

## Ontological Priority, Fundamentality and Monism

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### ABSTRACT

In recent work, the interrelated questions of whether there is a fundamental level to reality, whether ontological dependence must have an ultimate ground, and whether the monist thesis should be endorsed that the whole universe is ontologically prior to its parts have been explored with renewed interest. Jonathan Schaffer has provided arguments in favour of ‘priority monism’ in a series of articles (2003, 2004, 2007a, 2007b, forthcoming). In this paper, these arguments are analysed, and it is claimed that they are not compelling: in particular, the possibility that there is no ultimate level of basic entities that compose everything else is on a par with the possibility of infinite ‘upward’ complexity. The idea that we must, at any rate, postulate an ontologically fundamental level for methodological reasons (Cameron 2008) is also discussed and found unconvincing: all things considered, there may be good reasons for endorsing ‘metaphysical infinitism’. In any event, a higher degree of caution in formulating metaphysical claims than found in the extant literature appears advisable.

### 1. Introduction

Is the intuition that the smaller parts of our universe are prior to the larger ones compelling once put to careful scrutiny? Is it correct to assume that there must be a fundamental level of things that do not depend on anything? How is the relation of ontological dependence to be conceived of? These time-honoured philosophical questions have recently gained renewed popularity.

The *monist* view that what is basic is the entire universe and it is the *cosmos* that is ontologically prior and independent, while its parts are derivative and dependent, was held by the likes of Parmenides, Plato, Plotinus, Proclus, Spinoza, Hegel, Lotze and Bradley. It was then set aside in favour of the idea, perhaps more appealing to modern-day empiricists because (apparently) better supported by experience and science, that what is truly fundamental are elementary entities more or less fitting the description of Democritus’ atoms. Recently, however, Jonathan Schaffer has revitalised monism, formulating it in precise terms and arguing that there are important reasons for regarding it as preferable to the pluralist/atomist alternative.

This paper looks at Schaffer’s work, evaluating his arguments as well as discussing the *foundationalist* assumption that ontological dependence must have

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a ground and so there must be a fundamental level to reality (be it coinciding with the whole or with a bunch of tiny simples). Section 2 provides a definition of monism and the view opposite to it, i.e. *pluralism*, and outlines metaphysical foundationalism and the other general assumptions made by Schaffer. It then presents Schaffer's two arguments in favour of monism, one from quantum physics and emergence, and another based on the possibility of 'gunk'. Section 3 discusses the former argument, and finds it wanting. Section 4 analyses the argument from gunk and shows that an analogous reasoning can be symmetrically formulated in favour of pluralism and, therefore, Schaffer fails to demonstrate that we should opt for monism. That, consequently, metaphysical foundationalism should ultimately be put into doubt is maintained in section 5, where it is argued that it is perfectly possible that one's scientific and metaphysical beliefs justify one's commitment to metaphysical *infinetism*. In conclusion, a more careful general attitude towards this sort of issue is recommended.

## 2. *Monism versus pluralism, and the assumption of foundationalism*

According to Schaffer, monism is most plausibly understood as *priority monism* – the view that parts exist but the whole is ontologically prior to them – rather than as *existence monism* – the idea that only the whole truly exists. In his (forthcoming), he convincingly argues that priority monism is the conception that has been historically endorsed by the majority of (if not all) monist philosophers, and that existence monism is an obviously weaker thesis that can only be considered little more than a caricature.<sup>1</sup>

Arguing in favour of monism, Schaffer assumes that ontological priority relations form a well-founded partial ordering, that is, that they are irreflexive, asymmetric and transitive and give rise to series of dependence- (and, therefore, priority-) relations that terminate at some fundamental level of entities that do not depend on anything. This assumption of well-foundedness is what metaphysical *foundationalism* consists of: it amounts to the claim that there must be a 'ground of being', and chains of dependence can be neither infinite nor circular – metaphysical *infinetism* and metaphysical *coherentism* are ruled out.

Schaffer also assumes that composition is not identity (a whole is not identical to the plurality of its parts), which is a notoriously debated thesis but is necessary to represent the controversy between monism and pluralism as an opposition between two incompatible theses. Indeed, if the cosmos literally *is* the many things that exist, then pluralism and monism are not opposing views at all (see Schaffer forthcoming, section 1.1).

<sup>1</sup> For simplicity, the term 'monism' will be used from now on, but the only form of monism that will be dealt with is priority monism.

Moreover, Schaffer introduces a constraint on the mereological structure of the world: he calls it the ‘tiling constraint’ (forthcoming, section 1.3). According to the tiling constraint, the basic objects together constitute the world in its entirety, and no basics are related as whole to part. Coupled with this sensible assumption, metaphysical foundationalism entails that monism (there is only one basic object, the whole universe, hence every proper part of the universe depends on the universe itself) and pluralism (there is more than one basic object, hence the universe is not basic and depends on at least two entities that are constituent parts of it) are exclusive and exhaustive theses.

Importantly, Schaffer believes that whichever of the two positions turns out to be explanatorily superior is in fact metaphysically *necessary*: for, although what is the case in a given world may be a contingent fact, monism and pluralism must be applicable in all possible worlds because they are rival doctrines about fundamental laws of metaphysics. In other words, Schaffer rejects the idea that pluralism might be true of some worlds and monism of others, and believes that one of the two is a general metaphysical thesis true in all worlds.<sup>2</sup>

### 2.1 *The argument from quantum mechanics and emergence*

Two minor considerations that Schaffer makes in his evaluation of monism and pluralism concern commonsense intuitions. First, in analogy with the priority the whole seems to have in the case of ‘integrated wholes’ such as clocks, geometrical shapes, organisms and similar things, Schaffer claims that we regard the cosmos as an integrated whole whose identity is only properly grasped when it is considered in its totality. From which it is plausible to conclude, says Schaffer, that the cosmos as a whole is ontologically prior to its parts. The second consideration has to do with qualitative variegation. Schaffer objects to the inference from the manifest qualitative heterogeneity exhibited by reality to the idea that the latter must be constituted by a plurality of basic, homogeneous simples. He suggests that there could be a cosmos every part of which has heterogeneous proper parts and for which, consequently, complexity never bottoms out in a set of fundamental homogeneous entities. Moreover, he adds, basicness and homogeneity do not necessarily go together, as simple things can be heterogeneous.<sup>3</sup>

<sup>2</sup> Schaffer also considers the *nihilist* position, according to which there are no composites, that is, no instances of the proper parthood relation. Since reality appears not to be simple, nihilism may seem to support the general pluralist intuition (although not pluralism in Schaffer’s definition) that there isn’t a unique fundamental entity. However, Schaffer has arguments in favour of the opposite idea that nihilists had better be monists (see his 2007a). We don’t need to get into the details of this here.

<sup>3</sup> Schaffer, in particular, suggests that heterogeneity can be accounted for in terms of either a) ‘distributional’ properties – properties, like ‘being polka-dotted’, which are irreducibly complex (this requires conceiving of certain qualities of things as ‘existing in configuration

These considerations are not particularly compelling. As for Schaffer's first argument, one could respond that the sort of priority attributed to integrated wholes with respect to their parts is not ontological but merely epistemic. That is, that the whole has a clear function and/or some form of 'completeness' with respect to our conceptual schemes and, consequently, we tend to focus on it as the 'relevant' entity and not on its parts; but this does not mean that the parts are (to be regarded as) ontologically prior to the whole. As for the second argument, one might respond to Schaffer that conceiving of 'ungrounded heterogeneity' or of complex properties possessed by simple entities is less 'natural' than admitting that heterogeneity and complexity go hand in hand. In both cases, though, the risk of begging the question is evident, and so the outcome of the discussion remains unclear. Be this as it may, Schaffer himself, after having gone as far as to suggest that a consideration of commonsense makes monism the 'default' position, adds that commonsense cannot be given much weight in the discussion.

The first main argument Schaffer offers in favour of monism is based on physics. Looking at quantum mechanics (2007b, section 3.2.2 and forthcoming, section 2.2), Schaffer emphasises that so-called *entangled* quantum systems are such that facts about them as wholes composed of two or more particles are not reducible to facts about the separate particles. These systems are fundamentally *holistic*, because the total physical state in which they are found is not 'factorizable' (that is, decomposable) into separate states of the component particles. This, according to Schaffer, bears witness to the priority of the whole over its parts. Since it is reasonable to believe that entanglement is a pervasive and ubiquitous phenomenon, so that the whole cosmos is in a non-factorizable state ("the whole universe must be strongly entangled" (Zeh 2004, 115)), Schaffer concludes that the cosmos is a fundamental whole.

Next, Schaffer takes the *possibility* of emergence (new properties arising as complexity increases which are not constituted by the occurrence of ontologically more fundamental properties) to be uncontroversial, and the ensuing 'asymmetry of emergence' (the whole can have features that the sum of its parts doesn't have, but the parts cannot have features that the whole comprising them fails to have)<sup>4</sup> as a clear sign that one should opt for monism. The underlying idea seems to be that the specific argument based on quantum holism and the non-reducibility of entangled states can be generalised in two ways: first, by considering the entire

space'); or b) 'regionalized' properties – allowing the same entity to be P-here and Q-there (compare with the momentary tropes invoked for explaining the qualitative heterogeneity of extended simples in McDaniel 2009); or c) regionalized instantiations of properties – meaning that an entity can instantiate-here P and instantiate-there Q.

<sup>4</sup> Here, clearly, the difference between 'whole' and 'sum' is that the latter just consists of the 'lower-level' entities and their properties considered together, while the former is the higher-level 'structure' determined by the specific way in which the parts get together, possibly including new features and aspects with respect to those of the lower level.

class of properties, not analysable in terms of lower-level properties, that (may) come to exist as mereological complexity increases; secondly, by examining what is logically possible rather than a specific actual (at least according to what contemporary science tells us) case. The resulting picture allegedly lends further support to the monist thesis.

### 2.2 *The argument from the possibility of gunk*

A second argument that Schaffer presents in favour of monism is based on a possibility explored in detail in his (2003).<sup>5</sup> That is, that everything is divisible and the universe is consequently made of ‘atomless gunk’ – an infinite series of progressively smaller parts.

Such a possibility is not a mere fantasy. As shown by Zimmerman (1996), for example, it could be argued that the idea of extended objects literally touching requires ‘gunky junctures’. Even if one denies that gunk is necessary, at any rate, it appears to be at least metaphysically possible. But if the possibility of atomless gunk is to be admitted, Schaffer argues, one’s ontology should make room for it. And while the monist has no trouble doing so (the infinite series of divisible parts is still contained in the unique unitary cosmos), things stand differently for the pluralist: atomless gunk makes the idea that the part is prior to the whole entail the violation of metaphysical foundationalism, as instead of an ultimate, well-defined set of independent entities, the pluralist finds an infinite series of dependent ones. Since foundationalism is plausible and intuitive – it is, in any event, assumed in the discussion – Schaffer concludes that monism should be preferred to pluralism in view of the possibility of gunk.

In connection to this, Schaffer additionally points to an ‘asymmetry of existence’ analogous to the asymmetry of emergence, and equally supporting monism: atomless gunk is possible but ‘worldless junk’ (the converse of gunk, where everything is a proper part of something) is not, as there always exists a ‘totality’ that comprises everything; hence, the thesis that the whole is prior to the part must be true.

### 2.3 *Should we endorse monism?*

Schaffer’s general conclusion is that, since the pervasiveness of entanglement is an empirical fact, and the broader claims related to the asymmetry of emergence and the asymmetry of existence are supported by conceptual analysis, the only foundation one can give to one’s metaphysics is the universe as a whole. This

<sup>5</sup> And that he also uses to argue in favour of a ‘pluralistic’ approach to sparse properties, according to which it is not advisable to take only one level of fundamental (normally, physical) properties ontologically seriously – see Schaffer (2004).

conclusion follows, as mentioned, given foundationalism, the idea that composition is not identity and the tiling constraint. Schaffer's abovementioned views on the nature of metaphysical laws then lead him to regard monism as necessarily true. Should one agree with all this, and take monism to be necessarily true in view of Schaffer's arguments?

In the exploration of this question, which will occupy the next two sections of this paper, Schaffer's tiling constraint and the view that composition is not identity will not be questioned. First, it is very plausible that basic entities are simple, and so cannot overlap or share parts; and it is equally sensible to think that, given what is basic, what is derivative is *somehow* also given. As for composition and identity, the idea that the whole can have 'more content' than the sum of its parts – recall the possibility of emergence considered above – appears sufficient for denying that they are the same thing.<sup>6</sup>

The focus will consequently be on the actual strength of Schaffer's arguments, the foundationalist assumption and Schaffer's claim that either monism or pluralism is necessarily true. These are, indeed, important philosophical points that need to be discussed in detail.

### 3. *Discussion of the argument from quantum physics and emergence*

Starting from Schaffer's considerations concerning physics, the thought is, as we have seen, that in the case of entangled systems the whole must be deemed prior to the parts because the parts taken together are not equal to the whole, which is 'richer' in content, as it were; and that, since this can be generalised so as to obtain a broader asymmetry of emergence, monism must be preferred to pluralism.

In considering possible rejoinders, Schaffer suggests that the pluralist can achieve ontological completeness only by inflating his/her ontology with new fundamental external relations (forthcoming, section 2.2). That is, via the reformulation of mereological supervenience in terms of wholes supervening on their parts plus *all* relations among the latter. In the quantum case, this would mean to postulate entanglement relations that are as basic as spatiotemporal ones in determining how their relata give rise to the whole that comprises them as parts.<sup>7</sup>

To this, Schaffer objects that the postulation of basic entanglement relations does not represent a viable solution for the pluralist for two reasons. First, relativistic quantum field theory makes it possible that particles will not be retained in

<sup>6</sup> For an argument to the effect that emergence entails that composition is not identity, see McDaniel (2008).

<sup>7</sup> In other words, Humean supervenience should be reformulated as the claim that everything supervenes on the spatiotemporal *and quantum* distribution of local intrinsic qualities, where the 'quantum distribution' is determined by irreducible entanglement relations. On this, see Darby (2009), especially section 3.

future physical theorising, as their localisation becomes frame-dependent and even their number becomes variable. This potential revision of the supposedly fundamental building blocks of reality, says Schaffer, has a clear bearing on the idea of taking relations among them as ontologically basic. For, ontologically basic relations certainly require their relata to be well-defined. The second reason is that the physical unity of properties gets lost if one regards entanglement relations as ontologically fundamental, because what would *prima facie* seem to be identical relations in fact coincide with a number of different relations. For instance, 'having total spin 0' is a property that can be possessed by many physical systems, including, say, a system of 2 and a system of 264 entangled fermions. But this means that the property allegedly 'shared' by these several systems in fact corresponds to many different relations, an  $n$ -place one for each entangled system of  $n$ -particles with null total spin.

However, the first of these two points inconveniently mixes considerations about quantum mechanics and concerns stemming from relativistic quantum field theory. While it is true that the concept of a particle seems difficult to retain in the latter, it is also unclear what the ontology such a theory suggests is. At the same time, there are good reasons for claiming that entanglement relations remain ontologically basic when one switches to the relativistic quantum field-theoretical perspective – independently of the modifications that one is forced to introduce with respect to the traditional notion of a basic 'bit of matter'. This means that Schaffer is right that particles as relata for putatively fundamental entanglement relations lose a considerable amount of objectiveness once one moves to relativistic quantum field theory; but one could nevertheless insist that the basic constituents of the fields this theory deals with (*whatever they are* other than particles) still meet the requirements for grounding a pluralist ontology. Differently put, it can be contended that Schaffer's first reason for rejecting entanglement relations as ontologically fundamental is based on 'dialectical trickery', as in order to make his case he retains the background ontology of quantum mechanics while accepting *some* consequences of a different theory. To be sure, the idea that entanglement relations are fundamental external relations *between particles* cannot be kept fixed while shifting to relativistic quantum field theory, where the ontological background changes so radically; but doing so is not necessary for the pluralist.<sup>8</sup>

<sup>8</sup> On a more general note, it appears legitimate to believe that, given the present status of research a much more careful approach is required in extracting metaphysical lessons from the physics. For instance, Schaffer's claim that the "formalism looks, on surface, to be treating worldwide fields as fundamental" (forthcoming) is unwarranted, as there are arguments that go directly against such a field-interpretation of the physical theory in question (see, for instance, Baker (2009)).

As for the second point, concerning the supposed ‘loss of physical unity’ of properties, one could express reservations about Schaffer’s interpretation of the properties in question. When comparing entangled systems with a different number of components but the same total property, one should be careful not to automatically take the total property to coincide with several entanglement relations only differing in number of places. First of all, strictly speaking (and continuing to focus on spin properties), ‘having total spin 0’ *is not* a property that expresses entanglement. Entanglement is correctly conceived of as a correlation such as ‘having (or, being disposed to have) opposite spin values in a particular direction upon measurement’ (think here of a two-particle system), which entails, but *is not* the same as, the said total property.<sup>9</sup> Second, as a matter of fact the nature of entanglement is only easily understood in the two-particle case, and it is an open experimental question how to even recognize when many-particle systems involve entanglement among all their components, or just a subset of them. To be sure, although one generally refers to the states of certain many-particle systems as entangled, there are a number of *different relations* exhibited by different types of systems in such states.<sup>10</sup> Simply mentioning the total property of the system unduly hides this complexity. In view of this, the search for ‘physical unity’ may even turn out to be ungrounded. Third, even if one ignores this latter point, it could in any event be argued that the entanglement of many-particle entangled systems is generally analysable in terms of ‘ensembles’ of entanglement relations between constituents, and this restores physical unity. For example, one could interpret the four-particle state  $|\psi\rangle_{1234} = (|\uparrow\rangle_1|\downarrow\rangle_2 - |\downarrow\rangle_1|\uparrow\rangle_2) \otimes (|\uparrow\rangle_3|\downarrow\rangle_4 - |\downarrow\rangle_3|\uparrow\rangle_4)$  as one in which there are *two* binary entanglement relations (one between particle 1 and particle 2, and the other between particle 3 and particle 4), each one *exactly identical* to the entanglement relation exhibited by a two-particle entangled system. In other words, the truly fundamental relations could be the same in all cases and, consequently, it could be that the loss of physical unity Schaffer talks about doesn’t take place at all.<sup>11</sup>

As we have seen, on the other hand, Schaffer rests his case heavily on the thought that it is at least possible that supervenience fails so that duplicating the proper parts and their external relations doesn’t entail a duplication of the whole, as new properties appear when the whole is constituted. This is the abovementioned asymmetry of emergence, which Schaffer deems sufficient for preferring

<sup>9</sup> It is debatable whether entanglement correlations are dispositions, and whether they are identical with the categorical total property. The ontological interpretation of the properties of entangled systems, and of quantum properties in general, is indeed an important open problem in the philosophy of physics.

<sup>10</sup> It is already problematic to identify ‘genuine’ three-particle entanglement. For a general overview on these issues, see Horodecki et al. (2009).

<sup>11</sup> In the worst-case scenario, the pluralist has to admit of a differentiation between binary and ternary entanglement relations.

monism to pluralism even independently of quantum physics. Granting the possibility of genuine emergence, though, it doesn't follow that the whole is prior to the parts. For, why should the fact that the whole is richer than its parts entail that the direction of dependence is not from parts to whole but the converse?

In fact, it looks as though the whole and its properties are dependent on the parts and their properties for their *existence* (and, therefore, for their *identity*: see Lowe (2005)), as the former might fail to exist while the latter exist but not vice versa.

Expanding on this latter thought, one could even go as far as to claim that emergent properties are additional parts of the whole that are created once certain initial parts, properties and external relations are given.<sup>12</sup> Pluralism just requires that there be more than one basic entity (and, as long as foundationalism holds, a fundamental level of independent entities). Both of these requirements are preserved if one allows for 'emergent parts' of the sort just described.<sup>13</sup>

It could be objected that properties cannot be parts of objects (essentially rejecting the bundle theory) and/or that there cannot be more 'physical stuff' in the whole than in the parts. In this case, consider the view according to which only particulars are real ('resemblance nominalism'). According to this perspective, properties of concrete particulars are derivative on facts about those particulars belonging to certain classes ('similarity' or 'resemblance classes'). On this construal, therefore, emergence amounts to the fact that the whole belongs to one or more resemblance classes additional to, or different from, the 'expected' ones that are automatically given when the parts compose the whole: for instance, an entangled two-fermion whole belongs to the class of entities that exhibit opposite spin values upon measurement even though this latter correlation doesn't *directly* follow from facts about the separate fermions, for each one of which it is only the case that it belongs to the resemblance class of entities possessing equal probability of having spin up and of having spin down.

Now, against this background the pluralist can claim that the fact that the whole partakes in similarity classes that are 'unexpected' with respect to those its parts belong to doesn't make the whole ontologically prior, for the facts about the whole remain entirely dependent on facts about the parts, although the specific form of such dependence is 'non-canonical'. Some, for example Paul Humphreys

<sup>12</sup> Notice that this is not meant to suggest a nomological connection between parts and wholes: the sort of dependence pointed to here would be there even in cases of 'random emergence', in which there is nothing like a law determining *what kind* of emergent property is exhibited by *which* wholes. Existential dependence between specific whole- and part-tokens, that is, doesn't require a law-like relationship between whole- and part-types.

<sup>13</sup> This, it must be pointed out, would require a modification of the tiling constraint to the effect that, instead of requiring the universe to be the sum of all basic parts, it requires it to be the sum of all parts (basic plus emergent). But it is hard to see why this should be a problem for the pluralist.

(1997a), (1997b), go as far as to regard emergence as resulting from an essential interaction (Humphreys calls it ‘fusion’) between constituent properties that, although it can assume various forms, is in any case nomologically necessary for the very existence of the emergent property. This clearly suggests a pluralist viewpoint, as it insists on the priority of the parts while relaxing the requirement that every mereological structure must be constituted as a ‘direct product’, as it were, of parts. Even without taking Humphreys’ route, there is at most an equilibrium here between the monist claim that which resemblance classes the whole falls under are not determined by facts about the parts but the converse is the case; and the pluralist claim that emergence just points at non-canonical ways in which the ontologically more fundamental simples may give rise to complexes and their properties.

Upon scrutiny, then, it appears illegitimate to move from the possibility of emergence to monism, for the pluralist thesis doesn’t require that all facts about complex wholes be ‘already contained’ in facts about their parts. Indeed, the pluralist can make room for the emergence of new facts, only true of wholes of a certain complexity determined by specific sorts of interactions, while insisting on the ontological dependence of the whole on its parts.

It can therefore be concluded that Schaffer’s argument from physics and the asymmetry of emergence fails to lend substantial support to monism.<sup>14</sup>

#### 4. Discussion of the argument from gunk

In his defence of monism, as we have seen, Schaffer considers the conceivability of gunk, as opposed to the implausibility of junk, as a key element. Then, he adds that “perhaps most tellingly [...] gunk is scientifically serious” as scientists themselves sometime conjecture a ‘cosmic onion’ with an infinite series of progressively lower-level layers (forthcoming, section 2.4; Schaffer mentions Dehmelt 1989).

However, while Schaffer concludes that we should opt for monism, it seems that – contrary to what he claims – arguments can in fact be provided in support of the thesis that everything is a proper part of something, that is, in favour of ‘junk’; and that this prevents one from inferring the preferability of monism over pluralism. First, junk is conceivable (just imagine an infinite series of objects each

<sup>14</sup> An anonymous referee has objected that it can still be the case that the whole concrete cosmos fails (or may fail) to supervene on its object parts and their properties, and thus an asymmetry remains. However, first, Schaffer’s argument is that the asymmetry of emergence *cannot* be explained by the pluralist and, therefore, monism *must* be true and in order to counter this, the pluralist doesn’t need to show that his/her view holds for all possible worlds. Secondly, as for the actual world, clearly the pluralist will insist that emergent properties *are* either ‘extra parts’ or the by-product of non-canonical resemblance classes, along the lines just suggested.

one contained in a larger object). Second, thinkers such as Leibniz (1698/1989) and Whitehead (1919/2007) did in fact think that the universe is (or, at least, might be or might have been) constructed in such a way that everything is a proper part of something.<sup>15</sup> Moreover, and ‘most tellingly’, the idea that junk is possible is also supported by considerations coming from actual physics, and in particular contemporary cosmology. While it is obviously possible, and commonly believed, that matter is finite, it is equally scientifically acceptable to hypothesise a universe in which “space is infinite in size [. . .] and almost uniformly filled with matter, as observations indicate” (Tegmark 2003, 41). Additionally, according to some cosmological models, there is in fact an infinity of parallel universes, and hence no finite total amount of ‘stuff’. Furthermore, some theories, based on so-called ‘chaotic eternal inflation’ (see Guth and Steinhardt 1984), postulate that there is an infinite series of multiverses, each one containing a universe like ours and universes parallel to it.

Now, all this does not suffice for junk, as the latter requires not only infinite size, infinite matter and countless series of objects containing other objects as parts, but also the *in principle* impossibility to point to something that is the ‘biggest fusion’. However, imagine a higher level of infinitely many multi-multiverses, each one containing infinitely many multiverses; an even higher one of infinitely many multi-multi-multiverses, and so on *ad infinitum*. In this scenario, the ‘universal object’ can only be conceived as something that is reached ‘in the limit’. Should we accept *this* as a genuine object?

Schaffer answers this question in the affirmative, and argues that the possibility of infinite ‘upward’ complexity is by no means a problem for the monist. Indeed, he claims that ‘virtually no plausible’ account of composition allows for junky models, as it is always possible to conceive of a biggest fusion independently of whether or not the cosmos is an infinite series of matrioska-like universes. However, this claim of possibility and plausibility amounts to *presupposing* the validity of the axiom of *unrestricted fusion* (or, *unrestricted composition*) – which is what entails the necessary existence of a ‘top’ universal object; but, while such an axiom is an essential element of classical mereology, it is by no means indispensable. In fact, it does not appear among the basic axioms of all those extensional mereologies which do not bear the label ‘general’.<sup>16</sup>

As a matter of fact, one might consider the possibility of junk as sufficient for switching to these latter non-classical mereologies, allowing for the denial of the

<sup>15</sup> These references are taken from Bohn (2009b).

<sup>16</sup> Unrestricted composition says that every class of objects has a fusion (i.e. for all  $xs$ , there is some  $y$  composed by the  $xs$ ). More formally, that for entities  $v, w, z$ , generic condition  $\phi$  and overlap relation  $O$ ,  $\exists w\phi w \rightarrow \exists z\forall w(Ozw \leftrightarrow \exists v(\phi v \wedge Ov w))$ . See Hovda (2008) and Varzi (2009) for general discussions of mereology.

existence of a universal object.<sup>17</sup> Of course, however, the pluralist would be better off if setting restrictions on composition could be shown to be a plausible move independently of junk. But this is by no means an impossible task: the principle of unrestricted composition has in fact been attacked by various authors in the past, on the basis of intuitions about persistence through time, and by claiming that it implies mereological essentialism, leads to paradoxes similar to the ones afflicting naïve set theory, and entails the existence of objects that have properties that are not genuine (in that their contraries cannot be individuated).<sup>18</sup>

This may appear still insufficient, as simply rejecting unrestricted composition is not enough: for, the nihilist extreme (according to which, as mentioned, there simply are no instantiations of the parthood relation, and so no composition at all) also precludes junk; and, therefore, it looks as though the pluralist needs to specify what restriction should exactly be set on composition. A response could be that, in the same way in which one should rule out ‘unconventional’, unconnected objects such as umbrella-dogs wholes because they don’t meet the intuitively fundamental requirements for qualifying as ‘things’, so one should exclude objects that do not have definite properties. In a junky universe, the alleged universal object would indeed fail to have, say, a definite mass or size, as these could only be determined in the limit. And this appears to mean that one would necessarily fail to pick out a well-defined thing when attempting to ‘isolate’ such an object. This proposal can certainly be questioned, but it appears naturally supported by symmetry of reasoning in the present context: indeed, it looks as though if a bottom level of simples is ruled out in view of the infinite division characteristic of gunk, a top level should also be ruled out given the infinite series of fusions typical of junk. Otherwise, why not think that, as a matter of fact (*contra* Schaffer), gunk does not represent a problem for pluralists, for in gunky worlds a fundamental level of simple parts still exists, although it is only reached in the limit?<sup>19</sup>

As in the case of the asymmetry of emergence, therefore, contrary to Schaffer’s claim that we should opt for monism, two theses appear to oppose each other that are conceptually on a par: that classical mereology is to be assumed when it comes to ontology, and so junk is impossible; and that ontological analysis shows that junk is possible, and we should consequently refrain from giving an ontological significance to classical mereology. To be sure, whatever one thinks of this, to just

<sup>17</sup> For such an argument, see Bohn (2009a).

<sup>18</sup> For a recent attack against unrestricted composition, see, for instance, Elder (2008).

<sup>19</sup> Thanks to an anonymous referee for drawing my attention to this point. It is worth emphasising that the line of reasoning just suggested achieves something that another option, i.e. the restriction of composition to finite pluralities, doesn’t: that is, ruling out unrestricted composition in favour of junk without at the same time making gunk (which, recall, implies that everything has infinite, although progressively smaller, parts) impossible. It is exactly by noticing this latter consequence that Bohn (2009a) prefers to conclude that facts of composition are contingent, which we need not say here.

state that junk cannot be made sense of on ('virtually' (?)) any plausible account of mereology is simply question-begging.<sup>20</sup>

From a more general viewpoint, it now seems that one is left at an impasse where, if foundationalism is assumed, it is unclear where to locate the fundamental level. Pluralism might appear in trouble given certain conceptual and empirical considerations, but so does monism. In particular, Schaffer's considerations in favour of the latter via an appeal to the possibility of gunk are exactly counter-balanced by equivalent considerations in favour of junk and, therefore, pluralism. What should one do at this point?

It is clear that the foregoing leads one to question the very assumption that underpinned the entire discussion so far: namely, that *there is a fundamental level* of basic independent entities. Perhaps, what must be put into doubt is metaphysical foundationalism itself?

### 5. *The foundationalist assumption*

Cameron considers various reasons why an infinite chain of ontological dependence relations should be discarded, and finds all of them wanting, except one. Assuming that there is a fundamental ontological level not dependent on anything below it<sup>21</sup>, he claims, allows one to formulate more unified metaphysical explanations, as there is a finite collection of objects that explains the existence of every dependent thing (Cameron 2008, 12). Since explanations of this sort are effective with respect to the actual world, Cameron seems to suggest, we have methodological reasons for believing that foundationalism holds at least contingently. This sounds reasonable but, as Cameron acknowledges, methodological considerations alone support the intuition against infinite chains of dependence in a rather limited manner.

In fact, other thoughts of the same nature might pull in a different direction, so depriving the foundationalist intuition even of its alleged methodological basis. Schaffer himself (2003), for example, considers the possibility that the rejection of infinite compositeness be grounded on the fact that it makes room for more economical explanations, and points out that there are competing methodological considerations (e.g. explanatory scope and elegance) that might favour a different stance. Moreover, while it is true that if there is no basis for ontological dependence then there is no (finite) collection of *objects* that explains everything, there might be a (finite) collection of *statements* that does. Hence, one must make room

<sup>20</sup> For similar arguments in favour of the possibility of junk (and of 'hunk', that is, of worlds that are both junky and gunky, which is something relevant for the discussion of metaphysical infinitism below), see Bohn (2009b).

<sup>21</sup> Cameron only considers the possibility of downward ontological dependence but, clearly, his reasoning can be applied to upward ontological dependence too.

for different types of economy. Consider, for instance, what Schaffer (2003, 505) calls a ‘boring’ universe with infinite composition, such as the Pascalian universe in which each part of matter has a micro-universe in it which is the exact replica of our universe, and so on *ad infinitum*. The nature of such a universe wouldn’t allow for a comprehensive metaphysical account in terms of basic objects, but could nevertheless be defined in a very simple fashion via a description of the universe’s fundamental structure. As Tegmark puts it in explaining the scientific value of the idea of a multiverse,

an entire ensemble is often much simpler than one of its members [. . . and . . .] complexity increases when we restrict our attention to one particular element in an ensemble, thereby losing the symmetry and simplicity that were inherent in the totality of all the elements taken together (2003, 51).

It thus seems that even if one takes unified metaphysical explanations to be preferable, these can assume various forms; and that considerations relative to simplicity, elegance, explanatory scope and, most importantly, the (supposed) nature of reality all play a crucial role when it comes to evaluating different explanations. A universe violating certain foundationalist presuppositions might be postulated exactly *because* it makes room for better explanations.

To put it slightly differently, the nature of reality might even be taken to *require* one to abandon one’s foundationalist presuppositions. Let us look at this through the perspective provided by specific examples.

*Partial Identity and Fact Infitism.* Realists about universals have presented as their main argument the fact that similarity requires explanation, and postulating that resemblances between things depend on facts of numerical identity between instances of the same property provides one. More or less recently, however, they have been challenged to extend their explanation to cases of partial similarity between properties. The currently most popular proposal for doing so is to insist on an explanation in terms of identity, suggesting that partial similarity is nothing but partial identity. This makes the realist committed to so-called ‘structural universals’, i.e. universals that are constituted of simpler universals arranged in certain mutual relations. The idea is that partially similar things exemplify partially similar properties, and these are structures of universals that are identical in some of their components but not all.<sup>22</sup> Denkel (1998) argued that the account of partial similarity between universals as partial identity is *inconsistent* because it implies that two resembling universals have some identical constituents and some non-identical constituents falling under the same determinable, and for these the

<sup>22</sup> It is not agreed upon whether the simpler universals constitute the structural ones mereologically, but certainly the parts possessing the simpler universals are parts of the whole bearing the structural ones. In this sense, the partial identity account of property resemblance is one form of the pluralist approach to qualitative heterogeneity, mentioned earlier, that aims to account for such heterogeneity in terms of basic homogeneous parts.

request for an analysis of resemblance facts arises again, ultimately turning out to lead to an infinite regress. Gibb (2007) showed that for quantitative properties such as length or duration the analysis need not go on *ad infinitum*, as one gets (or, at any rate, may get) to the last stage, where there is complete identity, in a finite number of steps; and that Denkel's assumption that the non-identical aspect and the identical aspect of two similar universals must fall under the same determinable – and for this reason be either identical or partially identical – is incorrect, as properties may have various 'determination dimensions', each one corresponding to a distinct determinable, and partial similarities might consist of identity with respect to one dimension and non-identity with respect to another. On the other hand, Gibb acknowledges that Denkel's reasoning certainly applies within the individual determination dimensions, and concludes that there is indeed a *threat of logical incoherence* that can only be avoided by realists about universals if they manage to show that every determinate property is analogous to length, duration and the likes in its being ultimately quantitative in nature (Ib., 557).

There is a tacit assumption in both Denkel's and Gibb's reasoning: that an account of partial resemblances turning out to require an infinite number of *explanantes* (converging only in the limit towards identity, that is, towards basicness and homogeneity) is unacceptable. If gunk is possible, however, this is clearly not the case. If they accept the possibility of gunk, realists about universals can just insist that the proposed analysis of resemblance facts works and is not in danger of proving to be inconsistent – although it *may* require the world to be infinitely composed and the basic simples to have infinitesimal magnitude.<sup>23</sup> Doing so would in fact allow them to be 'agnostic' about a supposed privileged level of homogeneous finite quantities, all equal to one another and grounding all similarity facts, which is what Gibb considers necessary for the partial identity account to work.<sup>24</sup>

The one just outlined seems to be a case in which allowing for infinite downward dependence allows one to apply a metaphysical theory coherently and generally, so obtaining a simple and elegant general explanation of certain facts that, allegedly (at least under certain assumptions), cannot be given any other explanation.<sup>25</sup>

<sup>23</sup> Whether this latter claim can be taken literally or should be interpreted in the sense that basic simples don't really exist is an interesting question, directly relevant with respect to Schaffer's argument from gunk (this was mentioned in passing in the previous section). For the sake of argument, it was simply taken for granted in this paper that gunk entails a violation of pluralist foundationalism.

<sup>24</sup> Gibb's presupposition that there must be a level of fundamental simple properties can be put into doubt on grounds *not* exclusively related to the possibility of gunk: see Schaffer (2003) for detailed arguments against the 'fundamentalist' view of properties.

<sup>25</sup> The claim goes something like this: partial similarities are analysable in terms of partial identities among structural universals. Such analysis can either reach a level of homogeneous basic universals or go on *ad infinitum*, but the suggested explanation works in any case.

An analogous argument has been recently formulated with respect to another issue. In a response to Cameron's abovementioned argument for the contingent truth of metaphysical foundationalism, Orilia (2009) argues that, in view of Bradley's regress, we should abandon the requirement of well-foundedness for chains of ontological dependence, and account for the unity of states of affairs by embracing metaphysical infinitism (Orilia speaks of 'fact infinitism'). That is, we should acknowledge that any fact *F* of the form '*x* is *y*' must be analysed in terms of another fact *F'* of the form '*F* consists of *x*'s exemplifying *y*', and so on *ad infinitum*.

*The Contingency of Composition.* Something analogous holds for junk and infinite upward complexity. A standard view is that whenever two or more things compose something, they do so necessarily. Many also think, more strongly, that any collection of things composes something. However, the opinion is becoming widespread that there are no clear arguments for believing that facts of composition are necessary, and so we should in fact take them to be contingent until these arguments are provided (see, for instance, Cameron 2007). In this perspective, the possibility of junk can be taken as an element going in favour of such a claim of contingency. For, if junky worlds are possible, unrestricted composition is not a necessity.<sup>26</sup> In this sense, the possibility of junk, instead of being deemed unacceptable because in conflict with allegedly self-evident truths, could be employed in the framework of a larger project aimed to critically analyse currently widespread beliefs and provide arguments and explanations to replace presuppositions.<sup>27</sup>

It thus seems that Cameron is not justified in claiming that it is at least contingently true that infinite chains of ontological dependence do not exist. If metaphysical infinitism is a possibility, and if allowing for a universe without an ultimate (be it 'top' or 'bottom') ground supports certain metaphysical explanations about actual facts, then foundationalism may legitimately be regarded as false even for the actual world. Using the above examples, anyone who believes – on the metaphysical side – in universals (as a ground for similarity facts) and/or in the contingency of composition; and – on the physics side – in the infinite divisibility of

Since realism about universals is the only explanation of similarity facts, one should therefore accept realism about universals and the possibility of infinite compositeness (that is, that all properties are structural universals).

<sup>26</sup> See the discussion in Bohn (2009a). Notice, incidentally, that the idea that composition is restricted also grounds an argument for assuming, as done by Schaffer, that composition is not identity (at least if one agrees with Merricks (2005)).

<sup>27</sup> It might be suggested that if composition is not necessary, then one should be monist, as – contrary to what the tiling constraint requires – in duplicating the parts one does not necessarily obtain the whole, as opposed to the plurality of the initial things. However, this doesn't suffice for monism, as it is still true (according to the pluralist, at least) that *if* there is a whole, it depends on its parts.

elementary particles<sup>28</sup> and/or in the existence of junky multiverses will have reasons for claiming that the foundationalist intuition *is in fact* wrong (or, at any rate, is reasonably regarded as such given the explanatory power of certain theories).<sup>29</sup>

## 6. Conclusion

In recent work, Jonathan Schaffer used the possibility of gunk, together with what he calls the asymmetry of emergence, to argue against pluralism and in favour of monism. However, his arguments are not compelling, as a consideration of emergence doesn't generate truly compelling reasons for thinking that the parts depend on the whole and, moreover, there is no asymmetry of existence, since junk is as possible as gunk. Pluralism and monism, therefore, appear to be on a par. An overall evaluation might suggest complete agnosticism, or the need to revise the additional hypotheses employed by Schaffer and accepted in this paper (i.e. the tiling constraint, and the view that constitution is not identity). However, one may also choose to give up the basic underlying assumption that there is a fundamental level of reality. Cameron argues on methodological grounds that foundationalism is compelling at least as a contingent truth, but there are reasons for doubting even that, as certain plausible scientific and metaphysical views taken together may suggest a violation of foundationalism. The conclusion to draw from all this is that metaphysicians should be careful in claiming that this or that general thesis is necessarily true (as Schaffer does when presenting the very opposition between monism and pluralism); and that claims of contingency (and conditional dependence of one's metaphysical views on one's other commitments and beliefs) are preferable – and should themselves be put forward with great attention. In the present case, it seems that metaphysical infinitism and metaphysical foundationalism should, intuitions having been set aside, be given equal credit while waiting for further developments in our inquiry into the fundamental structure of reality.\*

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<sup>28</sup> Recall Dehmelt's (1989) postulation of an infinite regression of sub-electron structure, mentioned earlier.

<sup>29</sup> In particular, the joint commitment to either the first or the second of the two metaphysical theses and to the second or the first, respectively, of the physical ones suffices for a justified endorsement of metaphysical infinitism.

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