional status of *necessary existents* from the viewpoint of circumstantial modalities: they exist no matter how the circumstances are.[10] However, directions, numbers and sets are not in the quantification domain from the outset. They are not *excluded* from the domain when they have not been introduced. The past mathematician who operated before the introduction of real number in mathematics was not restricting her quantifications to rational numbers. By contrast, she was quantifying unrestrictedly, but at a stage of the expansions at which all the introduced numbers were rational, because real numbers had not been introduced.[11]

It is important to underline from the start two main differences between the kinds of mereological expansions which will be discussed in §4 on the one hand, and the set-theoretic and mathematical expansions discussed by Fine and Linnebo on the other. *First*, Fine thinks that mathematical entities are postulated into existence: they come to exist *in virtue of* the fact that someone postulates them. Linnebo qualifies the mathematical entities which are added through expansions as *thin objects*, inasmuch as their existence does not make a substantial demand on the world.[12] By contrast, I am not going to claim that the entities which are added in the domains through mereological expansions are postulated into existence, or that they are a minor or negligible ontological commitment.[13]

Second, Fine's and Linnebo's focus is on *indefinite expandability*. For example, Linnebo's

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paper. Also in Linnebo (2018) there are some isolated references to the possibility of seeing mereological fusions as "thin objects" (pp. 5, 9). As seen in fn. 2, the first application of interpretational modalities and expansionism to a mereological thesis – namely Composition as Identity – is Botti (2019).

[10] See for example Linnebo (2018, p. 189).

[11] See in particular Fine (2005, §3).

[12] See in particular Linnebo (2018, §2.8).

[13] The applications of expansionism and interpretational modalities in Botti (2019) are in contrast committed to this idea. Botti's proposal is indeed a version of Composition as Identity; as a consequence, the added entities are *identical* in a sense to previously admitted entities.

reconstruction of set theory is based on the following principle of set existence, formulated in plural logic (the predicate "SET" expresses a many-one relation of set formation):

$$\Box\, \forall xx \Diamond \exists y \; \text{SET}\, (xx, y) \qquad\qquad \text{(Set Existence)}$$

At a certain stage of the expansion, there are certain entities. (Set Existence) claims that, for any plurality of these entities which are in the domain at that stage, it is possible to expand the domain so that it comes to include also a set formed by these entities (*i.e.*, a set having each of them as a member and no other member). A necessity operator is prepended because this interpretational possibility holds at every stage of the expansion. This means that at each expansion there are new sets, and as a consequence new pluralities. These new pluralities can form further sets, so that the expandability of the set-theoretic domain is indeed indefinite.

By contrast, there is no general expectation that mereological expansions go on indefinitely, as we are going to see in §4 by considering the three broad categories of expansions at stake.[14] I make no general claim that there is no final, absolute domain of what exists (in §6.2 I am going to point out that indefinite expandability might regain a role if some external hypotheses are called into question). In §5 we will see that from this a sharp difference ensues between Fine's and Linnebo's metaontology and the metaontology presupposed by my expansionist compatibilism.

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[14] These differences do not preclude adopting the logical characterization of interpretational modality in Linnebo (2018, §12.2). In particular, nothing in this characterization depends on the expectation that the expansions can go on indefinitely (this depends on principles which concern specific domains to be expanded, such as Linnebo's (Set Existence) above).

According to Linnebo, the logical system for interpretational modality is S4.2 and includes the following axioms (besides the core principles of K):

$$\Box\phi \rightarrow \phi \qquad\qquad \text{(T)}$$

$$\Box\phi \rightarrow \Box\Box\phi \qquad\qquad \text{(4)}$$

$$\Diamond\Box\phi \rightarrow \Box\Diamond\phi \qquad\qquad \text{(G)}$$

The axioms (T) and (4) warrant that the accessibility relation of the frame is a partial order of the stages in the frame ((T) warrants the reflexivity of the relation, while (4) warrants its transitivity). Finally, (G) corresponds to the so-called *convergence* of frames (see Linnebo (2018, p. 65, p. 207)).

4 Three Kinds of Expansions

Let us now analyze the kinds of expansions which can fill the gap between our usual quantifications over objects surrounding us and the abundance of fusions to which MU is committed. First of all, the point of departure is quantification over *some ordinary objects*.

There is no pressure to delimit a single, specific domain of ordinary objects. From this viewpoint, expansionism should be allowed to be no less *flexible* than standard restrictionism: according to restrictionism, the large majority of quantifications is restricted to a domain of middle-sized objects surrounding us, whose limits vary according to a plurality of factors, such as the epistemic stance of the subject uttering the quantified sentence, the subject matter of the discourse to which the quantified sentence belongs and the communicative need to be understandable to certain hearers.

Expansionism should countenance an analogously diverse plurality of factors. The initial stage can be thought to be constituted by those objects surrounding us over which we are immediately disposed to quantify over. "Immediately" means that we are disposed to quantify over them without any need of going through an epistemic procedure, in order to begin paying attention to them and expanding our domains to them.

This may justly seem imprecise or even circular, but this is a feature, not a bug: there is no reason to expect any subject in any situation to "initially" quantify over an objectively or even inter-subjectively delimited domain of objects.[15] What is an ordinary object in this sense for me does not need to be an ordinary object also for a person living in a different environment or having a different cognitive condition.

Thus, we are allowed to say that, at the initial stage of the expansion, the domain includes some ordinary objects, while programmatically refraining from being more explicit about what an ordinary object is. It is important to underline that the role of ordinary objects in this variety of compatibilism for MU is different from the role of ordinary objects in the kind of mereological restrictionism endorsed for example by Thomasson (2007) and Korman (2015), according to which there is composition if and only if the composed entity is an ordinary object. In these kinds of mereological restrictionism, the concept of ordinary objects needs to be explicitly clarified, inasmuch as it determines a metaphysical distinction, namely the distinction between those pluralities of entities which compose something and those pluralities of entities which – by contrast – do not compose anything. As a consequence, in that context, it is inadmissible that objects are ordinary with respect to pragmatically and epistemically variable circumstances.

By contrast, the form of compatibilism for MU which I am exploring does not attach any

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[15] In the picture I am drawing, I also prescind – for the sake of simplicity – from the fact that the expansion process may interfere with processes of linguistic learning, which might determine stages of partial linguistic competence about quantification.

metaphysical weight to these ordinary objects from which the expansion begins: they are allowed to be metaphysically on a par with their arbitrary parts and fusions. This different role allows for an imprecise, flexible and contextual characterization of ordinary objects. In order to identify ordinary objects, we need to specify at least a subject and a context for this subject, as it happens in the story in §1.

From the initial stage, the expansion can proceed in three broad ways (upwards, downwards and sidewards), which are discussed in the following three subsections.[16]

4.1 Upward Expansions

Upward expansions are licensed by a general principle, which is a modalized form of MU. According to this principle, at any stage of the expansion, given any plurality of entities which are in the domain of that stage, it is interpretationally possible that there is their mereological fusion, in the sense that there is at least an accessible stage at which the domain includes the fusion. The principle can be expressed as follows (in all the paper the modal operators express interpretational modality):

$$\Box \forall xx \Diamond \exists y (y \; \Sigma \; xx) \qquad \text{(Upward Expandability)}$$

The prepended necessity operator expresses the fact that the principle holds at every stage of the expansion. The quantified plural variable xx takes as value any plurality of entities in the domain at that stage.

MU, in its unmodalized form, does not hold at every stage: at the initial stage in my story in §1 (and also at other later, expanded stages, until Lewis's argument in OTPW convinces me), the fusion of the lamp and of OTPW is not in the domain. Thus, the following is false:

$$\Box \forall xx \exists y (y \; \Sigma \; xx)$$

inasmuch as MU is false at many stages of the expansion.

We are in the context of a form of compatibilism for MU, a principle which is typically associated with Classical Extensional Mereology (CEM). CEM includes (either as an axiom or as a theorem, according to the axiomatization) Uniqueness of Fusion:

$$\forall xx \forall y \forall z (y \; \Sigma \; xx \wedge z \; \Sigma \; xx \rightarrow y = z) \qquad \text{(Uniqueness of Fusion)}$$

Uniqueness of Fusion warrants that for a certain plurality of entities the interpretational

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[16] The order of the subsections is not expected to correspond to the order in which the expansions happen. It seems to me plausible that we continuously alternate the three kinds of expansions.

possibility of adding their fusion in the domain can be exploited *only one time*. Once you have added it, you cannot add *another* fusion of the same entities, because of Uniqueness of Fusion. In the context of CEM, moreover, the addition of the unique fusion of some entities in the domain does not lead to new interpretational possibilities at later stages. Indeed, suppose that an entity t is the fusion of some uu. The fusion of any plurality of entities xx such that t is one of xx is identical to the fusion of the plurality of entities obtained from xx by replacing t with uu.

This contributes to make (Upward Expandability) different from Linnebo's (Set Existence), in spite of the analogous syntactic form. The addition of a new set S opens new possibilities of adding further sets in the domain: before the addition of S in the domain, no set having S might have been added. By contrast, the addition of a fusion t does not open any new possibility (all the fusions for which t is a term were already obtainable from uu).

It is important to observe that (Upward Expandability) should only be expected to hold for the non-philosophical, ordinary speaker. It should by contrast be expected to fail for the philosopher who opposes MU, and defends a specific restriction of composition. Thus, if you ask van Inwagen whether he endorses (Upward Expandability), van Inwagen is likely to give a negative answer. In van Inwagen (1990) he has indeed defended the claim that only those entities which constitute a life have a fusion, and there is no evidence that he might be disposed to concede the interpretational possibility of expanding our domain to other kinds of composed entities, given that these composed entities, according to van Inwagen, do not exist.

As I have anticipated in §1, this is simply to be expected. There is no reason why there should be a chain of gradual steps which make van Inwagen's restrictionism on composition compatible with MU: they are mutually incompatible philosophical contentions. The variety of semantic compatibilism which is here at stake is not aimed to resolve philosophical disagreements or to deflate them by showing that there is a sort of continuity between them. It only characterizes a continuity between what linguistically competent and informed subjects say and MU, and not a continuity between alternative metaphysical stances about composition and MU.

For what concerns ordinary speakers, the openness to upward expansions is made plausible by the fact that, for any fusion of already admitted entities and for any subject, there seems to be a scenario in which the subject might indeed be motivated to add that fusion in the domain of quantification. These scenarios are more or less mundane or quixotic, depending on the entities which are to be fused. The above case in which I read the titles of three volumes on their spines in a bookshelf, and I begin to quantify over the multi-volume work is a quite mundane case.

Here is another mundane case. The lamp on the table of my colleague Linda is over a base. The base is of a different color, and, as a consequence, Linda takes the base as an independent object. In this stage, both the base and the lamp are in Linda's domain. Then, Linda tries to move the lamp and she realizes that the base moves together with it: as a matter of fact, they are

glued together. Linda is now ready to begin quantifying over the sum of the body of the lamp and of the base. Before this, Linda was not excluding this composed object from the domain of her quantifications, thereby restricting it: she was simply convinced that there was no such object (but only two distinct objects).

This latter mundane example is instructive for two reasons. *First*, it shows again why the characterization of the initial stage should be flexible: the lamp and its base *are* glued together, and so their fusion objectively satisfies one of the most obvious criteria for being an ordinary object. However, we have now considered a subject, Linda, who has not yet moved them – thereby noticing that they move together – but have already paid attention to their different colors. Thus, the sum of the lamp and of the base is not an *ordinary object for Linda in that context*, and this is why it does not belong to the domain at Linda's initial stage. *Second*, this example shows that also the motivations for an expansion are contextual and rich of epistemic components: an expansion typically happens when a subject *realizes*, *discovers*, or *pays attention to* something.

What about arbitrary pluralities of objects, which – in contrast with the books with the same titles and the lamp with its base – are not objectively linked in any analogous way? What about – say – my left hand, Barack Obama's nose, and the Great Pyramid of Giza? Suppose that all these three entities belong to the domain at a given stage. In what sense there is the interpretational possibility of quantifying over their fusion?

Only a bit of imagination is required in order to fathom far-fetched scenarios in which a subject would be led to quantify over fusions of highly heterogeneous entities. These far-fetched scenarios can also be built in a highly generic way, thereby making them adaptable to *any* fusion of heterogeneous entities. A nice suggestion can be borrowed from Fine (2007). In order to appreciate Fine's suggestion, a bit of context is needed. Fine is replying to a critical remark in Koslicki (2007), according to which Fine's theory of parts would determine a form of ontological over-abundance.[17] Fine explicitly connects this abundance to his own works on ontological expansionism about mathematical objects, according to which the existence of mathematical objects is interpretationally possible. He suggests that, in the realm of *material* objects, some entities might be given, while others are "relative to what has been introduced" (p. 165).

While Fine does not explicitly apply his own framework of interpretational possibility to this picture, it seems reasonable to suppose that he would be willing to apply it. Indeed, he builds a scenario in which a fusion of highly disparate objects, namely a car and a bouquet of flowers, gets *introduced*:

> We may imagine that some future religious sect holds the view that cars are endowed

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[17] This theory had been presented in several works, including Fine (1994, 1999).

with souls who migrate to a neighboring bouquet of flowers after a gestation period of nine months (stranger religious views have been held). [. . .] We may explain why it is correct for us to deny the existence of car-bouquets and yet also correct for the future generations to affirm their existence by appeal to a difference in what each of us has introduced into the ontology. (*ibid.*)

The motivation for the introduction of the car-bouquets *is* the strange religious view held by the religious sect. In theory, the possibility of such views emerging cannot be excluded in any case, no matter how disparate are the entities to be fused. If the entities to be fused are such that there is no more mundane scenario in which their fusion could be introduced, we can always resort to a *wild card* of this kind.

This wild card is not a reproachable philosophical trick: it is a scenario in which, given any already admitted entities, some epistemic or broadly practical motivations might lead us to admit their fusion in our domain. The scenario is admittedly *remote*, but I fail to see any reason why it should be impossible. The need to quantify over a fusion of already admitted entities could always emerge, and this is the reason why there is no restriction in (Upward Expandability).

4.2 Downward Expansions

In our story in §1 I begin at a certain point to quantify over the lamp bulb. Later, I begin to quantify over molecules, physical atoms and microphysical entities which are part of the lamp, or of one of the books, or of the pencil shaving.[18]

I have practical reasons to consider the bulb, namely the need to replace it. I have no practical reason to consider the molecules or the microphysical particles. But, as a matter of fact, my rough chemical and physical competences *come to my mind* and lead me to quantify over them: this is an epistemic reason for an expansion.

The formulation of a principle of downward expandability in terms of interpretational modality requires some care,[19] in particular because the principle needs to be even more flexible than its corresponding for upward expandability. By *downward expansions* we insert in our domain parts of entities which already were in the domain. These expansions do not always consist in the addition to the domain of some parts which together compose an entity which

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[18] This last *expansion* presupposes that I had begun to quantify over the pencil shaving beforehand, and this is due to an instance of sideward expansions (§4.3). See fn. 16.

[19] Botti (2019), in the context of the development of a new version of Composition as Identity where expansionism and interpretational modalities play a pivotal role (see fn. 2), also considers some expansions which are similar to *downward expansions*. Botti's downward expansions depart from the mereological universe.

we already were quantifying over beforehand. For this reason the following candidate principle of downward expandability (a sort of reversal of Upward Expandability) is inadequate:

$$\Box \forall x \Diamond \exists yy(x \ \Sigma \ yy)$$
(Downward Plural Expandability)

(Downward Plural Expandability) does not capture the entire variety of downward expansions, and not even the most obvious cases, such as that of the bulb which is part of the lamp: in this case, we are not forced to begin quantifying *also* over other parts of the lamp, and in particular over a selection of its parts such that the lamp is their fusion. We need a more flexible and powerful principle of downward expandability, such that it gives us also the possibility of expanding our domains so to include *only some* parts of something.

The parts we *add* in the domain are always *proper parts* of previously admitted entities, *i.e.* they are not identical to previously admitted entities.[20] This is simply because we cannot *add* an improper part, inasmuch as the improper part (which is identical to the whole) is already in the domain. Thus, we might be tempted to endorse the following principle of unrestricted downward expandability towards proper parts:

$$\Box \forall x \Diamond \exists y(y \ PP \ x)$$
(Downward PP Expandability)

However, this principle is problematic, and its problems are a useful reminder that our varieties of expansionism is utterly modest: in contrast with what happens with the kinds of expansions involving abstract entities discussed by Fine and Linnebo, the expansions we are discussing are *constrained by how things really are.* As far as classical mereology is concerned, an entity might be such that some of his parts are *atomic*, in the sense that they *objectively* do not include further parts: atoms (if there are any) are objectively the ground floor of reality. We are not free to postulate that they have proper parts, and we are not therefore free to include their parts in our domain.

The truth of (Downward PP Expandability) depends on the hypothesis that the world is entirely gunky, in the sense that everything has objectively some proper parts. If the world is entirely gunky, then indeed, given an entity we already quantify over, pragmatic and epistemic reasons might lead us to pay attention to one or more proper parts of it, thereby expanding our domain. However, whether the world is entirely gunky or not is a controversial and independent

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[20] I am here presupposing the following definition of proper parthood (PP) in terms of part (P):

$$x \ PP \ y \equiv_{def} x \ P \ y \land x \neq y$$

In the literature about non-extensional mereologies there are other definitions of proper parthood which are not relevant in this context (see Cotnoir (2018) for an analysis).

problem, about which expansionist compatibilism should avoid any commitment.

In order to obtain a principle of downward expandability which holds independently of controversial assumptions about atomicity and gunk, we need to replace *proper parthood* with plain *parthood*, thereby obtaining the following formulation:

$$\Box \forall x \Diamond \exists y (y \; P \; x) \qquad \text{(Downward Expandability)}$$

In this way, suppose that we are at a stage of the expansion at which no further proper part of already admitted entities remains to be added: (Downward Expandability) holds also at this stage, because, for any entity already in the domain, there is an expansion at which (and so it is intepretationally possible that) there is a part of this entity: this part is *that same entity*, and the expansion is the stage at which we already were (every stage counts as a trivial expansion of itself).[21]

(Downward Expandability) is an *undemanding* and *underdetermined* principle. It is undemanding, because *for any stage* (and not only for the stages at which no further proper part of already admitted entities remains to be added) the principle is made true by *that stage itself*, inasmuch as – due to the reflexivity of parthood – at every stage everything in the domain is a(n improper) part of itself. The interesting instances of the principle involves *proper parts*. While (Downward PP Expandability) is unwarranted, (Downward Expandability) is designed to hold also for the stages at which it is not really possible to expand the domain to *further* parts. This makes for a first difference with respect to (Upward Expandability).

(Downward Expandability) is also *underdetermined* because it does not force us to add some parts instead of others. It is also underdetermined inasmuch as no underlying principle endows the added entities with identity conditions. This is a *second* difference with respect to (Upward Expandability), for which – as we have seen in §4.1 – (Uniqueness of Fusion), in the context of CEM, endows the added entities with identity conditions.

4.3 Sideward Expansions

Upward and downward expansions do not exhaust our interpretational possibilities. The case of the pencil shaving in our initial story does not belong to either kinds of expansions, because the shaving is neither a fusion nor a part of anything which is already in the domain.

We sometimes introduce in our domain *other* entities, which are neither downwards nor upwards in the mereological structure. These other entities are typically *mereologically extraneous* with respect to already admitted entities, *i.e.* they have no part in common with them. This is

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[21] This is warranted by axiom T for interpretational modality. See fn. 14.

indeed the case of the pencil shaving which lays unnoticed on my desk, and then is noticed at a certain point.

Apart from the pencil shaving, many other examples might be envisaged, already in the simplistic context of our story: for example, my rough competences in physics and chemistry might bring me to pay attention not only to the molecules and physical micro-particles in the books or in the lamp, but also to those in the portion of air which is above the desk. These molecules and micro-particles are indeed mereologically extraneous with respect to the books and to the lamp.

Are there good reasons to consider these kinds of sideward expansions, together with upward and downward expansions? One might protest that these expansions have *nothing to do* with mereology, because the added entities are in no interesting mereological relation with previously admitted entities. Mereology is the theory of the relations of parthood and composition, and the pencil shaving or a molecule in the air *are not* in these relations with the previously admitted entities. Thus, even granted that there are such expansions, why should they have a role in *mereological* expansionism?

This protest misunderstands the objective I am pursuing. My primary objective is not to discuss a form of expansionism along the lines of mereological relations. By contrast, what I am exploring is a sequence of expansions which go from a domain of so-called ordinary objects, subjectively and contextually selected, to the kind of abundance countenanced by MU. In order to obtain this result, we need to fill *gaps*. There is no reason to expect an initial, subjectively delimited domain of ordinary objects to fill spacetime: thus, the route which goes from such domain to abundance needs to include expansions which fill the gaps.

Moreover, the sideward expansions towards entities such as the pencil shaving or the molecules in the air, while failing to follow the lines of mereological relations such as parthood and composition, are analogous to upward and downward expansions with respect to their *motivations*. You discover something, or you begin to pay attention to something, for practical or epistemic reasons: this may happen *no matter* whether the entity you discover or pay attention to is a part or a fusion of previously admitted entities, or is mereologically extraneous to them.

Mereological extraneousness might be interpreted as *mereological disjointness*, *i.e.* the relation between entities which have no part in common. Some care is needed in order to thus obtain an acceptable general principle, analogous to (Upward Expandability) and (Downward Expandability). Consider the following attempt to formulate a principle of sideward expandability ($\wr$ is mereological disjointness):

$$\Box \forall x \Diamond \exists y (y \wr x) \qquad \text{(Sideward Expandability in Terms of Disjointness)}$$

The expansions at stake bring to the domain entities which are *apart* from already admitted entities; they are metaphorically at their side, and this is the sense in which these expansions are *sideward.*

A first (but not decisive) reason of perplexity about (Sideward Expandability in Terms of Disjointness) might be that it is not general enough, insofar as practical and epistemic reasons might also bring to my attention entities which are not mereologically disjoint from previously admitted entities, but have an *overlap* with them. For example, suppose that I look not only at my desk, but at the entire content of my room. There is a small closet in it, and I am already paying attention to it and to its metallic front door, and including them in my quantification domain. I am also paying attention to the ladybug-shaped magnet attached to the metallic door. But now I go closer and I begin paying attention to the fact that only the posterior, flat part of the ladybug shaped magnet is actually magnetic, while the anterior part is made of porcelain; and to the fact that the door of the closet is internally made of wood, with a metallic layer over the wood. Only the metallic layer of the door is magnetic, while its wooden kernel is not magnetic. I thereby begin to pay attention to the complex entity (*e*) which is held together by magnetic forces, overlaps both the door of the small closet and the ladybug-shaped magnet, and includes only their metallic parts.

e is not *directly* reached through a sideward expansion, legitimized by (Sideward Expandability in Terms of Disjointness), inasmuch as *e* is not mereologically disjoint from previously admitted entities. Nor *e* is *directly* reached through an upward or a downward expansion, inasmuch as *e* is neither a fusion nor a part of previously admitted entities. However, this entity can be reached *indirectly* in two moves: *first*, *by downward expandability* it is possible to introduce *f*, the metallic external layer of the door (a part of the door), and *g*, the posterior, flat magnetic part the ladybug shaped magnet; *second*, once we have *f* and *g* in the domain, we can introduce *by upward expandability e*, which is the fusion of *f* and *g*. Analogously, by variously combining the three forms of expandability,[22] we can reach any other similar entity, which ends up being introduced in the domain without being directly reachable either by upward or by downward or by sideward expandability.

However, there is a second and more worrying problem with (Sideward Expandability in Terms of Disjointness), a problem which concerns the necessity operator prepended to it. According to (Sideward Expandability in Terms of Disjointness), given every possible stage of the expansion, I can always add a mereologically disjoint entity to the domain. However, my interpretational possibilities are constrained by the objective limits of reality: I may ideally

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[22] Also (Sideward Expandability) (see below) may gain a role in these combined moves, inasmuch as we might need to introduce something whose parts are then fused. In the above example, we can begin at a stage at which we did not yet notice the ladybug-shaped magnet. Then, we can add it to the domain by a sideward expansion, and then proceed as above.

arrive at a point at which I have covered everything, and at which no mereologically disjoint entity can be added.

We have seen that something similar also happens with upward and downward expansions: we reach the point at which our interpretational possibilities are exhausted, because we have reached the limits of reality. However, the respective principles of expandability continues to hold also at that point, in a trivial way: given a plurality of entities, there is a (trivial) expansion in which there is their fusion; given an entity, there is a trivial expansion in which there is an (improper) part of it. The problem is that, while fusion and parthood are *reflexive* relations, *disjointness* is irreflexive, and this determines the falsity of (Sideward Expandability in Terms of Disjointness): at every stage at which the entire spacetime is covered, it is interpretational *impossible* that there is something else, mereologically disjoint.

In order to obtain a general principle we need to include the trivial, limit case, in the following way:

$$\Box\forall x \Diamond \exists y (y \wr x \lor y = x) \hspace{3cm} \text{(Sideward Expandability)}$$

Just as in the case of (Downward Expandability) the interesting expansions involve *proper* parts, so in the case of (Sideward Expandability) the *interesting* expansions involve entities which are mereologically disjoint from previously admitted entities.

(Sideward Expandability) is even more *undemanding* and *underdetermined* than (Downward Expandability). Moreover, like (Downward Expandability) and in contrast with (Upward Expandability), (Sideward Expandability) does not deliver identity conditions for the *new entities*.

5 The Non-Arbitrariness of Mereological Plenitude

At a certain point, no non-trivial expansions of the above kinds is interpretationally possible. (Upward Expandability), (Downward Expandability) and (Sideward Expandability) find no counterexample at this stage of expansion, because trivial expansions are admitted in all the three directions, but nothing *new* can be added through those principles. It is not obvious that there is such a stage (and we will come back to this problem in §6.2), but in this section we explain the importance of such a stage *if* there is such a stage.

We are in a condition of *mereological plenitude*. No further proper part and no mereologically disjoint entity can be added in the domain. Moreover, no further mereological fusion can be added: pick any selection of entities in the domain, and their fusion is already in the domain of quantification. Thus, at this stage, MU is true:

$$\forall xx \exists y (y \; \Sigma \; xx) \qquad \text{(Mereological Universalism)}$$

MU will be true also at other, non-plenitudinous stages: those stages at which every collection of admitted entities has a fusion, in spite of the fact that some proper parts and/or mereologically disjoint entities are not in the domain. We can make sense of these stages, from the viewpoint of our story in §1: presumably, when I read OTPW and Lewis's argument in support of MU convinces me, I am nonetheless unaware of myriads of physical micro-particles and of remote entities. Thus, my adoption of MU *does not* lead me to mereological plenitude.

In spite of the plausible difficulty or practical impossibility of reaching it, mereological plenitude is of the utmost importance among the stages of our expansion. It is the stage in virtue of which the present proposal qualifies as a compatibilist framework for MU, and in particular in virtue of which MU is a *metaphysical truth*. MU is uphold as a metaphysical truth, in this expansionist framework, because it holds at the stage of mereological plenitude, which is the *metaphysically preeminent* stage of expansion. Why is mereological plenitude metaphysically preeminent?

Due to the subjective and contextual character of the initial stage and to the variety of epistemic and pragmatic reasons which lead to the expansions characterized by the three principles of expandability, there is a huge variety of stages. All these stages, *except* mereological plenitude, depend on a variety of contingent and subjective factors: the fact that a subject stops at a certain point, and does not exploit further interpretational possibilities is the result of a mixture of epistemic limitations and concrete needs. The various non-plenitudinous stages are *constrained* by a lot of factors which do not depend on objective reality. The fact that at these non-plenitudinous stages some interpretational possibilities are not exploited may be interesting if you are studying the epistemic limitations or the practical condition of a subject, but should have no role if you are doing metaphysics and you are therefore interested only *in objective reality*.

The only stage at which it is not arbitrary to stop is the final one: mereological plenitude. Mereological plenitude is not constrained by epistemic limitations and practical needs, but only by the objective limits of reality. No non-trivial interpretational possibility is at disposal, and this depends on the fact that the *objective limits of reality* have been reached.

Thus, the metaphysical truth of MU depends on the fact that MU is true at the only non-arbitrary stage of mereological expansion. This corresponds to an important aspect of the Lewis/Sider argument for MU. In the literature about the argument, an *argument from arbitrariness* is sometimes kept distinct from an *argument from vagueness* (which we will consider again

in §6.1).[23] The reason why only the final stage of mereological plenitude matters for metaphysics corresponds to the argument from arbitrariness. According to the argument from arbitrariness, any limitation to composition would be arbitrary: it would draw an unmotivated, arbitrary limit between the pluralities of entities which compose something on the one hand, and the pluralities of entities which do not compose anything on the other. Inasmuch as arbitrariness should be avoided in metaphysics, any restriction on composition should be avoided. For this reason – the argument from arbitrariness concludes – composition is unrestricted.

Analogously, if we were to base our metaphysics of composition on an intermediate stage of expansion, our metaphysics would arbitrarily depend on subjective, contextual, epistemic or pragmatic factors. Only the final stage of mereological plenitude is not delimited by these factors, but only by the objective limits of reality.

The metaphysical preeminence of mereological plenitude with respect to the other stages also highlights the substantial difference between expansionist compatibilism for MU and the doctrine of quantifier variance, proposed by Eli Hirsch in several works.[24] There are also some superficial similarities, and it is important to make both them and the substantial difference explicit.

Roughly, according to the doctrine of quantifier variance, in a debate among a mereological universalist, a mereological nihilist and advocates of various kinds of limitations on composition, all the parties would be using unrestricted quantifiers, each one with a different domain. All the parties are saying the truth from the perspective of their own semantics (and in particular of their own interpretation of the quantifiers), and there would be no reason to give preeminence to any interpretation of the quantifiers.

Also expansionist compatibilism for MU holds that, at different stages, the quantifiers are employed unrestrictedly, having from stage to stage a different domain. However, the different stages *are not on a par* from the metaphysical viewpoint. All of them, with the single exception of the final stage, depend on subjectivist, contextual, epistemic and pragmatic factors, and this is a good reason not to base a metaphysical doctrine on them. Thus, expansionist compatibilism should not be confused with the doctrine of quantifier variance.

Mereological plenitude also exhibits the difference between the metaontology of mereological expansionism and the metaontology which is usually associated with interpretational modalities (please note that the present paper is a first attempt to apply interpretational modalities to the metaphysics of concrete entities and has, as a consequence, no ambition to fully address the metaontological worries which this application may raise). The debate about MU is usually framed in the context of a broadly Quinean metaontology, according to which to exist is to

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[23] See for example Korman (2010) and Korman (2015, chs. 8-9).

[24] Some of his most important essays on quantifier variance are collected in Hirsch (2011).

be in the domain of absolutely unrestricted quantifiers. This was for example the metaontology assumed by Lewis in his discussion of the arguments for MU. The philosophers which have introduced interpretational modalities (and Fine in particular) do not endorse a Quinean metaontology,[25] also due to their contentions about indefinite expandibility in the realm of abstract entities: according to them, there is no absolutely unrestricted quantification about – say – sets; quantification is unrestricted only relatively to a certain stage of the expansion.[26]

As I have anticipated in §3, my adoption of interpretational modalities does not bring with itself a commitment to indefinite expandability.[27] If we reach the metaphysically preeminent stage of mereological plenitude, the limits of the domain come to coincide with the limits of reality. This does not mean that expansionist compatibilism adopts a fully Quinean ontology either: the quantifiers are unrestricted at any stage of the expansion (they are restricted only in specific circumstances within a stage, as it happens in the case of the Unphilosophical No Answer to Ernest). At the intermediate stages it is not the case that to exist is to be in the domain of these quantifiers: these stages are affected by a form of arbitrariness which disqualifies them from being metaphysically significant.

The metaontology at stake contends that not every form of unrestricted quantification is metaphysically significant: only those which avoid arbitrariness are significant and reveal what really exists. This corresponds to some aspects of the thesis, advocated in recent years by Ted Sider, that only some quantifiers (the fundamental quantifiers) "carve nature at its joints".[28] According to Sider, the fundamental quantifiers may be missing in ordinary language and the ontologist may need to introduce them in a language which is designed to formulate substantive ontological questions: the so-called Ontologese. The fundamental quantifiers of Ontologese are such that – in Sider's words – "any normal metasemantic pressure towards tolerant interpretations that assign non-joint-carving meanings to quantifiers" (Sider, 2011, p. 204) is stipulatively removed.

The metaontology presupposed by my expansionist compatibilism for MU (and correlatively by my attempt to apply interpretational modalities to the metaphysics of concrete entities) is not committed to a *linguistic discontinuity* between ordinary quantifications and quantifications at the stage of mereological plenitude: what gradually changes (by exploiting – step by step – our interpretational possibilities) is only the interpretation of the language. There is also no commitment to a stipulation. What gets removed at the stage of mereological plenitude is arbitrariness (determined by a variety of epistemic limitations and practical needs), and

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[25] See in particular Fine (2001, 2009).

[26] See in particular Fine (2006).

[27] As we will see in 6.2, expansionist compatibilism can be amended to gain compatibility with some forms of indefinite expandability, and this amendment also requires an amendment in the underlying metaontology.

[28] See in particular Sider (2011, ch. 9).

arbitrariness is identified as the barrier preventing the previous stages from being metaphysically preeminent or – in Sider's terminology – joint-carving.

6 Three Objections

In the following three subsections, I anticipate three potential *prima facie* worrying objections which might be raised against my proposal. They are ordered according to their degree of severity: the first can be answered in a satisfying way; the second requires an amendment to expansionist compatibilism, and the amendment also involves the underlying metaontology, which I have sketched above in §5; the third suggests that the choice between expansionist compatibilism and the most convincing form of restrictionist compatibilism depends at the end of the day on broad philosophical assumptions, which is not possible to defend in this paper. I hope that the discussion of these objections will help clarify some aspects and also expose some limitations of expansionist compatibilism.

6.1 A Vagueness Argument against Expansionism?

The Lewis/Sider argument for MU is sometimes analysed in two components – the argument from arbitrariness and the argument from vagueness – and that the argument from arbitrariness is connected with the reasons why the final stage of mereological plenitude (at which MU is true) is metaphysically preeminent.

What about the argument from vagueness? Here is a quick synthesis of the argument from vagueness. Any intuitively motivated restriction on composition calls into question *vague* conditions, such as spatial proximity, cohesiveness and joint movement. However, the existence of a fusion is asserted in sentences which include no vague expression. Consider for example a sentence which says that my copy of OTPW (p) and the lamp bulb (b) have a fusion (@ is an operator which builds a plural constant out of the singular constants p and b):

$$\exists x(x \; \Sigma \; p@b) \qquad \text{(Fusion of OTPW and Bulb)}$$

According to the upholders of the argument for vagueness, no expression in (Fusion of OTPW and Bulb) is a candidate for vagueness. Moreover, as Sider (2001, pp. 120-132) has observed, if a sentence such as (Fusion of OTPW and Bulb) were vague, also sentences about the number of existing entities would be vague, and no expression is vague in them. In particular, the upholders of the argument from vagueness insist that *quantifiers cannot be vague*. Thus, the intuitive motivations for restricting composition cannot be satisfied, and composition is unrestricted.

The standard, restrictionist compatibilism for MU nicely squares with the argument from

vagueness. Our usual quantifications would be restricted by some predicates, typically expressing features such as spatial proximity, cohesiveness and joint movement. These predicates are plausibly vague.

An objector to our non-standard, expansionist compatibilism for MU might try to extract from the argument from vagueness an argument against the *intermediate* stages of quantification. Indeed, at any stage of expansion, the fact that some entities have (or lack) a fusion will be expressed precisely by a sentence analogous to (Fusion of OTPW and Bulb). In the specific case of the book and the bulb, at many stages (Fusion of OTPW and Bulb) is false. Only at some later stages (those whose domain includes that fusion), (Fusion of OTPW and Bulb) is true. At all these stages the expressions used are the same, and are those expressions which, according to the upholders of the vagueness argument for MU, cannot be vague. Thus – the objector might continue – the limitations to composition at the various stages cannot be vague and, as a result, cannot correspond to the intuitive motivations for the restriction.

I concede that, indeed, no vague expression is present in a sentence such as (Fusion of OTPW and Bulb); and that the truth-value of (Fusion of OTPW and Bulb) is indeed *definite* at each stage of the expansion. However, there is no reason why there should be vagueness in these sentences. The point of expansionism *is not* that of satisfying the intuitive motivations which lead a philosopher to restrict composition. It is a compatibilist project for the doctrine that *composition is unrestricted*, and so it has no ambition to satisfy the intuitions according to which composition is restricted. More specifically, it is an analysis of our ordinary quantifications, with the purpose of creating a continuity among them and MU. It is precisely motivated by the conviction that our ordinary quantifications (except in specific cases, such as the Unphilosophical No Answer to Ernest) *are not* restricted by any condition, and this entails that they are not restricted by *vague* conditions.

Thus, no vague condition is required to determine the limits of the domain at each stage. More in general, there is no reason to think that, as a matter of fact, this domain is imprecisely delimited. At each stage, a subject quantifies over some entities, and those entities come to be included for a variety of epistemic and practical reasons. As a result, the limits of the domain at each stage are *arbitrary*, as we have seen in §5. It does not follow from this that at a certain stage it is *indeterminate* whether a subject is quantifying over a certain entity or not, and I see no other reason for this indeterminacy claim. Thus, expansionism has no problem with the fact that there is no vagueness in sentences such as (Fusion of OTPW and Bulb). The argument from vagueness can be accepted as an argument for MU, without any undesirable side effect on intermediate stages of expansion.

6.2 Junk, Gunk and Sideward Infinity: Expansions Without Plenitude?

In the stage of mereological plenitude analysed in §5, nothing else can be added by upward, downward or sideward expansions. The limits of the domain at this metaphysically preeminent stage are determined by the limits of what objectively exists.

Have we any warrant that *there is* such a stage? Unfortunately, *no*. The warrant that there is mereological plenitude might only come from the doctrine that the domain of what objectively exists is not, *on its turn*, indefinitely expandable. Otherwise, the fact that there is mereological plenitude does not follow from the fact that the limits of the domain at this metaphysically preeminent stage are determined by the limits of what objectively exists: both kinds of limits risk being expandable.

This risk is exposed by three metaphysical hypotheses Junk, Gunk and Sideward Infinity (they correspond to upward, downward and sideward expansions). Only the second and the third are really worrying, and in any case – as we are going to see – there is a promising way to amend expansionist compatibilism and make it independent of mereological plenitude.

Junk is the hypothesis that everything is the proper part of something:[29]

$$\forall x \exists y (x \; PP \; y) \tag{Junk}$$

If the actual world is junky, upward expansions can go on forever: there is no top layer of reality, no universe of which everything is a part. (Upward Expandability), which I have discussed in §4.1, will be true at every stage in a non-trivial way.

Junk is not worrying for us, because it is incompatible with MU.[30] We are analysing a form of compatibilism for MU, thus we are presupposing that MU is true: we are speaking to philosophers who subscribe MU, presumably because they accept the Lewis/Sider arguments from arbitrariness and vagueness. Inasmuch as MU is incompatible with Junk, these philosophers are *already* committed to reject Junk; when they adopt expansionist compatibilism for MU, they should not fear any negative consequence from a hypothesis which they reject.

Gunk is the hypothesis that everything has at least a proper part:[31]

$$\forall x \exists y (y \; PP \; x) \tag{Gunk}$$

Gunk can also be meant as a partial hypothesis. In a partial gunky scenario, only some entities are composed by atoms, while others are such that all their parts have at least a proper part.

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[29] See Bøhn (2009b).

[30] See Bøhn (2009a) and Cotnoir (2014). Contessa (2012) argues that Junk is compatible with a form of MU in which only binary sums are admitted, but this is not the formulation of MU which I have adopted in this paper.

[31] The hypothesis of gunk has been introduced in the contemporary mereological literature in Lewis (1991, p. 20).

The following is the claim that at least one entity is gunky:

$$\exists x \forall y (y\ P\ x \rightarrow \exists z (z\ PP\ y)) \qquad \text{(Partial Gunk)}$$

The hypothesis of Gunk is compatible with MU: as far as MU is concerned, the world might be fully atomic, fully gunky, or partially atomic and partially gunky. If the world is entirely gunky, then the principle (Downward PP Expandability), which I have rejected in §4.2 as a formulation of downward expandability, becomes true:[32] given any entity at any stage, there is another stage such that the domain includes at least a proper part of it. If the world is partially gunky, then the following more modest principle expresses the fact that we never reach a stage at which it is interpretationally impossible that there are further proper parts of already admitted entities:

$$\Box \exists x \Diamond \exists y (y\ PP\ x) \qquad \text{(Partial Downward PP Expandability)}$$

The problem is that, if the world is either fully or partially gunky, mereological plenitude is never reached. Both (Downward PP Expandability) and even the weaker (Partial Downward PP Expandability) are enough to exclude the existence of a stage at which the downward limits of our domain coincide with the downward limits of reality.

Sideward Infinity is the hypothesis (more interesting for cosmology than for mereology) that the universe has no spatio-temporal limits. Given Sideward Infinity, also the principle (Sideward Expandability in Terms of Disjointness), which I rejected in §4.3, comes out vindicated: at every stage, there is always the interpretational possibility of adding some further mereologically disjoint entity in the domain. Sideward Infinity is a dubious cosmological hypothesis, but is completely independent of MU, just as the hypothesis of Gunk. Sideward Infinity, analogously to Gunk, precludes the attainment of mereological plenitude.

Thus, given either Gunk or Sideward Infinity, there is no single stage which is metaphysical preeminent in the sense of §5, and in virtue of which MU is true. Every stage is arbitrary, in the sense that its quantification domain includes entities only up to a certain limit, either downwards, or sidewards, or in both these directions.

The following amendment to expansionist compatibilism can satisfyingly deal with this worrying outcome. Suppose – for the sake of simplicity – that the world is both gunky and sideward infinite (the cases in which it is either only gunky or only sideward infinite are not significantly different). This does not put *every* stage on a par from the viewpoint of arbitrariness. In particular, the stages in which you refrain from exploiting your interpretational possibilities of expanding your domains upwards will be affected by *more arbitrariness* than the stages at

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[32] Also the expandibility principle I have accepted – (Downward Expandability) – is true in gunky scenarios.

which you have at least exploited all your interpretational possibilities of going upwards. In other words, even if you cannot attain absolute mereological plenitude, you can nonetheless attain *upward mereological plenitude*: in that direction, you can make the limits of your domain coincide with the objective limits of reality. This means that all these stages at which MU holds are comparatively less arbitrary than those at which MU fails. We thus obtain a reason to endorse MU, despite the absence (due to Gunk and Sideward Infinity) of a single, preeminent stage of absolute mereological plenitude.

This requires an amendment also to the metaontology which I have sketched at the end of §5. There is no single preeminent stage at which the interpretation of quantifiers is – in Sider's terminology – joint-carving, but there are some stages which are *more preeminent than others*, and at which the interpretation of the quantifiers is more joint-carving than at others: those at which we do not stop going upwards due to (metaphysically insignificant) epistemic limitations and practical needs, but because we reached the upward limits of reality.

6.3 Objective Restrictions

In §2 we have seen that there is no evidence that all ordinary quantifications are restricted, and exclude fusions of disparate entities. Deliberateness and retractability are often lacking. It is now time to discuss the hypothesis that the lack of deliberateness and retractability does not matter, because the quantifications are *objectively* restricted.

The fact that they are restricted would have *nothing to do* with what the speakers are aware of, want to say or are disposed to do later. Once MU is accepted, it becomes an objective matter of fact that the ordinary speakers quantify over only some of the existing entities: when, among the entities on the table, I only quantify over the three books and the lamp, I am quantifying restrictedly *not because* I have the intention or I am aware of excluding something, *but because objectively* there are other entities: objectively there is also the bulb, the pencil shaving and – if MU is true – various fusions of the other entities; inasmuch as I do not quantify over them, I quantify restrictedly.

Objective restrictionism depends on a broadly *externalist* approach to the semantics of quantification. As far as I know, the copious linguistic literature on restricted quantification is entirely concerned with restrictions which can be revealed *somehow*, either in the conversation or through the concurring behaviour. The request is not that the restriction is fully conscious or reflexive, but merely that it should be revealed or revealable by *something* in language or behaviour.

By contrast, it might be that Lewis and many others after him had in mind something different, when they speak of a kind of quantifier restriction which excludes entities the commitment to

which comes from a philosophical doctrine (such as MU) which is patently ignored by the large majority of speakers. These are cases – the objector might continue – in which patently the speakers are unaware of the existence of some entities, which *nonetheless exist*: the restriction (an objector might say) is here an objective relation between what they say and the world, and which is completely independent of what the speakers mean or know.

I have no definite answer to this objection. The stage of mereological plenitude is metaphysical preeminent and determines what exists. This means that, according to my own proposal, *objectively*, at the previous stages, the domains of quantification do not include existent entities. This is not a dispensable feature of my proposal, inasmuch as it simply depends on the adoption of MU. Thus, in front of a philosopher which insists on an objective understanding of quantifier restriction, I might only contest this objective understanding of a linguistic phenomenon, and the kind of externalism it presupposes. This is a very general project, which cannot be pursued in the context of this paper.

Nonetheless, I contend that a form of semantic compatibilism which pays attention to what speakers know and mean to say (and is therefore free of questionable externalist presuppositions) is intrinsically interesting, and this is the prospect which this paper has explored. Expansionism seems to open the possibility of *not ignoring* the internalist component of meaning, and this is *ceteribus paribus* an advantage with respect to an alternative – restrictionism – which is forced to ignore it.

Acknowledgements

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