Neither Simples nor Gunk

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By

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Abstract:

Investigations into mereology, an axiomatic theory of the part-whole relation, often involve attempts to answers both the Composition Question and the Simple Question. An answer to the Composition Question will determine under what conditions some objects compose (i.e., are the parts of) an object. An answer to the Simple Question will determine what the necessary and sufficient conditions are for an object to be a mereological simple (i.e., an object that has no proper parts). Defenders of certain answers to the Composition Question, hold that there might not be any simples; however, if there are no simples, then the world is made of gunky objects, which are objects such that all of their proper parts also have proper parts.

If one hopes to answer either the Composition Question or the Simple Question, then they are committed to the hypothesis that the world has an Intrinsic Mereological Structure (IMH), which entails that the world is made of simples or gunk. In this thesis I argue that there is good reason to think that there are neither simples nor gunk, so there is good reason to think that IMH is false and that there are no correct answers to the Composition Question or the Simple Question.

Chapter 1: Fact, Fiction, and Mereology

Chapter 2: Simples

Chapter 3: Gunk

1

Fact, Fiction, and Mereology

"Parting is such sweet sorrow." — Shakespeare

1. Introduction

Consider the sentence "The Morlocks feast upon the Eloi." The proposition expressed by this sentence, concerning the dietary habits of fictional creatures inhabiting a fictional future Earth, is different from propositions concerning the Eiffel tower, your breakfast, and all the world's giraffes. This is because the Morlocks, the Eloi, and the world they inhabit are creatures of fiction. Their existence is bound to a fictional work, *The Time Machine*, written by H.G. Wells. In *The Time Machine*, the Morlocks are ascribed a host of properties. Most notably, they are said to feed upon the hapless Eloi, who occupy the Earth's surface. Unlike the Eiffel tower, these Morlocks do not exist anywhere in space and time; however, given

that the Eiffel tower's existence in France from 1887 to the present day is what makes claims about it true, the following question arises: What makes it true that the Morlocks eat the Eloi? The cursory answer to this question is that the proposition expressed by "The Morlocks feast upon the Eloi" is *true in fiction* because *The Time Machine*, a piece of fiction, specifies the relevant details about the Morlocks and the Eloi. What truth in fiction amounts to will be discussed later, but now consider the sentence "All Souls College is a part of the University of Oxford."

The proposition expressed by this sentence does not, like the previous one, seem true in fiction. It seems true *simpliciter*. More importantly, it seems to express a true proposition about the relation *being a part of* that All Souls College bears to the University of Oxford. If the proposition is true, then there must be an object, All Souls College, and an object, the University of Oxford. In addition, there must be a relation *being a part of* that All Souls College bears to the University of Oxford. The relation of parts to wholes (i.e., the parthood relation) that this sentence alleges All Souls College bears to the University of Oxford is the subject matter of mereology, which aims to provide an axiomatic treatment of the parthood relation.

At first glance, there seems to be little that the two propositions offered above have in common. They are both expressed by sentences that share certain grammatical similarities (e.g., verbs, names, definite articles), but the subject matter of these propositions seems strikingly different. The first sentence concerns the content and characters of a science fiction novel, while the other reports a fact about a well-reputed educational institution. In this thesis, I will argue that there is good reason to view these propositions as importantly related. This is because both sentences, properly understood, fail to report facts about the world. Instead, they express propositions that are true only in fiction. Just as the proposition

expressed by "The Morlocks feast upon the Eloi" is true only in the fiction of *The Time Machine*, the proposition expressed by "All Souls College is a part of the University of Oxford" is true only in certain mereological fictions. Despite the absence of any canonical text specifying the details of our everyday mereological fictions, this sentence and all others that claim that mereological relations hold among material objects are nevertheless fictitious.

This is, of course, a contentious claim. Talk of parts and wholes is ubiquitous in our language and bound tightly to our view of the physical world. Still, the ubiquity of parts and wholes in language and thought should not be taken as evidence that facts about parthood are stitched into the fabric of reality. Furthermore, the denial of the existence of mereological facts is not a denial of the usefulness or of the intelligibility of discourse about parts and wholes. It is only the denial that there are, strictly speaking, facts about parts and wholes. By 'strictly speaking' I mean that, if one knew all the facts about the world, one would not know that All Souls College is a part of the University of Oxford or that my hand is a part of my arm. Strictly speaking, there are no facts of this type. Philosophers who assert that there are facts about parts, wholes, and other mereological posits support what I will call the *Intrinsic Mereological Hypothesis* (IMH). They maintain that there are mereological facts in (or about) the world.

There are many positions that entail the truth of IMH. Nihilists hold that the world's mereological facts are exhausted by facts about simples[1] (mereological atoms that have no proper parts[2]), while others hold that there are, in fact, no simples. Some, dubbed

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[1] Nihilism is defended in Rosen and Dorr (2002), Dorr (2002), Dorr (2005), and Unger (1979).

[2] According to classical mereology, there are two types of parts: proper parts, which are not identical to composite objects; and improper parts, which all objects have, since the improper part of any object is just the object itself.

'Organicists', assert that the only objects that have proper parts are living organisms.[3] In addition, Universalists assert that all objects compose further objects (or 'fusions').[4] For example, all the giraffes, gazebos, and graveyards of the world compose a fusion (i.e., a composite object that has all giraffes, all gazebos, and all graveyards as parts). Most Universalists about composition also maintain that the world could be made of gunk (something every proper part of which itself has a proper part). A feature common to all these positions is that they can be true only if IMH is true.

In part, my skepticism about IMH is motivated by the apparent futility of the disputes between Nihilists, Universalists, and Organicists; however, this skepticism is only a motivation. It falls far short of counting as an argument. That said, in order to ground this skepticism, I will offer one rather large argument against IMH: I will argue that we have good reason to deny that both simples and gunk exist. This denial entails the falsity of IMH.

If IMH is true, then objects are either composed of simples, composed of gunk, composed of some simples and some gunk, or are themselves simple. As a result, if there is good reason to think that there are neither simples nor gunk, then there is good reason to think that IMH is false. Before arguing against the existence of simples and gunk, I explain what exactly simples and gunk are in Chapter 2 (Section 1) and Chapter 3 (Section 1). I then present my case against the existence of simples in the remainder of Chapter 2 and a parallel case against the existence of gunk in Chapter 3. If the arguments offered against both simples and gunk are compelling, then IMH is false.

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[3] I follow Dorr (2005) in employing the term 'Organicism'. See van Inwagen (1990) for a defense of Organicism and Merricks (2001) for a defense of limited Organicism (or perhaps Anthrocism), which holds that the only composite objects are persons.

[4] Universalism is defended in Lewis (1986) and (1991) as well as in Sider (1993) and (2001).

This strategy for attacking the assumption that the world has an intrinsic mereological structure is by no means novel. In the Second Antimony of Pure Reason, Kant argues that the world is made up of indivisible entities and also that the world is infinitely divisible.[5] In light of this contradiction, Kant maintains that the world is neither atomic (such that all objects have simples as parts) nor gunky (such that all objects have proper parts). While rejecting the existence of mereological facts leaves a lacuna of sorts, Kant's transcendental idealism is not a position I will endorse. Still, faced with the falsity of IMH, talk about material objects must somehow be made intelligible without presupposing the existence of mereological facts.

With this lacuna in mind, after outlining my case against mereological facts I will indicate how we can get by without taking mereology seriously. As mentioned above, this strategy will center upon the notion of truth in fiction and the fictitious character of mereology. In Chapter 4 I develop a fictionalist strategy for dealing with mereological claims. To this end, I outline the general character of fictionalism about various types of objects and propose that a distinction between quantification and existence be adopted.

Before making my case against simples and gunk and developing a thoroughgoing mereological fictionalism, it will be of use to first get clear on the central theses of mereology and the nature of IMH.

2. A Brief History of Mereology

Mereology can be conceptualized in one of two ways. In the first way, mereology, often referred to as "classical extensional mereology," is an axiomatic theory that attempts to provide a systematic understanding of the parthood relation. One of the first axiomatic

[5] See van Cleve (1981) for a discussion of the mereological implications of the Second Antinomy.

treatments of mereology was outlined in *Foundations of a General Theory of Manifolds* by Stanislaw Leśniewski and was developed further in Nelson Goodman and Henry Leonard's "Calculus of Individuals" and Goodman's later work *The Structure of Appearance.* These systems vary in their axioms, notation, and existential commitments, but the central elements of these and any other mereological system remain largely constant. In general, axioms of reflexivity, antisymmetry, and transitivity are held to properly characterize the parthood relation:

(A.1) $\forall x \mathrm{P}xx$ Reflexivity

(A.2) $\forall x \forall y(\mathrm{P}xy \wedge x \neq \mathrm{y}) \rightarrow \neg \mathrm{P}yx$ Antisymmetry[6]

(A.3) $\forall x \forall y \forall z (\mathrm{P}xy \wedge \mathrm{P}yz) \rightarrow \mathrm{P}xz$ Transitivity

Investigations into mereology as an axiomatic theory have led to advances in topology, logic, and set theory. In particular, David Lewis's efforts to formulate set theory by using the mereological framework have led to noteworthy advances in the foundations of mathematics.[7] This way of viewing mereology as solely a formal language poses no glaring problems for metaphysicians; however, when mereology takes the material world as its subject matter, the nature of the parthood relation has proven rather controversial.[8]

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[6] The axiom of Antisymmetry can also be formulated as follows: $\forall x \forall y(\mathrm{P}xy \wedge \mathrm{P}yx) \rightarrow x = y$.

[7] See Lewis (1991).

[8] Questions regarding the application of mereology to ontological categories other than that of material objects are taken up in McDaniel (2004) and Uzquiano (forthcoming). For present purposes, these issues will not be discussed. The version of IMH I will argue against holds only that the category of material object has an intrinsic mereological structure. There may be other ontological categories that have an intrinsic mereological structure. In fact, there are good reasons offered in Lewis (1991) to think that set theory can be formulated by employing only mereology and an appropriate primitive. See also Paul (2002) for a case in favour of holding properties to have an intrinsic mereological structure.

This second way in which mereology constitutes an area of inquiry is as a metaphysical investigation into what sorts of things have parts Much of contemporary 'metaphysical' mereology is bound up with questions of what sorts of things exist. This is because much of the recent work on mereology has focused on the *Composition Question.*[9] The Composition Question is the following: What necessary and sufficient conditions must some objects, the *x*s, satisfy in order for it to be the case that there is an object composed of the *x*s? Investigations into the Composition Question attempt to complete the following biconditional in a non-trivial, finite, reductive manner and in doing so answer the Composition Question: *Necessarily, the xs are parts of an object y if and only if* _____ .

Intuitively, everyday things like umbrellas, giraffes, and gazebos have parts (e.g., handles, necks, and decks). But many metaphysicians reject these intuitive assumptions. For the most part, answers to the Composition Question can be located on the following spectrum. At one end of the spectrum there are people who maintain minimal answers to the Composition Question, where 'minimal' refers to the quantity of objects posited in the world. The most minimal answer is offered by *Nihilists*, who hold that the *x*s compose *y* if and only if there is one *x* and *x* is identical with *y*. According to the Nihilist, only simples exist and these simples compose only themselves; therefore, things like umbrellas, giraffes, and gazebos do not exist. Instead of umbrellas, giraffes, and gazebos, there are only simples arranged umbrella-wise, simples arranged giraffe-wise, and simples arranged gazebo-wise.[10]

While the Nihilist's position is strikingly counterintuitive, there are considerations that count in its favour. These considerations revolve around the conceptual difficulties

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[9] In what follows I am interested primarily in the Special rather than the General Composition Question. Both are discussed in van Inwagen (1990). For this reason, I omit the "Special" prefix.

[10] Lowe (1996) actually defends the view that persons are simples. See Olson (1998) for a critical discussion of Lowe's position.

found in offering a principled distinction between things people commonly think of as objects and things few people would be inclined to think of as objects. Take, for example, a chair and a mug. Most sensible people would affirm that these things are objects in good standing. Now consider a mug placed upon a chair. Do the mug and chair compose a further object: chair-mug? Providing a principled reason for holding chairs and mugs to be objects, while denying that a chair-mug is an object has proven difficult and, in response, the Nihilist holds the ontological status of the chair, mug, and chair-mug to be the same: the Nihilist denies that any of them exist. So, for parsimony's sake and for other reasons, Nihilists reject commitment to any objects above and beyond mereological simples, which are commonly held to be microphysical particles.[11]

To be fair, much of Nihilism's support emerges from the failings of the other positions that occupy the mereological spectrum. The opposing pole on the spectrum is *Universalism*, which holds that any *x*s compose an object *y*, no matter what the *x*s are or how the *x*s are arranged. The virtues of Universalism, as far as our intuitions are concerned, outweigh those of Nihilism. Universalists affirm the existence of umbrellas, giraffes, and gazebos. Universalism, unlike Nihilism, is also consistent with the possibility that everything in the world has proper parts (i.e., that gunk exists).

The intuitive difficulty with Universalism is that, in preserving the existence of umbrellas, giraffes, and gazebos, the Universalist is committed to the existence of an object that has all umbrellas, all giraffes, and all gazebos as parts. Objects of this sort might be counterintuitive to countenance; but, in the eyes of many, accepting their existence is preferable to the objectual famine entailed by Nihilism.

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[11] See Unger (1979) for several *sorites*-based arguments against the existence of composite objects not surveyed here.

A moderate position, located between Nihilism and Universalism on the mereological spectrum, is *Organicism*, which offers a specific and restricted answer to the Composition Question. Organicism holds that simples compose an object if and only if they are involved in the existence of a living organism. This is a restricted view of composition, since it holds that only living organisms and simples populate the universe. In comparison to Nihilism and Universalism, Organicism view is slightly less counterintuitive. People and giraffes exist, but umbrellas and gazebos do not; all there are are simples arranged umbrella-wise and simples arranged gazebo-wise, since umbrellas and gazebos are not living organisms. The existence of fusions of disparate objects is also denied by Organicists, provided that such fusions are not organisms.

Despite the appeal of Organicism's coherence with our intuitions about objects, it faces several difficulties upon closer scrutiny. Not only does Organicism deny the existence of commonly accepted objects like tables and chairs, it also entails that there can be only a vague answer to certain questions about whether an object is part of a composite object or not. This is because, as van Inwagen admits, it is not clear when certain things actually participate in the activity of an organism. Markosian puts this point as follows:

> [C]onsider some simples that would ordinarily be taken to compose a carbon atom. Suppose those simples get ingested by a woman drinking tea, so that they are eventually absorbed into her bloodstream. At precisely what instant does it come to be the case that those simples are caught up in that woman's life?[12]

Concerns of this sort seem to indicate that this restricted view of composition leads to a vague answer to the Composition Question. A vague answer is arguably an unacceptable one. Lewis, in *On The Plurality of Worlds*, says the following: "If composition obeys a vague restriction, then it must sometimes be a vague matter whether composition takes place or

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[12] Markosian (2005) p. 14.

not. And that is impossible."[13] This impossibility, which entails that existence is a vague matter, is considered by many to be good reason to reject Organicism.[14]

A second moderate answer to the Composition Question is defended by Brutalists about composition.[15] Brutalism about compostion holds that "There is no true, non-trivial, and finitely long answer to [the Composition Question]."[16] This answer to the Composition Question is at odds with reductive answers, which attempt to explain instances of composition in non-mereological terms.

The motivations for Brutalism include (a) the unsatisfactory character of other answers to the Composition Question and (b) the difficulties that result from attempting to deny *The Doctrine of the Mereological Circle*, according to which no mereological concept is capable of analysis in terms of concepts outside of the mereological circle (where the mereological circle is the cluster of mereological concepts including part, whole, etc.). The merits of Brutalism are difficult to assess, but a position analogous to Brutalism will be discussed later with the hopes of determining whether Brutalism in mereology is an acceptable or defensible position.

Having outlined the responses to the Composition Question, it should be apparent that those who endorse Nihilism, Universalism, and any views of composition falling between the two are commited to IMH. For, on all of these views, there is some mereological fact about when, if ever, the xs compose an object. But endorsing IMH requires more than an answer to the Composition Question, since the Simple Question must also be answered.

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[13] Lewis (1986) p. 212.

[14] See Nolan (forthcoming) for an argument against Lewis's claim that composition cannot be a vague matter.

[15] See Markosian (1998b).

[16] Ibid. p. 214.

Investigations into the Simple Question attempt to complete the following biconditional: *Necessarily, x is a simple (or mereological atom) if and only if* _____. According to those who maintain that the world is gunky, there are no entities in this world that satisfy the right-hand side of this biconditional. For most who believe that the world is atomic, there is some way to complete the biconditional in a non-mereological and, therefore, reductive way (i.e., by specifying some non-mereological criterion for an object to have no proper parts). In the following chapter, I outline proposed answers to the Simple Question with the aim of showing that the Brutal Answer to the Simple Question, the analogue of Brutalism about Composition, is the only adequate answer. In Section 2.2, I argue that, because the Brutal Answer is the only tenable answer to the Simple Question, there is good reason to deny that there are any simples. In Section 2.3, I supply further reason to deny the existence of simples.

2

Simples

"I see not why we must needs believe that there are any primogeneal and simple bodies, of which, as of pre-existent elements, nature is obliged to compound all others." — Boyle

"Seek simplicity; and distrust it." — Whitehead

1. Simple Answers

A number of different answers to the Simple Question have been offered. If one of these answers is correct, it will succeed in specifying what, if any, are the necessary and sufficient conditions for an object to instantiate simplicity (i.e., the property of having no proper parts). Of these answers, several attempt to reduce simplicity to spatial or physical properties, while others attempt to explain simplicity in more "metaphysical" terms (e.g., using fundamentality or intrinsicness). In surveying these answers, the various proposals can be classified as follows: (1.1) The Indivisible Answers; (1.2) The Independent and

Fundamental Answers; (1.3) The MaxCon Answer; (1.4) The Point-Sized Answer; and (1.5) The Brutal Answer.

1.1 The Indivisible Answers

There are two proposed answers to the Simple Question that attempt to reduce simplicity to indivisibility, both of which are presented in Markosian (1998a). The first of these, *the Physically Indivisible Answer*, holds that, necessarily, x is a simple if and only if it is physically impossible to divide x. Initially, this view seems to square well with our intuitions about simples. This is because most of us are inclined to think that, if there are any mereological simples, they would be the fundamental constituents of our world and would therefore be physically indivisible.

Upon further consideration, however, the Physically Indivisible Answer yields mereological conclusions that seem to be radically counterintuitive. This is because the Physically Indivisible Answer entails the simplicity of distinctly non-fundamental objects. Markosian provides the example of an expertly booby-trapped bomb that would explode if divided. This bomb, since it cannot be divided without being annihilated, is, given the Physically Indivisible Answer, a mereological simple. But such a bomb seems to have parts in an uncontroversial sense (e.g., a fuse and detonator). Consider a similar example: a chain built out of physically indestructible links. Although it seems uncontroversial that these links are parts of the chain, the chain cannot be physically divided and, as such, the Physically Indivisible Answer commits one to the claim that it is a simple.

To avoid the counterintuitive results the Physically Indivisible Answer yields, Markosian considers *the Revised Version of the Metaphysically Indivisible Answer*, which answers the Simple Question as follows: Necessarily, x is a simple if and only if it is metaphysically

impossible to divide x without first changing x's intrinsic properties.[17] This revised answer avoids ascribing simplicity to the bomb and chain considered above; but, according to Markosian, it leaves point-sized objects as the sole candidates for being simple. This is because any object extended in space can possibly be divided without changing its intrinsic properties. Markosian rightly notes that this view is then subject to the objections levied against the Point-Sized Answer, which will be considered shortly.

One problem common to both of the above answers is that, by employing the concept of indivisibility to analyse simplicity, a reductive analysis of simplicity is no longer possible.[18] Divisibility presupposes parthood, since divisibility must itself be explained as the disconnection of the parts of an object. So, for this reason, the concept of indivisibility cannot be invoked to analyse simplicity.

The Revised Metaphysically Indivisible Answer provides only a circular analysis of simplicity, not only because indivisibility is bound up with the concept of parthood, but also because it relies on intrinsicness as an *analysans* of simplicity. Intrinsicness cannot be a constituent of a non-circular explanation of simplicity because it must itself be analysed in mereological terms. McDaniel makes this point as follows:

> Recall the definition of "intrinsic property": a property is intrinsic if and only if it never differs between duplicates. Now recall that the analysis of duplication also appealed to the concept of parthood: x and y are duplicates if and only if there is a 1:1 correspondence between their parts that preserves perfectly natural properties and relations.[19]

Because of the failure of the above answers to provide a reductive analysis of simplicity by employing indivisibility, an alternative answer to the Simple Question is required.

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[17] Markosian (1998a) p. 221. I here ignore Markosian's *Unrevised Version of the Metaphysically Indivisible View.*

[18] See McDaniel (2004) p. 103 for further discussion.

[19] Ibid. p. 102.

1.2. The Independent & Fundamental Answers

The Independent and Fundamental Answers to the Simple Question attempt to reduce simplicity by employing ontological notions like possibility and naturalness. *The Independent Answer*, outlined in McDaniel (2004), is as follows: Necessarily, x is a simple if and only if there is a possible world w at which (1) x is the only existing material object and (2) x instantiates an intrinsic property P at the actual world if and only if x instantiates P at w.[20] As indicated above, any answer to the Simple Question that relies on intrinsicness as an *analysans* can provide only a circular analysis of simplicity. The Independent Answer does exactly this and, as a result, fails to satisfactorily answer the Simple Question.[21]

The Fundamental Answer, also considered in McDaniel (2004), attempts to analyse simplicity in terms of naturalness. It holds that a sufficient condition for an object to be a simple is for it to instantiate a perfectly natural property, where perfectly natural properties are understood as properties "that are both required and jointly suffice to provide a complete description of the world."[22] This answer seems to offer a reductive account of simplicity; but, in doing so, it is committed to the difficult task of specifying what properties are, in fact, perfectly natural.

Aside from the challenge of determining which properties are perfectly natural, there remain two significant problems with this response to the Simple Question. First, the Fundamental Answer entails that there are at least some simples, since there must be some properties that provide a complete description of the world and these properties must be instantiated. The objects that instantiate these properties might not be the only objects that exist, but this view entails that there is either an atomic world or a world that contains both

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[20] See McDaniel (2004) p. 101.

[21] See McDaniel (2004) p. 122 for discussion of *the Revised Independent Answer* suggested by Caplan.

[22] Ibid. p. 91.

simples and gunk. Commitment to the existence of some simples might not be sufficient grounds to reject this answer; but, if one believes it is possible that the world be made entirely out of gunk, then this answer will be unsatisfactory. Second, the Fundamental Answer, much like the Physically Indivisible Answer, yields counterintuitive results in identifying mereological simples.

As McDaniel notes, the property *being point-sized* qualifies as perfectly natural; however, if point-sized fusions are possible, the Fundamental Answer is false, since a point-sized fusion will instantiate a perfectly natural property, namely *being point-sized.* There is good reason to think that *being point-sized* is perfectly natural, since a description of the world requires reference to point-sized objects or properties instantiated at point-sized locations. So, given the naturalness of *being point-sized*, there is good reason to reject the Fundamental Answer.

The circularity of the Independent Answer and the unattractive consequences of the Fundamental Answer are reasons to think that both fail to adequately answer the Simple Question. For this reason, further attempts to analyse simplicity in terms of more basic spatial concepts ought to be considered instead.

1.3. The MaxCon Answer

The MaxCon Answer to the Simple Question is not one that accords with common intuitions about fundamentality or parthood. This is because the MaxCon Answer attempts to analyse simplicity in purely material and spatial terms and, in doing so, entails commitment to the possibility of extremely large and extremely complex simples. The extent to which the MaxCon Answer is counterintuitive seems sufficient to warrant scepticism

about its adequacy, but the MaxCon Answer ought to be taken seriously because, unlike most other analyses of simplicity, it seems, at least superficially, to avoid circularity.

Defended in Markosian (1998a, 2004a, 2004b), *the MaxCon Answer* holds that an object is mereologically simple if and only if it is maximally continuous. An object x is maximally continuous if and only if "x is a spatially continuous object and there is no continuous region of space, R, such that (i) the region occupied by x is a proper subset of R, and (ii) every point in R falls within some object or other."[23] This answer entails that, no matter how large an object is, or how complex its shape is, it can still be a mereological simple. As a result, there could be a planet-sized object with an immensely complex internal structure that, so long as it is spatially continuous and the region it occupies is filled with matter, is nevertheless a simple. If the MaxCon Answer is correct, then planet-sized simples are possible. If it is false, then common sense might be validated and things of this sort might indeed have parts. Fortunately for those who place some stock in common sense, there are several reasons to think that the MaxCon Answer is incorrect.[24]

The MaxCon Answer, like any other answer to the Simple Question that relies on material or spatial criteria, stands at odds with Mereological Monism. Mereological Monism, defended in Lewis (1991), holds that mereological composition applies to all ontological categories (e.g., material objects, sets, propositions); therefore, if Mereological Monism is true, then composition, across all ontological categories, is governed by the axioms of mereology.

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[23] Ibid. p. 80.

[24] McDaniel (2003) outlines two significant and, I think, convincing arguments against the MaxCon Answer: (i) The Problem of Spatial Intrinsics and (ii) The Problem of Supervenience of Constitution coupled with The Doctrine of Arbitrary Undetached Portions. Hawley (2004) also makes a case against the MaxCon Answer and other "borderline" accounts of simplicity. I will not rehearse these arguments here, but the reader unconvinced by the case for rejecting the MaxCon Answer is encouraged to review them.

If Mereological Monism is true, then an answer to the Simple Question will be required to specify the conditions sufficient for any object, belonging to any ontological category, to qualify as a mereological simple. As a result, the MaxCon Answer is incompatible with Mereological Monism, because, if there are simples that are not material objects, these simples cannot satisfy the conditions specified by the MaxCon Answer. Because this problem is faced by many reductive analyses of simplicity, it is one that the MaxCon Answer advocate could reasonably "bite the bullet" on. That said, if this problem generalizes to all answers to the Simple Question that involve material or spatial criteria, then it might provide sufficient reason to doubt that any answer of this kind is adequate.

A more serious problem with the MaxCon Answer arises because the MaxCon Answer entails that point-sized material objects are simples. If there is reason to deny that point-sized material objects are necessarily simples, then there is reason to deny that the MaxCon Answer is correct. I outline one such reason in the following section.

1.4 The Point-Sized Answer

If mereological simples are the smallest possible objects, then they must be point-sized objects (i.e., those objects that lack any spatial dimensions). One answer to the Simple Question, motivated by the intuition that simplicity is a function of size, is the Point-Sized Answer. *The Point-Sized Answer*, like the MaxCon Answer, relies on a spatial criterion for determining which objects have no proper parts. It holds that, necessarily, x is a simple if and only if x is a point-sized object. The Point-Sized Answer faces a serious and, I think, decisive objection offered in McDaniel (2004).

If multiple point-sized objects, the xs, can be co-located and compose an object y, then a point-sized object y can have proper parts. If being point-sized is not a sufficient

condition for being a simple, which would be the case if point-sized fusions are possible, then both the Point-Sized and MaxCon Answers fail as responses to the Simple Question.

To resist this argument, one might object that co-located, point-sized objects are impossible. Whatever form this objection would take, there seems to be a compelling counter-objection to be offered against it. Imagine two point-sized objects travelling towards each other:

> If co-located material objects are impossible, then they must swerve out of each other's way. Or they must stop dead in their tracks. Or one of them must spontaneously disintegrate. Some event must occur in each world that prohibits them from occupying the same space. There is a *de re* necessary repulsion between these two objects. The price of denying the possibility of co-located objects is accepting brute *de re* modal facts like these. The price is too high.[25]

To avoid positing brute modal facts, it seems that the possibility of co-located point-sized objects and fusions thereof must be acknowledged. If so, then the Point-Sized Answer and the MaxCon Answer are false.

One might also contest the claim that there are point-sized fusions. To do so would require defending a restriction on composition that ensures point-sized fusions are impossible. This presents a unique question about composition: Would a view that holds that any object x and any object y compose an object if and only if x and y are not both co-located and point-sized be tenable? This would result in a restricted view of composition; but, unlike most restricted views of composition, it does not seem obviously susceptible to the problem of vagueness. Such a view would be compatible with the Point-Sized Answer; however, the *ad hoc* character of this view makes it inadequate for underwriting an objection to the existence of point-sized fusions.

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[25] McDaniel (2004) p. 77.

To offer a properly motivated response to this objection to the Point-Sized and MaxCon Answers, one might claim that point-sized objects do not compose anything other than themselves. This would provide grounds for denying the existence of point-sized fusions, but the cost of this strategy is that the Point-Sized Answer and the MaxCon Answer would be incompatible with Universalism. This cost is an extremely high one, given that most advocates of IMH endorse Universalism, so there is reason to reject the Point-Sized and MaxCon Answers rather than Universalism.

1.5 The Brutal Answer

Having surveyed a number of responses to the Simple Question, it seems that all of them are genuinely suspect. *The Brutal Answer*, defended by McDaniel, acknowledges the problems with each allegedly reductive answer to the Simple Question and draws the following moral: "there is no correct, finitely stateable, and non-circular answer to the Simple Question."[26] As McDaniel himself admits, this is a disappointing result for the metaphysical variety of mereology. But how exactly does one arrive at such a pessimistic conclusion about simples? By disjunction, of course. McDaniel supports the Brutal Answer because all other answers fail to specify the necessary and sufficient conditions for an object to lack proper parts. Clearly, the arguments considered here vary in the degree to which they are compelling; but, if these views exhaust tenable answers to the Simple Question, then the Brutal Answer, however unpleasant, would seem to be a consequence.

I am inclined to agree with McDaniel. None of the above accounts is satisfactory. For this reason, the Brutal Answer is the only tenable account of simples. This is in keeping with the Doctrine of the Mereological Circle, which motivates Brutalism about composition.

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[26] Ibid. p. 68.

If mereological concepts cannot be correctly analysed without employing other mereological concepts, then reductivism about simplicity or composition seems impossible. That said, the Brutal Answer is not merely a disappointing result; it is also an inadequate one. A more satisfactory answer, which I will defend in the following sections, holds that there are, strictly speaking, no simples whatsoever. To indicate why we ought to reject the Brutal Answer to the Simple Question and the existence of simplicity along with it, I will now outline several reasons to deny the existence of simples.

2. Brutally Simple

In metaphysical analysis, certain notions require reductive explanation or all metaphysical concepts will need to be viewed as unanalyzable conceptual primitives. If a notion cannot be explained reductively, it must be taken as a conceptual primitive or eliminated altogether. These three strategies for dealing with concepts exhaust the alternatives for analysis and three 'stances' result: reductionism, primitivism, and eliminativism. In modal analysis, these three strategies are well represented: Lewis offers the primary reductive account of possible worlds, Quine takes the eliminativist stance, while all other accounts are, by default, primitivist in character.[27] In analyzing mereological composition, these stances are similarly represented, though demarcated less clearly. Nihilism, in denying that objects compose anything other than themselves, takes a radically reductionist stance.[28] Universalism and Organicism also endorse reductionism and attempt to reduce composition to logical (existence) and biological (participation in the life of an organism) concepts respectively.

[27] See Sider (MSb) for a discussion of these three stances and their relation to modality.

[28] There might be reason to deny that Nihilism is truly reductive. If one denies that there is any composition whatsoever, then one would likely deny that simples compose themselves. If this is the case, then Nihilism would indeed be an eliminativist stance towards composition. In what follows, I assume the account of Nihilism under discussion is the reductionist variety, according to which simples compose only themselves.

Brutalism, in conjunction with certain assumptions about brute facts, takes the primitivist stance, since the Brutalist makes no attempt to reduce the notion of composition.

An additional thesis required to ensure that the Brutalist is indeed a primitivist about composition is *The Brutality of Composition Facts* (BCF), which says "for any *x*s, if there is an object composed of the *x*s, then it is a brute fact that there is an object composed of the *x*s."[29] Markosian, the sole defender of Brutalism, endorses BCF, and according to the Brutalist who endorses BCF, there can be no explanation for when, if ever, composition takes place. And, as I will now argue, all Brutalists are committed to BCF.

A Brutalist about composition might be tempted to reject BCF and argue that their variety of Brutalism is, in fact, reductive. In doing so, they would be denying that facts about composition are "brute facts," which are defined by Markosian as follows: "F is a brute fact $=_{df}$ F is a fact, and it is not the case that F obtains in virtue of some other fact or facts."[30] This particular definition of "brute fact," which relies on the *in virtue of* relation, is, I think, required if Brutalism is to be endorsed without directly entailing BCF. This can be made clear in considering Markosian's remarks on the nature of brute facts:

> I wish I were in a position to give an analysis of the *in virtue of* relation, but I am not. I think it is fair to assume, however, that we have some rough idea of what that relation is. For the purposes of this paper, I will assume that there is such a relation, and I will take it to be unanalyzable.[31]

If one follows Markosian in employing the *in virtue of* relation to define brute facts, then an additional primitive, the *in virtue of* relation, must be adopted. Unlike Markosian, I do not have a sufficient understanding of the *in virtue of* relation, at least not to the degree that would make it a plausible conceptual primitive. And, if the *in virtue of* relation is to be taken

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[29] Markosian (1998b) p. 6.

[30] Ibid. p. 6.

[31] Ibid. p. 6

as a primitive in this instance, then the conceptual cost of endorsing Brutalism and BCF is a high one: commitment to two conceptual primitives (i.e., composition and the *in virtue of* relation). Given that Markosian's definition of brute facts requires an additional primitive, there is reason to attempt to define "brute fact" reductively.

Brute facts can, I think, be defined adequately and without an additional primitive in the form of the *Explanatory Definition of Brute Fact* (EDBF): F is a brute fact $=_{df}$ F is a fact, and it is not the case that F can be explained by some other fact or facts. As Markosian notes, the often pragmatic character of explanation might pose a problem for those who would rely on it to explicate metaphysical notions. If so, the challenge of reducing brute facts by employing the explanation relation rather than *in virtue of* relation will be difficult. But, despite this difficulty, it will not require a mysterious primitive notion and, for this reason, the EDBF should be more attractive than Markosian's more mysterious conception of brute facts.

Adopting the EDBF has consequences for Brutalism. As noted above, Brutalists could, according to Markosian's definition of brute facts, deny BCF and still endorse Brutalism. Such a denial would amount to the following account of composition: the *x*s compose an object *y* if and only if the *x*s are cited in a non-circular, non-finitely stateable answer to the Composition Question. Given Markosian's original definition of brute fact, the Brutalist who denies BCF would contend that this account is reductive, since the *x*s would compose object *y* *in virtue of* being cited in the non-circular, infinitely stateable answer to the Composition Question. But, having seen that Markosian's definition of brute fact requires a questionable, additional primitive, we ought to endorse the EDBF and, if one endorses the EDBF, the above account of composition is inadequate, since it employs the *in virtue of* relation instead of the *explanation* relation.

Given the EDBF, the Brutalist cannot plausibly deny BCF. This is because the explanation relation is (a) causal in character and (b) non-symmetric. I won't attempt to offer a reductive account of explanation here, but these criteria seem to be relatively uncontroversial necessary conditions for fact *x* to explain fact *y*. Consider the following example: I can explain the fact that I am human by making reference to the fact that my parents are human. I cannot, however, explain the fact that my parents are human by making reference to the fact that I am human. This is because my being human did not cause my parents to be human. Nor could these two facts explain each other. They bear an explanatory relation to one another that is necessarily non-symmetrical.

Given the EDBF, the fact that Brutalism entails BCF can be made evident when one considers the question: Do the *x*s compose an object *y* because they are cited in a non-circular, non-finitely stateable answer to the Composition Question; or are the *x*s cited in a non-circular, non-finitely stateable answer to the Composition Question because they compose an object *y*? The problem indicated by the intelligibility of this question is that, given the EDBF, the fact that the *x*s compose an object *y* and the fact that the *x*s are cited in a non-circular, infinitely stateable answer to the Composition Question do not bear a causal relation to one another. More importantly, there is no non-symmetric explanatory relation between the two. Each fact might be used in an attempt to explain the other fact equally well.[32] This is reason to think that, whatever relation obtains between these facts, it is not the explanation relation. As a result, Brutalism entails BCF because facts about composition

[32] To see why Universalism and Nihilism, unlike Brutalism, are genuinely reductive, consider whether the fact that object *x* is self-identical or the fact that *x* exists could explain why *x* composes something. It seems that, if Universalism or Nihilism were true, either account would be yield an explanation of why *x* composes something; however, unlike Brutalism, the Nihilist's and the Universalist's explanation is non-symmetrical. It is unintelligible to ask if the fact that *x* exists or the fact that *x* is self-identical explains the fact that *x* composes something; *x*'s existence and *x*'s being self-identical are prerequisites for *x* having any properties at all.

meet the criteria, specified by the EDBF, to qualify as brute facts: they cannot be explained by other facts.

The claim that Brutalism entails BCF is not problematic for Markosian, since he readily endorses BCF; however, the claim that Brutalism entails BCF will be unattractive to those who endorse the Brutal Answer to the Simple Question. This is because, if Brutalism entails BCF, then the Brutal Answer entails *The Brutality of Simplicity Facts* (BSF), which says that, for any object x, if x is a simple, then it is a brute fact that object x is a simple. In what follows I assume that this entailment holds and that one cannot endorse the Brutal Answer without endorsing BSF. As such, proponents of the Brutal Answer are committed to primitivism about simplicity.

Although adopting conceptual primitives should be avoided when possible, primitivism is not a *prima facie* objectionable stance. As a view of modality, it seems both plausible and defensible. But, as I will show, primitivism about simplicity, in the form of the Brutal Answer, is significantly less attractive than modal primitivism.

In the previous section, I established that there is no adequate and reductive account of simplicity and that those who endorse the existence of simples must also endorse the Brutal Answer to the Simple Question. The reasons outlined below are intended to motivate the rejection of the primitivism entailed by the Brutal Answer. If there is reason to abandon primitivism about simplicity, then the only remaining option is eliminativism about simple facts and there is good reason to find this eliminativist stance towards simplicity appealing.

2.1 Brutal Skepticism

If one endorses the Brutal Answer to the Simple Question (and the Brutal Answer entails BSF), then there are no non-mereological criteria for identifying which objects are

mereological simples. If there are no non-mereological criteria for determining when an object instantiates simplicity and mereological facts cannot be perceived, then there is no way to know if any given object is actually a simple. This problem is acknowledged by Markosian in his defense of Brutalism. He admits,

> Presumably what [the opponent of Brutalism] wants is for composition to be linked by systematic, general, (and illuminating) principles to some non-mereological concepts. And here I think that [Brutalists] must bite the bullet – we must admit that composition is not linked by any such principles to any non-mereological concepts."[33]

The proponents of the Brutal Answer also face these same problems.

Although the Brutal Answer could possibly coincide with all of our intuitions about simplicity, it is possible that objects we do not think are simples are, in fact, simples, according to the Brutal Answer. At any rate, no *a priori* knowledge is possible about whether any given object is simple, because knowledge about the mereological structure of the world would be dependent upon (a) knowledge about the contingent existence of various physical objects and (b) the axioms of mereology. Knowledge of (a) is *a posteriori* and there is good reasons to doubt that (b) is *a priori*.[34] Given that we cannot perceive or simply intuit mereological facts, the only way in which we could come to know that object x is a simple is if facts about simplicity were, in Markosian's words, "linked by systematic, general, (and illuminating) principles to some non-mereological concepts." This link between mereological facts and non-mereological facts is exactly what the Brutal Answer, in conjunction with BSF, denies, so knowledge of the instantiation of simplicity, given the Brutal Answer, is impossible.

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[33] Markosian (1998b) p. 35.

[34] If the axioms of mereology were *a priori*, they would presumably be exceptionless, but many have denied the truth of these axioms. An early case against the truth of the axioms of mereology is offered in Rescher (1955). Hossack (2000) also offers the following example, due to Moltman (1997), of the alleged failure of transitivity: "The page is part of the book, and the book is part of the library, yet the page is not part of the library" (p.423). Johnston (2002) also denies that the axioms of mereology are *a priori*.

2.2 Brutality and Utility

If the Brutal Answer entails the epistemological problems outlined above, then any attempt to provide a mereological analysis of material objects encounters serious difficulties. Suppose someone asks you to paint one part of a barn and you proceed by painting some area of the barn's surface. Presumably, you've accomplished your task; but, given the Brutal Answer, there is no way to know if you actually succeeded. This is because, according to the Brutal Answer, the barn might be a simple (in which case you haven't painted any parts, since you would need to paint the entire improper part to paint even one part) or it might be composed in one of countless different counterintuitive mereological configurations (in which case you might have painted many parts). It seems, then, that the Brutal Answer denies the tenability of inferences about parthood needed to make mereology theoretically or, in this case, practically useful.

If one supports the Brutal Answer, there is no way to know how many parts a barn has or what physical objects instantiate simplicity. As a result, if one says "The blue part of the painting is my favourite," the truth-value of the proposition expressed by this sentence, taken at face value, cannot be known, since the painting might or might not be a simple. If the painting is a simple, then it has no blue part. If there is, in fact, no blue part, then the proposition expressed by the above sentence. The problem the Brutal Answer poses for the analysis of our everyday discourse is significant. But the problem the Brutal Answer poses for applied mereological analysis is more severe.

If any mereological claim about any given object is subject to skepticism because of commitment to the Brutal Answer, then any attempt to provide an analysis of an object's physical structure will be in question. If this is the case, then all claims about objects changing parts over time can be doubted, because the world might in fact be one large

simple. This theoretical deficit should make the Brutal Answer an unattractive response to the Simple Question.

2.3 Brutality and Repugnance

The Brutal Answer, as indicated above, entails the existence of brute facts about when objects instantiate simplicity. Positing brute facts of this type is not something that should be taken lightly in ontology. Indeed, some find brute facts metaphysically repugnant. Horgan (1993) takes those who would posit such things to task:

> [A] good metaphysical theory or scientific theory should avoid positing a plethora of quite specific, disconnected, *sui generis*, compositional facts. Such facts would be ontological danglers; they would be metaphysically queer. Even though explanation must bottom out somewhere, it is just not credible – or even intelligible – that it should bottom out with specific compositional facts which themselves are utterly inexplainable and which do not conform to any systematic general principles. Rather, if one bunch of simples compose a genuine physical object, but another bunch of simples do not compose any genuine object, then there must be some reason why; it couldn't be that these two facts are themselves at the explanatory bedrock of being.[35]

Horgan's impassioned plea to reject Brutalism can, of course, be extended to the Brutal Answer. The Brutal Answer denies that there is an explanation for why object x is a simple and object y, a physical duplicate of x, is not. This is not only because the Brutal Answer entails BSF, but also because the Brutal Answer fails to determine whether a physical duplicate of a simple is, at another possible world, a composite object: it remains mysteriously neutral on this issue. Given the Brutal Answer's failure to conform to a systematic general principle about simplicity and its inability to determine the modal properties of simple objects, there is reason to be dissatisfied with it.

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[35] Horgan (1993) p. 695. This passage is also quoted in Markosian (2005).

Markosian, in discussing the tenability of Brutalism, offers three criteria that would justify the assertion that there are brute facts of a given type. Since the Brutal Answer entails brute facts about simplicity, there is reason to investigate whether simplicity satisfies Markosian's criteria. These criteria are the following: "(i) being [a concept that is] relatively easy to grasp on an intuitive level, (ii) being [a concept] such that there seem to be clear-cut cases of both instantiation and non-instantiation, and (iii) being [a concept] such that no account of what it is in virtue of which some *x*s instantiate that concept seem to be forthcoming."[36]

I am skeptical that simplicity meets any of the above criteria, apart from (iii). It might be the case that simplicity satisfies (i), but this is plausible only if one already has an intuitive grasp of the concept of parthood. There are, however, alternative ways to conceive of parthood that are incompatible with classical extensional mereology.[37] If the nature of parthood is open to dispute, then the nature of simplicity is similarly in doubt. So, unless classical extensional mereology can be shown to correctly capture the concept of parthood, it is debatable that simplicity satisfies (i).

I am also skeptical that simplicity satisfies (ii). It might be counterintuitive to think that objects held to be simple by the MaxCon Answer are indeed simple. But the MaxCon Answer is readily endorsed by some, just as the Point-Sized Answer is defended by others. Although there is reason to reject both of these as answers to the Simple Question, the mere fact that some find these views defensible is indicative of a considerable disparity between our respective intuitions about simplicity. I myself doubt that any object instantiates

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[36] Markosian (1998b) p. 30. I here use talk of concepts and properties not interchangeably, but with the assumption that the analysis of a concept will determine the instances in which a property corresponding to a given concept will be instantiated.

[37] Arguments have been offered elsewhere against the adequacy of classical extensional mereology. See Fine (1994, 1999), Johnston (2002), Levey (1997), Rescher (1955), van Fraassen (1995), and Horgan (1993).

simplicity;but, given the conceptual gulf between the denial that there are any simples and the plurality of objects held to be simple by defenders of the MaxCon Answer, it is, at best, unclear that the instantiation of simplicity is anything like a "clear-cut" matter.

The final criterion, (iii), is, I think, clearly satisfied. There is no reductive account of simplicity forthcoming; however, it does not follow from this that we must take simplicity to be a conceptual primitive. The fact that there is no reductive account of simplicity is equally compatible with endorsing eliminativism about simplicity; and, in light of the above discussion, it should be clear that there is little to be gained from endorsing primitivism over eliminativism.

The Brutal Answer provides no helpful answers to our questions about simplicity, and it is unclear whether the concept of simplicity satisfies the criteria required to justify positing brute facts about the instantiation of simplicity. For this reason, the Brutal Answer represents an attempt to sustain IMH and the posits of IMH (e.g., simples) without any of the utility mereological analysis provides. And, if adopted along with the Brutalism, the Brutal Answer makes many facts about material objects inexplicable and unknowable.

2.4 A Brutal Defence

One might defend the Brutal Answer by claiming that it is the only way to preserve talk about part and wholes, which is both ubiquitous and useful. The extent to which the Brutal Answer preserves this talk is severely limited. All talk of this kind is subject to skepticism once the Brutal Answer is adopted. If this is the case, then, if eliminativism can provide a plausible interpretation of parthood talk, this defence of primitivism fails. I will outline the eliminativist approach to simplicity in Chapter 4, but there is one further counter-objection available to the primitivist about simplicity. The advocate of the Brutal Answer might offer a

"good company" argument and claim that, if modal primitivism is a viable option, then primitivism about simplicity is similarly viable.

This objection fails, because the analogy between modality and simplicity cannot be supported. Modal concepts, unlike simplicity, can be plausibly viewed as primitive, since they draw on, not only intuitions about conceivability, but also on modal heuristics like Humean Recombination, which holds that any pattern of instantiation of fundamental properties or relations is possible.[38] Not only does simplicity lack an epistemological analogue to conceivability, but there is also no *a priori* heuristic like Humean Recombination to explain its instantiation. If simplicity is not reductively explained, its content is determined entirely by the axioms of mereology. But these axioms are not likely *a priori*, whereas at least some modal facts (i.e., those about impossibility) are plausibly thought to be *a priori*. For this reason, primitivism about simplicity cannot be made tenable by likening it to primitivism about modality.

The costs of endorsing the Brutal Answer are high, and the sole benefit seems to be its compatibility with IMH and the possibility of simples. If, however, there is nothing to be gained by endorsing primitivism about simplicity beyond these alleged benefits, then eliminativism ought to be taken seriously.

3. Epiphenomenal Simples

One argument offered by Nihilists against the existence of composite objects holds that, because things like umbrellas and gazebos lack causal powers, they do not exist. Composite objects are, according to this argument, epiphenomenal and, because of this, claims asserting

[38] See Sider (MSa) for discussion of Humean Recombination.

their existence are false.[39] According to the Nihilist, there exist no epiphenomena like umbrellas and gazebos; there exist only mereological simples, which exist in virtue of being causally efficacious. In order to offer this argument, the Nihilist must establish that composite objects lack causal powers. In addition, the premise that objects without causal powers do not exist is also required. Given these two premises, the Nihilist's argument can be formulated as follows:

(P1) Composite objects have no causal powers.

(P2) Objects that lack causal powers do not exist.

(C1) Composite objects do not exist. (from P1, P2)

(P2) is a significant ontological assertion, since it specifies that a necessary condition for existence is the possession of causal powers. One issue it therefore raises concerns the status of abstract objects like sets, possible worlds, and propositions: objects that some believe lack causal powers. Some realists about abstract objects will claim that these objects exist, despite lacking causal powers. Other realists will hold that (P2) doesn't deny the existence of abstracta, since abstracta do have causal powers.[40] Nominalists will deny the existence of any abstracta. For the time being, however, let us leave aside the implications (P2) has for abstract objects.

According to the Nihilist's argument, most of the everyday objects that we speak of do not exist. In their place, there exist only microphysical objects, which the Nihilist holds to be causally efficacious simples. These microphysical objects and their properties are constituents of the microphysical domain. This domain has a number of unique properties that the domain of macro-level objects (e.g., the domain including battleships, elephants, and

[39] Arguments against the existence of composition are outlined in Dorr (2002), Merricks (2001), and Unger (1979).

[40] See, for example, Caplan and Matheson (2004).

baseballs) does not. In particular, the microphysical domain is both nomologically complete and nomologically self-contained. Something is *nomologically complete* if and only if "all the facts about what the world is like, including the facts about the distribution of emergent properties and relations, are nomologically determined by [it],"[41] and something is *nomologically self-contained* if and only if all its "goings-on can in principle be given complete explanations in microphysical terms, to the extent that they can be explained at all."[42] If microphysics is both nomologically complete and nomologically self-contained, then everything about the world is explainable in terms of microphysical entities and the laws governing them. In other words, the thesis of *microphysical reductionism* is true. The truth of microphysical reductionism entails that macro-level objects, entities somehow distinct from their microphysical constituents, are epiphenomenal. And, given (P2), there are no epiphenomena.

The moral to be drawn from the argument against composite objects is twofold. First, we should be wary of positing objects that have no causal powers. The problematic character of these types of objects is most obvious when we consider counterfactual claims. In world w an umbrella exists; in a different world w^* there are only microphysical entities arranged exactly as those found in world w are, but there is no composite object that has all the parts the umbrella in world w does. Assume that microphysical reductionism is true: What is different about these two worlds? Nothing, aside from additional ontological commitment in w.[43] This indicates that the umbrella, as an object distinct from the arrangement of microphysical objects, is, along with any other macro-level objects,

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[41] Dorr (2002) p. 47.

[42] Ibid. p. 44.

[43] See Sidelle (2002) for a discussion of the indiscriminability of various mereological proposals. Given this indiscriminability, the further claim that the posits of various mereological theories are epiphenomenal should seem increasingly plausible.

ontologically gratuitous. Second, mereological properties are not causal. There is no physical difference between world *w* and world *w**. The mereological property *composing an umbrella* accomplishes nothing in world *w**. Therefore, the mereological properties in world *w** are epiphenomenal. And, as a result of (P2), we should deny the existence of such things.

3.1 Causation and Simplicity

It should be clear how an argument similar to that put forward by Nihilists can be offered against the mereological property of simplicity; however, there is an important difference to note. In the above argument against composite objects, a case is made against aardvarks, xylophones, and all other macro-level objects. To extend this argument into a denial of the existence of simples, some clarification is required. In rejecting the existence of composite objects, an argument can be made against one of two things: composite objects *or* the mereological property *being a composite.* One can argue that composite objects simply do not exist, *or* one can argue that, while the same configuration of matter and energy in spacetime is present, there is no mereological property possessed by microphysical entities of the type *composing* x. I hold that the latter argument, though different from the former, is equally effective. The virtue of this formulation of the Argument from Epiphenomenality is that it can be extended into an argument against the existence of simplicity with relative ease. This argument runs as follows:

(P3) Simplicity has no causal powers.

(P4) Properties that lack causal powers do not exist.

(C2) Simplicity does not exist. (from P3, P4)

The truth of (P3) can be inferred from the same features of the physical world that prompt us to reject the existence of composite entities, namely microphysics' nomological

self-containment and nomological completeness. All the properties of all the objects that determine the state of the world are microphysical in character. They are specifiable in microphysical terms and likely include properties like spin, mass, charge, etc. Noticeably absent from the class of properties invoked in a microphysical explanation for the state of the world is simplicity. There is nothing that having or lacking simplicity alters about the spin, mass, or any other property of microphysical objects.

With the apparent eliminability of simplicity from our best scientific theories in mind, a definition of a causally efficacious property can be provided in one of two ways. First, a causally efficacious property could be held to be any property quantified over in our best scientific theories. Call this *the Naturalist Criterion for Causal Efficacy.* Much like the Naturalist Criterion for Ontological Commitment (i.e., Quine's Criterion), the Naturalist Criterion for Causal Efficacy says that those properties posited by science are the only properties that we should hold to be causal.[44] In conjunction with (P4), the Naturalist Criterion allows commitment to only those properties posited by our best physical theories, which are present in our best scientific theories because of their explanatory power. In the context of our best scientific theories, this explanatory power amounts to causal power since, in the content of our best scientific theories, no posit is warranted if it does not provide a direct (e.g., a particle) or indirect (e.g., a constant) causal explanation of some phenomena. Simplicity, unlike particles or constants, is not a constituent of our best scientific theories; so, given the Naturalist Criterion, it is epiphenomenal.[45]

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[44] Quine's Criterion specifies that a necessary and sufficient condition for ontological commitment to an objectis is quantification over that object in an axiomatized formulation of our best scientific theory. For example, if object x is the value of a bound variable in the best axiomatization of microphysics, then x exists. See Quine (1980) for further discussion.

[45] One might object that the properties *being a gorilla* or *being a mountain* are constituents of our best physical theories. While these properties of course figure in scientific practice, the notion of "our best scientific theories" is intended to refer to the complete and reductive axiomatization of our physical theories. In such an

A criterion of this kind squares well with a view of physics as a method for discovering the fundamental properties of the world; however, the discrepancy between metaphysical posits (e.g., possible worlds) and the commitments of our scientific theories make this criterion one that is unlikely to warrant universal acceptance. For this reason, we can consider a more neutral criterion for causal efficacy and show that the epiphenomenality of simplicity is further confirmed.

Consider *the Counterfactual Criterion for Causal Efficacy*: if in world w object x possesses property F and in world w^* object x lacks property F, then, if there is no difference in the natural properties possessed by object x in world w and world w^* apart from the instantiation of F, then property F is causally inefficacious. Given either of these two criteria, simplicity is denied causal efficacy. Simplicity is not quantified over in our best scientific theories, nor does any natural property vary between w and w^*. Properties that are derivative of an object not instantiating simplicity (e.g., having n parts, having $n + 1$ parts, etc.) will vary, given the instantiation of simplicity, but such properties are non-natural.

3.2 The Case against Epiphenomena

The truth of (P4) is more difficult to establish than that of (P3) because of the challenge of proving the non-existence of causally impotent properties. Still, there are a number of considerations that count heavily against positing such things. The most prevalent objection to the existence of epiphenomena is that, if they do indeed exist, knowledge of them would be impossible. This is because, according to theories of knowledge that impose a causal constraint, all knowledge requires an appropriate causal connection between the knower and

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axiomatization, macro-level objects would either be eliminated, reduced (given that our most comprehensive explanation of the physical world would proceed from the micro-level upwards), or paraphrased away in terms of micro-level objects.

the object of knowledge.[46] If, for example, I bear no causal connection to abstract objects like sets or possible worlds, then there is no way to explain how I could acquire knowledge of these entities. Simplicity as an epiphenomenal property would, by parity of reasoning, be unknowable given such a causal constraint on knowledge.

Arguments based on so-called 'causal constraints' are generally considered to be the strongest motivation for positions, like nominalism, that deny the existence of epiphenomena and abstracta; however, there are several ways such arguments might be resisted in this case. The stipulated causal constraint could be outright rejected or, more importantly, knowledge of epiphenomena might be held to be somehow deducible.[47] The possibility of inferential knowledge of epiphenomenal simples is not, however, a viable defence for supporters of IMH.

Inferential knowledge of mereological facts (e.g., those involving simplicity) cannot be acquired in a way analogous to how some contend mathematical knowledge can be acquired. This is because mathematical knowledge is held to be necessary and derivable from the laws of logic or some *a priori* concepts. Mereological knowledge, including knowledge about simples, is not derivable from logic alone and cannot be derived from *a priori* concepts. It cannot be derived from the purely *a priori*, because the existence of any given mereological fact (e.g., the fact that object x is a simple) will be contingent upon, not only the axioms of mereology that are true at a given world, but also the fact that the physical world is such that object x exists. The existence of this physical object is, however, contingent, so it cannot be inferred from necessary truths.

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[46] See Benacerraf (1973) for an outline of the causal constraint on knowledge and the problem it poses for knowledge of abstracta and varieties of epiphenomena.

[47] See Balaguer (1998) for a discussion of how certain accounts of abstract objects allow for the possibility that deductive inference is sufficient to ensure knowledge that some claims about abstract objects are true.

A second argument that cautions against positing epiphenomena relies upon causal theories of reference.[48] According to these theories, in order to refer to an entity, an appropriate causal relation must obtain between an individual expressing a proposition about an object and the object that that proposition is about. If simplicity has no causal powers, no such relation can exist. As a result, discourse that purports to refer to simplicity in fact refers to something altogether different or, more plausibly, nothing at all. In any case, if the causal theory of reference is correct, then simplicity is not just an unknowable property; it is ineffable.

A further reason that counts against positing epiphenomena like simplicity has to do with questions of basic questions of economy. What reason could one have for positing the existence of properties that lack any causal powers? Epiphenomenalists about consciousness, unlike those who believe in simplicity, are able to circumvent these epistemic and linguistic problems on *a priori* grounds. They can claim that they have unmediated direct access to phenomenal consciousness.[49] There does not, however, seem to be a similar option available in affirming the existence of simplicity. All things considered, there seems to be no compelling reason to affirm the existence of epiphenomenal simples, but there are still two potential objections to consider.

Objection One: *Simplicity has causal power.* The denial of (P3) would entail the claim that simplicity, unlike composition, does indeed have some purchase in the physical world. In particular, simplicity might have the causal power to prevent any object that instantiates it from being physically divided into parts. There are two ways to contest this claim and thereby overturn this objection to (P3). If extended simples are possible, then clearly

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[48] See Burgess and Rosen (1997) for an outline of the problem causal theories of reference pose for abstracta.

[49] See, for example, Chalmers (1996) for discussion of the immediacy of conscious experience.

simplicity does not have the causal power to prevent objects that instantiate it from being divisible. This is because simples posited by the MaxCon Answer along with other extended simples would be divisible. A counter-objection of this sort is, however, of little interest to those who deny the possibility of extended simples.[50]

Consider then, Markosian's example of a bomb that cannot be divided. A bomb of this type is an example of an entity that is indivisible, though not because it possesses simplicity (a fact that those who deny the intelligibility of extended simples will agree upon), but rather because it is an intricately crafted device. If this is the case, then there are properties other than simplicity that give rise to indivisibility. Given that indivisibility does not, in the eyes of those who deny the existence of extended simples, require the instantiation of simplicity, there is no reason to maintain that the indivisibility of an object is contingent upon the instantiation of simplicity. Moreover, if any extended object can be divided without altering its intrinsic properties, then the only objects that could be indivisible are point-sized. But there is no reason to believe that point-sized objects are indivisible because they are simple (as shown earlier, being point-sized is not a sufficient condition for being simple); they are indivisible because they instantiate the natural property *being point-sized* and also fail to instantiate the natural property *being co-located.* Perhaps there is some other power that simplicity might confer upon an object; but, aside from indivisibility, it is difficult to conceive of what such a power could be.

One might, however, object to (P3) by claiming that a sufficient condition for an object to be epiphenomenal is for it to be gunky. So, if no object instantiates simplicity, then, according to the opponent of (P3) every object must be gunky and, therefore, without causal

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[50] Friends of extended simples include Simons (2004), Scala (2002), Parsons (MS), Markosian (1998a), McDaniel (2004), Sider (MSa).

powers.[51] To see that being gunky is not a sufficient condition for an object to be epiphenomenal, consider the following case: Object x instantiates the natural property *being point-sized* and has some other natural micro-physical properties (e.g., spin, charge, etc.). Object x is also gunky, despite being point-sized. Denying the possibility of point-sized gunk would, after all, require endorsing brute modal facts, which would be at odds with Humean Recombination. If object x instantiates the same natural properties as a point-sized simple object y, but, for some reason, unlike y, lacks causal powers, then it seems that a brute modal fact (i.e., that object x cannot engage in causal relations) is being posited. There is reason to reject the existence of the brute modal facts that would rob object x of its causal powers solely because it is gunky and, since Humean Recombination supports the possibility of point-sized gunk, there is reason to deny that being gunky is a sufficient condition for an object to lack causal powers.

Objection Two: *Properties with no causal powers exist.* Demonstrating that (P4) is false requires that a property lacking causal power be shown to exist. There are, it seems, three candidate types of properties that might accomplish this: properties already accepted into one's ontology that, upon further inspection, turn out to have no causal powers; properties of abstract objects; and phenomenal properties.

Consider first the case of phenomenal properties. Phenomenal properties are experiential in character. The redness of blood and the smell of napalm are, according to some, phenomenal properties, since they are part of conscious experience.[52] These properties are held by substance dualists, property dualists, and non-reductive physicalists to be distinct from physical properties. They are a part of the world over and above the world's purely

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[51] See Dorr (2002) p. 63, where Dorr argues that all objects would be epiphenomenal in a world where there are no simples.

[52] See Chalmers (1996) for a discussion of the nature of phenomenal properties.

physical properties. They are also, in some sense, thrust upon us. They are experienced, so we are directly aware of their existence. A problem with views of the mind that hold phenomenal properties to be distinct from purely physical properties is that of mental causation. If our consciousness is phenomenal and therefore distinct from the physical, how can our phenomenal properties effect change in material reality? More directly, how is it that our minds bring about actions in the world? There is, it seems, a serious challenge to be found in providing an answer to this question once the phenomenal-physical distinction is presupposed. This is largely because the physical world, microphysics in particular, is nomologically self-contained. Nevertheless, what of those who hold that phenomenal properties exist?

If it is true that phenomenal properties are causal efficacious, then (P4) stands: no epiphenomena have been posited in countenancing phenomenal properties. But, if phenomenal properties are causally impotent, then (P4) denies their existence. Denying the existence of phenomenal properties is by no means uncommon or entirely without justification, but a compromise would be preferable to a categorical rejection of dualism. To this end, we can amend (P4) in the following way: (P4*) Purportedly physical properties that have no causal power do not exist. This is adequate if only because phenomenal properties are defined by the very fact that they are not physical. Moreover, (P4*) also resolves the perceived difficulties in denying the existence of the properties of abstracta like the property of having members (possessed by sets), the property of being a rational number (possessed by integers), and the property of being expressed (possessed by propositions).

The remaining type of property that might provide a counter-example to (P4*) would be those properties endorsed by our scientific theories that, upon further inspection, lack causal powers. The only properties that might fall under this category are extrinsic

properties, but one need only look to counterfactuals to prove that extrinsic properties, particularly relational properties, satisfy the Counterfactual Criterion for Causal Efficacy. If object x has the property *being two feet left of y* at world w, then in any world w^* where x lacks this property there will be a different distribution of natural properties (e.g., spatial properties like *being located at L*), so something other than x's *being two feet left of y* will be different.

One might object that the above revision to (P4) is either *ad hoc* or contentious. I'm inclined to think that it is perhaps both, but not objectionably so. Left unrevised, (P4) is acceptable, not only to nominalists, but also to realists about abstract objects who hold that abstracta have causal powers. (P4) will, however, be unacceptable to realists who believe that abstracta lack causal powers or epiphenomenalists about consciousness. If there are abstract objects or phenomenal experience, there is, I think, good reason to believe they would have causal powers. The revision to (P4), in the form of (P4*), is, for this reason, a concession to epiphenomenalists or realists who will countenance inert abstracta. Those who find this revision objectionably *ad hoc*, they need only ignore it and endorse one of the many positions compatible with (P4). To those who find (P4) too contentious, I can only suggest that their conception of abstracta and phenomenality is both implausible and mysterious. Why, after all, would there be something that does nothing?

One might further object that an additional revision, one that preserves mereological commitments, is no more *ad hoc* than the above revision. I think this objection fails because mereological properties, unlike phenomenal or set-theoretic properties are not required to give a complete description of reality: they are not natural properties. So a revision that distinguishes phenomenal and set-theoretic properties from mereological properties can be independently justified.

3.3 The Revised Argument from Epiphenomenality

Having shown that objections to both premises can be managed via compromise or counter-objection, it would seem that the revised argument against simplicity stands:

(P3) Simplicity has no causal powers.

(P4*) Purportedly physical properties with no causal powers do not exist.

(P5) Simplicity is purportedly physical.

(C2) Simplicity does not exist. (from P3, P4*, P5)

Taken together with the Nihilist's argument against composite objects, the following stronger argument can be offered against all mereological properties:

(P6) Mereological properties have no causal powers.

(P7) Purportedly physical properties with no causal powers do not exist.

(P8) Mereological properties are purportedly physical.

(C3) Mereological properties do not exist. (from P6, P7, P8)

This conclusion entails the falsity of IMH, since it maintains that there are neither simples, given the non-existence of simplicity, nor gunk, given the non-existence of the property *composing x*.[53]

[53] According to some, the non-existence of composition would entail the non-existence of simplicity, given that some hold simples to compose themselves.

3

Gunk

"Hence, a homogenous continuum which admits of the sort of divisibility needed to realize the infinitely small is nowhere to be found in reality." — Hilbert

1. The Arguments for (and against) Gunk

If IMH is true and there are no mereological simples, then all objects must have proper parts, which in turn have proper parts themselves and so on *ad infinitum*. Such objects would be gunk. An object is gunk if and only if every part of that object has a proper part. Mereology is commonly thought to apply to at least two ontological categories: material objects and regions of space. For this reason, there are commonly thought to be two types of gunk: material gunk and spatial gunk. In this chapter I will be concerned only with the former. That said, there is an important relation between these two ontological categories and their alleged mereological structures.

It might be the case that, if spatial regions are atomic (i.e., consist of points that have no proper parts), then it is impossible for material objects to be gunky. Conversely, the existence of gunky spatial regions might preclude the possibility of atomic material objects. The interplay between the mereological composition of material objects and the mereology of the spatial regions they occupy is no simple matter. To some extent, the lack of consensus about the mereological relation between spatial regions and material objects is a function of the diversity of views about the ontological status of space and time.[54] My aim in this chapter is not to adjudicate these disputes. Instead, I will be concerned mainly with the issues surrounding gunky material objects and the arguments both for and against their existence.[55] I will first survey the arguments for the existence of gunk and then, after reviewing a recent argument against the existence of gunk, offer several additional arguments against gunk.[56]

1.1 The Inductive Argument for Gunk

The Inductive Argument for the existence of gunk is not a complicated one. At several points in the history and pre-history of physics, scientists have claimed that the fundamental level of physical reality has been identified. In each case, it has been conclusively shown that objects these scientists held to be constitutive of the fundamental level of physical reality are, in fact, not elements of the fundamental level. Given the possibility that this process of discovery could continue indefinitely as well as the assumption that the descending levels posited in physical theory can be analysed in mereological terms (e.g., atoms are composed

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[54] I have in mind here the dispute between substantivalist and relationist views of spacetime, which differ as to whether regions of space exist.

[55] Arguments for and against the existence of gunky regions of spacetime, rather than gunky material objects, can be found in Forrest (1996) and Arntzenius (MS).

[56] Hudson (2001) offers an argument against the existence of gunk, but since his argument relies on the claim that either the MaxCon Answer or the Point-Sized Answer is correct, I ignore it in what follows.

of protons, which are composed of quarks, which are composed of strings), the Inductive Argument for gunk can be offered. It is, roughly, as follows: we keep chopping up objects and finding more objects; therefore, objects can be chopped up *ad infinitum* and, because of this, objects are gunky. Schaffer (2003) offers the following version of the Inductive Argument for gunk:

> Indeed, the history of science is a history of finding ever-deeper structure. We have gone from "the elements" to "the atoms" (etymology is revealing), to the subatomic electrons, protons, and neutrons, to the zoo of "elementary particles," to think that the hadrons are built out of quarks, and now we hypothesize that the quarks are built out of preons (in order to explain why quarks come in families). Should one not expect the future to be like the past?[57]

Sider (1993) also offers an argument, intended to establish the mere possibility of gunk:

> Scientists discovered that hydrogen 'atoms' have proper parts. Then they discovered that protons have proper parts. At one point, at least, it was legitimate scientific hypothesis that this process could go on forever, that there is no end to the world's complexity. A metaphysical theory should not have the consequence that a legitimate scientific hypothesis is metaphysically impossible. So we ought to accept the possibility of material objects made of gunk.[58]

It should be evident that the Inductive Argument for the actual existence of gunk is less compelling than the argument for the mere possibility of gunk. The inductive case for the actual existence of gunk is, in fact, a very weak one, since the evidence the argument appropriates in supporting the conclusion that gunk exists can be explained without invoking gunk. Instead, reference to contingent facts about the history of physical science and the propensity of scientists, like philosophers, to make claims about the fundamental nature of the world can explain the evidence the Inductive Argument relies on.

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[57] Schaffer (2003) p. 503.

[58] Sider (1993) p. 287.

Given the complexity of the physical world and the comparatively short history of physics, it should not be surprising that we have yet to determine the fundamental character of the material universe. To infer, from our present rate of progress, that the discovery of fundamental physical entities is impossible is to exceed the hypotheses supported by the evidence. That said, the inductive argument for the possibility of gunk, in virtue of its more modest conclusion, is more difficult to undercut. Still, I will present my case against the possibility of gunk in Sections 2 and 3.

1.2 The Topological Argument for Gunk

In contrast to the Inductive Argument, Dean Zimmerman's argument for the existence of gunk relies on a family of related topological notions drawn from the prehistory of formal mereology and topology. By drawing upon three topological definitions, Zimmerman offers a transcendental argument for the existence of at least some gunk on the grounds that there is contact between material objects. The definitions he requires for deducing the necessity of gunk are the following:

> x is a closed object $=_{df}$ x is spatially located object; and for every y such that y is a part of x adjacent to a region which is not filled by a part of x, there is a set A of simple parts of y such that each member of A is adjacent both to regions filled by parts of x and regions not filled by any part of x.
>
> x is an open object $=_{df}$ x is a spatially located object; x has proper parts; and there is no set of simple parts of x such that each member is adjacent both to regions filled by parts of x and regions not filled by any part of x.[59]
>
> Contact: If two objects are in contact, then it is impossible for two distinct non-overlapping objects to be closer together than the two objects in question.[60]

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[59] Zimmerman (1996) p. 6.

[60] Ibid. p. 9.

Assuming the existence of contact, Zimmerman attempts to establish the existence of gunk by arguing that worlds populated by extended physical objects with (i) only closed surfaces, (ii) only open surfaces, (iii) only partially open surfaces, and (iv) a mixture of closed and open surfaces are all either impossible or entail the existence of gunk.[61] The remaining possibility that accounts for the existence of contact is the existence of open surfaces that are made up of at least some gunk.[62] Zimmerman says,

> Thus, if there are extended objects, they must have extended parts which (a) are infinitely divisible (since they are extended), but (b) cannot be identified without remainder with a sum of extended parts. Consequently, if there are extended objects, then they have at least some parts that satisfy David Lewis's description of a piece of 'atomless gunk'.[63]

Zimmerman's argument against the existence of (i) holds that, given a continuum of non-denumerably infinite spatial points, no two points can ever come into contact; there will always be some spatial magnitude, no matter how infinitesimal, preventing two points from being as close together as possible: "however hard you push two closed surfaces together, there will always be a three-dimensional region separating the simples on their skins."[64]

Zimmerman then offers several arguments against (ii). In particular, he indicates that, given the assumption that there are composite objects, there cannot be a world where objects have only open surfaces. He says,

> [T]he suggestion that all extended objects are open but also composed of simple parts remains utterly incredible. Consider a solid open sphere which,

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[61] A skin of simples would be a set of simple objects that occupy all and only the boundary points of the outermost region occupied by an object.

[62] Some have rejected most, if not all, of the presuppositions Zimmerman's argument requires. For example, Kline and Matheson (1987) indicate that contact (or "collision") can be explained without recourse to topology: "It is easy to imagine a mechanism for collisions whereby they occur as the result of some short or long-ranged force. Thus two objects could repel each other violently without touching, in the way that electrons repel each other. While this situation makes perfect sense, it is not a mechanistic one." (p. 510). Kline and Matheson also register concern with the open and closed distinction: "[W]e find the assertion that a physical object does not include its boundary to be completely mysterious, but this may only reflect our lack of imagination" (p. 513).

[63] Zimmerman (1996) p. 8.

[64] Ibid. p. 12.

> on the present view, consists of a collection of simple parts filling every plane and line running through its interior. Don't the simples filling the plane that separates the sphere's left and right halves form an object – a very thin film cutting the sphere in half? But then why is it impossible for the left hemisphere and this thin film to form a partially closed object?[65]

Zimmerman exhausts the final options, (iii) and (iv), by arguing that, according to these views, we would need to attribute strange repulsive powers to objects given their topological interactions. But, given that (iii) and (iv) require positing these strange repulsive powers, we should reject these remaining options. So, given that the above topological possibilities are exhausted, Zimmerman holds that open surfaces with a skin of gunk are required (he dubs this view 'Whiteheadian'): no distinct non-overlapping extended objects could be closer together than objects related by the Whiteheadian contact-relation, since no objects could have "distinct but coincident skins of simples."[66]

An objection offered in Sider (2000) against Zimmerman's argument provides sufficient reason to reject it as a proof of the existence of gunk. This objection holds that there is no reason to posit mysterious repellent forces that are necessarily keyed to the interactions between different objects. Instead, the strange topological interactions that Zimmerman believes take place in (iii) and (iv) are explicable in terms of the modal properties of material objects. There are worlds like (iii) and (iv); however, there are also worlds where material objects interpenetrate or repel because of non-topological properties. For this reason, we should reject Zimmerman's claim that (iii) and (iv) entail the existence of such forces; they are merely worlds that can be accounted for given Humean Recombination. As a result, we should deny that (iii) and (iv) are impossible. Following

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[65] Ibid. p. 16.

[66] Ibid. p. 13

Sider, McDaniel (2004) focuses upon Zimmerman's conception of material objects, which relies on the following claim:

> (Matter): Necessarily, if x and y are material objects, then it is not possible for x and y to exactly occupy the same region of space (at the same time).[67]

McDaniel's case against (Matter) rests on the familiar argument for the possibility of co-location offered earlier in Chapter 2. Given this argument, unless we hold there to be *de re* modal constraints on the motion of physical objects, thereby violating the Humean principle that denies necessary connections between distinct existences, we cannot explain why co-located objects are impossible. We ought to reject necessary connections between distinct existences, especially of this odd *de re* type; so, if Zimmerman's account of material objects requires such a connection, we ought to reject Zimmerman's account of material objects along with his account of contact. Because of the errant modal assumptions required to support the Topological Argument, as noted by Sider and McDaniel, this argument for the existence of gunk fails.[68]

1.3 The Super-Cutting Argument against Gunk

In Hawthorne and Weatherson (2004), the consequences of positing the existence of gunk are shown to extend beyond strictly mereological considerations. Given the existence of gunk and the truth of the three assumptions below, it follows that motion in the physical universe cannot be continuous:

> Conservation of Matter: No mereological sum of quantities of matter can be destroyed by any sequence of cuts (though it may be scattered).

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[67] See Zimmerman (1996) pp. 2-4.

[68] See also Mason (2000) for an earlier case against the Topological Argument.

> Occupation: If a quantity of matter occupies a point of space, then there is some volume, extended in all dimensions, to which that point belongs which that quantity of matter occupies.
>
> Super-cutting: The laws of the world permit super-cutting.[69]

Hawthorne and Weatherson offer a formal model for viewing the super-cutting of gunk that seems nomologically possible. Super-cutting is a supertask (i.e., an operation that requires an infinite number of actions to occur in a finite amount of time) that involves the division, in this case, of a piece of gunk an infinite number of times.

By dividing and then moving pieces of gunk in the course of a super-cutting that takes one second and requires only one inch of space, the gunk occupying a region S is shown to be both *dense* (such that "for any point *y* in S, and any distance *d*, there is another point *z* in S such that $[y\text{-}z] < d$"[70]) as well as *disconnected* (such that "for any two points *y* and *z* in S, there is an extended region *r* between *y* and *z* that is wholly unoccupied"[71]). These two features of gunk are, however, inconsistent. The density of the region requires that any open distance must be occupied by a point, but because the region is disconnected there must be unoccupied, open distances. In order to make consistent these two features, Hawthorne and Weatherson argue that all the pieces of gunk would have to "jump location at the limit"[72] and, in doing so, allow for a distribution of pieces compatible with both the denseness and disconnectedness of region S.

Facing the choice between denying continuity of motion or denying the existence of gunk, it would seem that some methodological considerations must be brought to bear.

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[69] Hawthorne and Weatherson (2004) p. 341.

[70] Ibid. p. 346.

[71] Ibid. p. 346.

[72] Ibid p. 347.

Consider, then, Lewis's remarks on the prospects for advocating revisionist theses in mathematics and set theory on purely philosophical grounds. He says,

> I'm moved to laughter at the thought of how presumptuous it would be to reject mathematics for philosophical reasons. How would you like the job of telling the mathematicians that they must change their ways, and abjure countless errors, now that philosophy has discovered that there are no classes?[73]

If Lewis is right that "philosophy is as shaky as can be,"[74] then the very idea of an advocate of gunk explaining to physicists that motion is not continuous seems absurd.

There is, however, at least one reason to doubt that the Super-Cutting Argument is sufficient grounds to deny the existence of all gunk: the possibility of point-sized gunk. If point-sized gunk is possible and point-sized objects are indivisible, then some gunk will not be super-cuttable. So the existence of gunk of the point-sized variety, unlike gunk located at more than one spatial point, does not obviously entail the denial that motion is continuous.

2. The Modal Arguments against Gunk

The case for the mere possibility of gunk is a strong one. Given that we seem able to conceive of an object being divided into parts and that we can conceive of this process being repeated indefinitely, it seems that we can conceive of gunk. The inference from the apparent conceivability of gunk to its possibility is, of course, contestable. Nevertheless, the conceivability of gunk provides enough evidence for most to affirm that gunk exists at some possible world. So, in order to establish the impossibility of gunk, despite its apparent conceivability, a contradiction must derived from the claim that gunk is indeed possible. In this section, I attempt to do exactly this.

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[73] Lewis (1991) p. 59.

[74] Ibid. p. 58.

2.1 The Gunk Reductio

The existence of gunk entails the existence of composition. Along with the existence of composition, the existence of gunk also entails the existence of an infinite number of objects all of which are composed by some other objects and all of which also compose themselves. Nihilism, which holds that objects compose only themselves, is incompatible with gunk because it rejects what I will call "plural composition." Plural composition occurs when there are some objects, the *x*s, that compose and object *y* and *y* is not identical to any of the *x*s. Because gunk entails plural composition, an argument against plural composition counts against the possibility of gunk.

In Chapter 2 (Section 3), the Nihilist's argument against plural composition based on the epiphenomenal character of composite objects was considered. If that argument holds, then there is no gunk; however, a further argument against plural composition can be offered, one that relies on the initial assumption that gunk is possible. This argument is parasitic on an argument offered in Sider (1993) against views of composition that are incompatible with the existence of gunk.

In "Van Inwagen and the Possibility of Gunk," Sider argues that Nihilism and Organicism entail the impossibility of gunk; but, according to Sider, there is good reason to think that gunk is possible, so Nihilism and other views of composition incompatible with gunk (GICs) are false.

(P1) If any GIC is true, then it is true at all possible worlds.

(P2) At any world where gunk exists, all GICs are false.

(P3) There is a possible world where gunk exists.

(C1) There is a possible world where all GICs are false. (from P2, P3)

(C2) All GICs are false. (from P1, C1)

If all GICs are false, then one of two positions is very likely to be true: Universalism or Brutalism. In Chapter 2 (Section 2), I argued that we ought to reject the Brutal Answer to the Simple Question. The same reasons that count against the Brutal Answer can also be extended to show that Brutalism, in conjunction with BCF, is an untenable position. Brutalism is void of utility, entails skepticism about material objects, and is metaphysically repugnant, so it should not be accepted as a view of simplicity or composition. If Brutalism is rejected, then the remaining view of composition available is Universalism. But there is also good reason to reject Universalism.

Not only is Universalism at odds with the Doctrine of the Mereological Circle, which is consistent only with primitivism or eliminativism about composition, it also entails both the existence of radically counterintuitive objects and the denial of uncontroversial possibilities. The former charge, that the objects entailed by Universalism offend our intuitions about objecthood, is a serious one, but it is not a decisive objection. The existence of an object that has Pluto, Billy Zane, and Peru as its parts is obviously a radical entity to countenance, but its intuitive oddness is a theoretical price some are willing to pay.

A further problem with Universalism, discussed in Comesãna (MS), which cannot be as easily dismissed, arises because, if Universalism is true, there is no possible world where there are only two things. Given that Universalism holds that for any objects, the xs, there is an object y such that the xs are parts of y, a world where there are only two objects, a and b, would also contain the fusion of a and b, a+b. Therefore, there is no world where there are only two things; nor would there be a world where there are only four things; nor would there be any world where there are anything other than 2^n-1 objects.[75] The claim that there is no world where only two things exist is, at the very least, a difficult one to accept. In fact, it

[75] See Eagle (MS) p. 3.

is difficult to imagine what would constitute a more uncontroversial modal claim than "There could be only two objects." Faced with the possibility of claiming that any world where there are anything other than 2^n-1 objects is impossible or rejecting Universalism, there is reason enough to deny Universalism.

If Universalism and Brutalism are false, then we ought to endorse eliminativism about composition. But, given the antecedent assumption that gunk is possible, the contradiction between the claim that there is no composition and the claim that there is necessarily some composition arises. The resultant *reductio* of the possibility of gunk can be formulated as follows:

(A1) (Assumption) There is a possible world where gunk exists.

(P1) If any GIC is true, then it is true at all possible worlds.

(P2) At any world where gunk exists, all GICs are false.

(C3) There is a possible world where all GICs are false. (from A1, P2)

(C4) All GICs are false. (from P1, C3)

(P4) If all GICs are false, then either Universalism or Brutalism is true.

(P5) Brutalism is false.

(P6) Universalism is false.

(C5) Not all GICs are false. (from P4, P5, P6)

(C6) There is no possible world where gunk exists. (from A1, C4, C5)

This *reductio* can be best resisted by denying the truth of either (P5) or (P6). If one is willing to accept the unappealing results entailed by denying (P6), then one can say that the argument is unsound and the possibility of gunk remains; however, denying (P6) would require rejecting the Doctrine of the Mereological Circle, which is incompatible with any reductivist account of composition. This result should, at the very least, make eliminativist

about gunk more appealing; however, there is still a second argument available to the eliminativist that does not rely on a refutation of Brutalism or Universalism.

2.2 The Inverse Modal Argument

The crux of Sider's argument against GICs is the modal status of mereological claims about composition and fundamentality. Given that Sider holds that the modal status of these claims varies, a distinction between two types of mereological laws is needed. *Composition laws* determine the conditions under which composition occurs; therefore, any answer to the Composition Question purports to offer a composition law. *Fundamentality laws* are exhausted by laws that posit mereological atomicity (simples), atomlessness (gunk), or a combination of both simples and gunk. There are, given this distinction, four ways the modal status of these two types of laws might be viewed (let 'C' indicate contingency and 'N' indicate necessity).

(A)	(B)	(C)	(D)
N-Composition Laws	N-Composition Laws	C-Composition Laws	C-Composition Laws
N-Fundamentality Laws	C-Fundamentality Laws	C-Fundamentality Laws	N-Fundamentality Laws

Sider's argument requires that composition laws are necessary, which is compatible with either the (A) view or the (B) view; however, the (A) view would entail that either atomicity or atomlessness is impossible, but Sider claims atomlessness is a legitimate scientific hypothesis. And, if gunk is a legitimate hypothesis, it would seem atomicity is as well. Therefore, the (A) view would entail that a legitimate scientific hypotheses is metaphysically impossible: a conclusion Sider is opposed to. As such, there is good reason to think he is committed to the (B) view.[76] If this is the case, then composition laws are,

[76] See Sider (1993) p. 287.

according to Sider, necessary, while fundamentality laws are contingent. With these modal mereological claims as premises, the impossibility of the GICs can be deduced; however, there is reason to be skeptical about the soundness of Sider's argument. Consider the above views of the modality of the mereological laws individually.

The (A) View: If the (A) view is correct, then Sider's argument is not a particularly interesting case for the falsity of the GICs. Sider would, given the (A) view, merely be claiming that gunk necessarily exists; therefore, all GICs are false. But this argument falls short of being compelling, since Sider fails to provide reason to commit to anything more than the contingent existence of gunk.

The (B) View: If the (B) view, which Sider seems to endorse, is correct and the existence of gunk is contingent, then Sider's argument is both sound and interesting.

The (C) View: If the (C) view is correct, then Sider's argument is unsound, since the GICs need not be true at all possible worlds. Moreover, if the (C) view is true, then no interesting modal mereological arguments are possible.

The (D) View: The (D) view is an interesting view of the modal status of the mereological laws. It is also the inverse of the (B) view defended by Sider. If the (D) view is correct, then an argument against gunk can be formulated, an argument that parallels the argument Sider gives against GICs. This argument runs as follows:

(P7) If atomlessness is true, then it is true at all possible worlds.

(P8) At any world where Nihilism is true, atomlessness is false.

(P9) There is a possible world where Nihilism is true.

(C7) There is a possible world where atomlessness is false. (from P8, P9)

(C8) Atomlessness is false. (from P7, C7)

This argument entails that there is no gunk. But, if it is to be a defensible argument against the existence of gunk, then a defence of the (D) view of the modality of mereological laws is required. The reasons for endorsing the (D) view can be outlined by answering two distinct questions: Why are composition laws contingent? And why are fundamentality laws necessary?

Why might composition laws be contingent? Lewis denies that objects necessarily perdure or endure. At the far reaches of the multiverse, the metaphysics of material objects are entirely different from the metaphysics of material objects at our actual world. That objects do not necessarily perdure or endure casts some doubt upon the necessity of other claims about the metaphysics of material objects. In particular, it seems to be a defensible view that Organicism is true only at outer worlds, while some other view of composition is true in worlds (non-spatially) closer to home. If so, then the (C) view or the (D) view, which both make composition laws contingent, are not implausible ontological views.

Why are fundamentality laws necessary? Because at least some ontological categories are necessarily atomic or atomless. In particular, the ontological category of sets, if there are such things, is necessarily atomic. There are no gunky sets. A set is either a singleton or a fusion of singletons. In either case, if it has proper parts, those proper parts do not all have proper parts; therefore, it is impossible for sets to be gunky. This seems to be an essential feature of the ontological category of sets. The same seems to hold true for propositions, if there are any.[77] One could have a vastly complex proposition, but it would nevertheless have constituents that are necessarily atomic. If fundamentality laws obtain necessarily in the case

[77] Mereological extensionality would seem to fail if propositions are composed mereologically, since different propositions may have the same constituents; however, propositions might have their structure as a part in the way that some hold objects to have the time at which they exist as a part. See Rosen and Dorr (2002) for discussion.

of some ontological categories, there is good reason to think that the ontological category of material object is also governed by a necessary fundamentality law.[78]

If these reasons are sufficient to entice one to adopt the (D) view, then the above argument for the impossibility of gunk should be a compelling one. Adopting the (D) view has not here been shown to be an inevitable result of analyzing the modality of mereology, but it should be clear that there is room for dissent about the modal status of the laws of mereology. And, if the (D) view is correct, then there is no gunk at any world.

3. The Set-Theoretic Argument against Gunk

A third argument against the existence of gunk emerges when the possible varieties of gunk are considered. Given antecedent commitment to the possibility of gunk, there is no clear and principled reason to deny further gunky commitments that clash directly with otherwise attractive set-theoretic and metaphysical commitments. This is particularly unappealing given the defensible thesis that mathematics is ultimately reducible to set theory. To see how this direct conflict between mereology and set theory arises, two theses are required. One is mereological; the other is set-theoretic.

3.1 Hypergunk

(HG) Hypergunk is possible.

HG is a modal mereological claim about the possible composition of the world. It says that there is a possible world that is, not only non-atomic, but also massively gunky. An object is

[78] One might object that, given results in non-well-founded set theory, sets can, in fact, be gunky; however, if non-well-founded sets exist, then, given the failure of the Foundation Axiom, a set can have itself as a subset. If so, the subset relation would not be anti-symmetric and, *pace* Lewis (1991), it could be proven that sets are not be composed mereologically.

hypergunk when "it is atomless, and whenever there are some of its parts there are some others of its parts such that there are more of the second than there are of the first."[79] That is, "something is hypergunk iff it is atomless, and for every set S containing only parts of it there is another set S´ containing only parts of it which has a subset whose members are equinumerous with the members of S, but S' is not itself equinumerous with S."[80]

Although a mereological definition of hypergunk is unproblematic, hypergunk has a number of interesting ontological consequences solely because it entails the existence of such a massive number of individuals. As Daniel Nolan has shown, a consequence of hypergunk's sheer size rules out a number of views about the nature of possible worlds.[81] If a world is held to be a set of propositions, then hypergunk cannot exist at any possible world. This is because

> Hypergunk is gunk such that for any set of its parts, there is a set of strictly greater cardinality of its parts. There would thus be too many pieces of hypergunk to form a set – for any sized set, there would be enough pieces of hypergunk to make up a larger set.[82]

If possible worlds are sets of propositions, no world could be one at which there is hypergunk. For there would be no set large enough to include all the propositions required to express the existence of a piece of hypergunk: <part$_n$ of piece of hypergunk *x*, *existence*>; <part$_{n+1}$ of piece of hypergunk *x*, *existence*>; and so forth. Defenders of theories of modality that hold worlds to be sets of propositions might claim that hypergunk is, for this reason, impossible. To claim that hypergunk is impossible on the grounds that its existence is inexpressible given certain views about possible worlds is, however, an inadequate case

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[79] Nolan (2004) p. 307.

[80] Ibid. p. 306.

[81] Ibid. p. 308.

[82] Ibid. p. 305.

against hypergunk. In order to show hypergunk to be impossible, some account of why an object that has such an immense cardinality of parts is impossible is required.

There are a number of ways one might motivate the rejection of HG, but most of them rely entirely on antecedent commitments to other ontological views (e.g., those about possible worlds) and, for this reason, fall short of convincing. One might, however, attempt to prove hypergunk impossible through an argument like the following:

(P13) No point-sized object has proper parts.

(P14) Hypergunk has a strongly inaccessible number of proper parts.

(C11) Any piece of hypergunk has a strongly inaccessible number of non-point-sized parts. (from P13, P14)

(P15) All objects that are not point-sized are extended.

(P16) All extended objects are located at more than one spacetime point.

(C12) A piece of hypergunk must be located at more than a strongly inaccessible number of spacetime points (from C11, P15, P16)

(P17) There cannot be a strongly inaccessible number of spacetime points.

(C13) There cannot be hypergunk. (from C12, P17)

This argument holds that, because the massive number of parts of hypergunk have further parts and something can have parts only if it is extended, any piece of hypergunk must be located at a strongly inaccessible number of spacetime points. The number of spacetime points in the world, given certain assumptions about location and cardinality, cannot be strongly inaccessible in number; therefore, there cannot be any hypergunk, since it is too big to exist in spacetime.

As formulated, this argument seems to beg the question against at least one variety of hypergunk, since it assumes that hypergunky spacetime is impossible. Regardless, the

point of the argument is to draw out a more fundamental concern that actually provides evidence for the possibility of hypergunk, if mere gunk is held to be possible. If the modal principle of Humean Recombination entails that any way to instantiate a fundamental relation is possible, then the occupation relation that obtains between objects and locations can be recombined to allow for the possibility of co-located point-sized objects and further extended to allow for point-sized hypergunk.[83] In fact, in order to preclude the possibility of the extreme co-location required for hypergunk, one would have to endorse a necessary connection between distinct existences. With this high cost of denying HG in mind, it seems we ought to accept the possibility of hypergunk.

3.2 Urelement

(Urelement) $(\exists x)(\text{Set}(x) \wedge (\forall y)(\neg\text{Set}(y) \rightarrow y \in x))$

Urelement is a posit of our best mathematical and metaphysical theories. It is not only required for a robust account of strongly inaccessible cardinals in second-order ZFC; it also ensures the existence of a set of all individuals, which is required if we hope to make ontological claims intended to apply to all individuals with perfect generality. Urelement is also necessary to ensure the categoricity of second-order ZFC. Without categoricity, the truth-value of the claims about strongly inaccessible cardinals vary across models of ZFC and, as a result, the results of set-theoretic investigations into their properties are indeterminate.[84] In light of the work that Urelement does in set theory and metaphysics, there is good reason to adopt it. McGee extols the virtues of Urelement as follows:

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[83] See Sider (MSa) for discussion.

[84] Following Uzquiano (forthcoming), "A cardinal K is strongly inaccessible just in case: (i) K is not denumerable. (ii) For any $\lambda < K$, $2^{\lambda} < K$, and (iii) K cannot be represented as the supremum of fewer than K smaller ordinals. In sum, K cannot be reached from lower cardinalities through applications of the operations used in (ii) and (iii)."

> We need the Urelement Set Axiom to ensure that there is such a set as U_o [the set of all urelements]. Once we have U_o, the axioms of ZFCU will guarantee the existence of the other U_αs [any subset of the set of all urelements]... Without the [Urelement] axiom, we should have no reason to suppose that U_o exists, so no reason to suppose that any of the U_αs exist. The whole construction never gets off the ground.[85]

> There are two ways of motivating the Urelement Set Axiom, one from the bottom up, as a picture of how the universe of set theory is built up, the other from the top down. Models in which we clip off the construction of the universe at the first inaccessible, either by treating erstwhile large sets as *urelemente* or by excluding them from the universe of set-theoretic discourse, are unintended models, we want to say, because the intended models of set theory are ones in which the universe of pure sets is as a large as possible.[86]

To show that HG and Urelement are incompatible, imagine a world where there exists a piece of hypergunk. At this world, if we adopt Urelement, then there is a set of all individuals; however, if we know anything about hypergunk, we know the following: "There would thus be too many pieces of hypergunk to form a set – for any sized set, there would be enough pieces of hypergunk to make up a larger set."[87] As a consequence, there can be no U_o that has all individuals at that world as members; therefore, Urelement is inconsistent with the existence of hypergunk.[88] Barring the relativization of set-theoretic axioms to worlds, there seem to be two options available for resolving the tension between HG and Urelement: (TMS) take mereology seriously and deny Urelement; (TSTS) take set theory seriously and deny HG.

There is some reason to think that TSTS is an attractive strategy; HG has disastrous consequences for certain views about possible worlds, propositions, and properties.[89] Still, if

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[85] McGee (1997) p. 52.

[86] Ibid. p. 53.

[87] Nolan (2004) p. 305.

[88] Thanks to Gabriel Uzquiano for his very helpful discussion of this point.

[89] A strategy not considered here is outlined in Hazen (2004) where Hazen details ZFSU set theory, which ensures that the set of all urelements is not a proper class. As such, hypergunk is held by Hazen to be

hypergunk is indeed impossible, an independent proof of its impossibility is needed. Such a proof is absent and an *ad hoc* division between commitment to gunk and hypergunk would be *prima facie* objectionable. Because this division is both *ad hoc* and not supported by substantive argument, a dilemma arises: If gunk is possible, then HG is true; if HG is true, then Urelement is not necessarily true, but Urelement is necessarily true (or, at least a very attractive set-theoretic axiom and metaphysical posit). So, to preserve Urelement, one need only adopt TSTS and deny the possibility of gunk.

There is already sufficient reason to think gunk is highly suspect; so, by endorsing TSTS, set theory goes unmutilated and, by denying the existence of gunk (and HG with it), TSTS is available without being adopted in a demonstrably *ad hoc* fashion. This is a desirable result: it preserves our commitments to set theory and provides further evidence that IMH is not a serviceable hypothesis.

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impossible on set-theoretic terms. Conveniently, this preserves Hazen's account of possible worlds as sets of propositions.

4

Mereological Fictionalism

"An aggregate is nothing other than all those things from which it results taken at the same time, which really have their unity only from a mind, on account of those things which they have in common, like a flock of sheep." — Leibniz

1. Fictionalisms

In the previous chapters, I have argued that, because there are neither simples nor gunk, IMH is false. But, if IMH is indeed false, then something more needs to be said about quantification and ontological commitment. This is because disputes over the Composition Question and the Simple Question are commonly viewed as disputes over what things exist. As different answers to the Composition Question and the Simple Question make different claims about what physical objects exist, the position that I have defended, which rejects all answers to the Composition Question and the Simple Question, must offer an account of what physical objects there are and how to interpret discourse about them.

There are several ways in which an account that rejects IMH might be developed. One possible account, which I outline in this chapter, attempts to explain quantification over and discourse about physical objects by holding claims about mereological posits to be true only in fiction.[90]

This fictionalist account entails that existential claims about simples and composite objects are true only in fiction. In contrast to these truths of fiction, some existential claims must be held to be true *simpliciter*. To distinguish between those claims that are true in fiction and those claims that are true *simpliciter*, a distinction must first be drawn between those objects quantified over in various theories and those objects we are, in fact, ontologically committed to (i.e., those objects that exist *simpliciter*). The particular distinction between quantification and ontological commitment I will adopt is outlined in Azzouni (2004) and hinges on what Azzouni calls 'The Separation Thesis'. The Separation Thesis denies that objects that are quantified over in axiomatized scientific theories are the objects whose existence we are committed to. Azzouni clarifies the Separation Thesis as follows:

> When we regiment a scientific theory, or indeed, our entire conceptual scheme, we will still (say) use Tarskian semantics with what have come to be called 'objectual' quantifiers (we are *not* considering the various technical moves that, in the past, have been such an important part of the strategy to avoid ontological commitments, e.g., substitutional quantification). However, the existential and universal quantifiers, in neither the object language, nor the metalanguage, will be taken to have ontic force. Rather, that force will be carried by an 'existence' predicate, namely 'physically real', which we may imagine to arise in both languages. In other words, the Tarskian formalism is adopted, but without the standard ontological interpretation that usually accompanies it. This move is perfectly cogent, since the first-order apparatus of an object language, even when connected to a metalanguage which 'gives'

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[90] There are many available alternatives. One might adopt a non-mereological mode of composition, following Armstrong (1997). One could rely on a "feature-placing language" that avoids ontological commitment, following O'Leary-Hawthorne and Cortens (1995). One could eschew fictionalism for something like the conventionalism defended in Heller (1990). Or adopt an "indifferentist" approach to claims about simples and composites. Indifferentism, as an ontological stance, is outlined in Eklund (forthcoming). Another alternative is outlined in Sidelle (2002).

> it its semantics, does not wear its ontological interpretation anywhere on its logical sleeves.[91]

The Separation Thesis is highly useful for formulating a comprehensive mereological fictionalism, although it is not strictly necessary.[92] But, given the Separation Thesis, objects might be commitments of our scientific and semantic discourse, while, *pace* Quine's Criterion, still being outside of the domain of ontological commitment (OC). If an object is not included in the OC, then it can exist only in fiction. The distinction between existential quantification and ontological commitment the Separation Thesis entails is a controversial one and it raises at least one important question: What is it that we are ontologically committed to, if not those things quantified over in our best scientific theory? The most plausible answer, and the one that I will endorse, is that the objects and properties that constitute the Humean mosaic posited by Lewis in the form of the Humean Supervenience Base (HS-base) are the objects to which we are ontologically committed. Lewis describes Humean Supervenience and its ontological commitments as follows:

> [Humean Supervenience] says that in a world like ours, the fundamental relations are exactly the spatiotemporal relations: distance relations, both spacelike and timelike, and perhaps also occupancy relations between point-sized things and spacetime points. And it says that in a world like ours, the fundamental properties are local qualities: perfectly natural intrinsic properties of points, or of point-sized occupants of points. Therefore it says that all else supervenes on the spatiotemporal arrangement of local qualities throughout all of history, past and present and future.[93]

> [Humean Supervenience] is the doctrine that all there is to the world is a vast mosaic of local matters of particular fact, just one little thing and then another ... We have geometry: a system of external relations of spatio-temporal distances between points ... And at those points we have local qualities: perfectly natural intrinsic properties which need nothing bigger than a point at which to be instantiated. For short, we have an arrangement of

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[91] Azzouni (1997) p. 206. See Azzouni (2004) for further discussion of the Separation Thesis.

[92] One might, for example, hold fictional characters to exist *simpliciter* and then simply quantify over fictional composite objects.

[93] Lewis (1994) p. 474.

> qualities. And that is all. There is no difference without difference in the arrangement of qualities. All else supervenes on that.[94]

Among the objects quantified over in our various theories but denied anything more than *existence in fiction* are simples, composite objects, and the other posits of mereology, all of which are noticeably absent from the above formulation of Humean Supervenience. So, according to the fictionalist who endorses this position, objects quantified over in scientific theory but distinct from the elements of the HS-base do not fall within the OC.[95]

In holding the OC to be so minimal and by denying the existence of macroscopic objects, a fictionalist position of this sort runs the risk of being mistaken for Nihilism; however, conflating these two views requires seriously misconceiving of either fictionalism or Nihilism. By denying IMH, the fictionalist denies the existence of composite objects *and* mereological simples. And, while some Nihilists might hold the constituents of the HS-base to be simples, any correspondence between the ontological commitments of the Nihilist and the commitments of the fictionalist is coincidental. This is because what determines the OC of the fictionalist is a strictly non-mereological criterion. While the Nihilist holds x to exist if and only if x is a simple, the fictionalist denies that simplicity is a necessary or sufficient condition for inclusion in the OC. Moreover, the fictionalist denies the existence of simples altogether and thereby rejects the existence of the only physical objects Nihilists are committed to.

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[94] Lewis (1986) p. ix.

[95] Schaffer (2003) comments indirectly on the compatibility of rejecting IMH and endorsing fundamentality as follows: "[T]he fundamentalist might maintain that, while there is no evidence for mereological atoms, there may yet be evidence for something else. I think that there is one particularly interesting form of this retreat, on which this 'something else' is a fundamental supervenience base…The disassociation between the mereological and supervenience hierarchies involved in this maneuver violates the fundamentalist assumption that these connotations of 'levels' comport. Nevertheless, the view is perfectly consistent (although I know of no one who has explicitly advocated it)" (p. 509).

The mereological fictionalism being developed here should also be explicitly distinguished from the compositional fictionalism outlined in Rosen and Dorr (2002). Compositional fictionalism holds that composite objects, a subset of the possible commitments entailed by IMH, do not exist. In this way, compositional fictionalism is a variety of Nihilism, since it maintains that, strictly speaking, only simples exist. The compositional fictionalist and mereological fictionalist positions differ because the compositional fictionalist affirms the existence of mereological simples and therefore the truth of IMH, while mereological fictionalism denies, not only the existence of simples, but also the truth of IMH.

2. How to be a Fictionalist

Fictionalism is a relatively novel development in ontology. Those who endorse fictionalism, in any of its forms, hold that it can explain discourse about certain objects while avoiding ontological commitment to these very objects. This is an appealing option for those who reject the existence of abstract objects like numbers and possible worlds but think that talk of such things is not meaningless. Because things like mathematical objects and possible worlds are markedly different from objects populating the physical world, fictionalist accounts of mathematics and modality allow philosophers to continue using mathematical and modal concepts without commiting to the existence of things like numbers and possible worlds.

To establish that fictionalism about an ontological category is a plausible position, two things are required. First, a case must be made against the existence of the class of objects that one hopes to be a fictionalist about. Second, it must be shown that a fictionalist account can support the theoretical commitments that a non-fictionalist account would

(apart from ontological commitment to the objects one hopes to be a fictionalist about). For example, the most notable formulation of fictionalism, developed in Field (1980), holds that we ought to consider mathematical claims to be akin to fictional claims. Field's case against mathematical objects hinges on the typically nominalist claim that we cannot acquire knowledge of abstract objects, because abstract objects, unlike humans, exist outside of space and time. The resulting problem of explaining how a human could interact with an abstract object and thereby come to have knowledge of it constitutes, for Field, adequate justification to reject the existence of mathematical objects.

Having provided a case against the existence of mathematical objects, Field then provides a criterion for determining which mathematical fictions are "good" (i.e., why the fiction of standard arithmetic is preferable to some other mathematical fiction). This criterion relies on the claim that mathematics is 'conservative'; that is, no assertions (other than those about mathematical objects) entailed by it are dependent upon the actual existence of mathematical objects. Field's resulting position holds that

> A mathematical theory needn't be true to be good; and, indeed, if it were true, this wouldn't be enough for it to be good, for a good mathematical theory must have a property that might be called strong consistency or conservativeness and that doesn't follow from truth alone. To say that a mathematical theory M is strongly consistent is to say roughly that if you take any theory T that says nothing about mathematical entities, and add T to M, then if T is consistent, so is T + M.[96]

In defending fictionalism, Field shows how a fictionalist view of mathematics can support mathematical discourse and scientific practice while arguing that the actual existence of mathematical objects is dispensable to scientific theory.

Issues regarding the indispensability of mathematical objects to scientific theory are, in fact, central to Field's fictionalist programme. This is because, given Quine's Criterion, an

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[96] Field (1984) p. 529.

object falls within the OC only if it is quantified over in our best scientific theory. If Quine's Criterion were adopted, Field's mathematical fictionalism would be tenable only if mathematical objects are not quantified over in our best scientific theories.

While the question of whether Field satisfactorily establishes the dispensability of mathematical objects is not yet settled, his strategy for accommodating the non-existence of mathematical objects is only one of several.[97] Field attempts to avoid commitment to mathematical posits by denying that Quine's Criterion is satisfied by mathematical objects; however, another strategy for defending nominalism is premised upon the rejection of Quine's Criterion.

Azzouni, unlike Field, clearly rejects Quine's Criterion and defends the view that ontological commitment and quantification come apart in such a way as to avoid commitment to some of the objects one quantifies over. This is the Separation Thesis considered earlier. It is the latter strategy, advocated by Azzouni, that is of immediate and greater use to the mereological fictionalist. While Field's strategy removes mathematical objects from the scope of our unrestricted quantifier, Azzouni's strategy allows for quantification over objects that we are not ontologically committed to. In this way, Azzouni's strategy can accommodate unrestricted quantification over mereological posits that are denied existence *simpliciter*. This utility seems reason enough to pursue Azzouni's strategy rather than Field's.

A central point to note is that any fictionalist project consists of two stages: a case against the truth of propositions about a class of entities and then an outline for how truth in fiction can play the role of truth *simpliciter* without leaving discourse about a class of objects

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[97] See Malament (1982) and Shapiro (1989) for arguments against Field's claim that quantification over mathematical objects is actually dispensable in our best physical theories.

impoverished. The distinction between these two stages is perhaps most apparent in the case of modal fictionalism.

Modal fictionalism, developed by Rosen (1990), holds that possible worlds, the entities involved in modal discourse, exist only as creatures of fiction. Specifically, truths about possible worlds are true only in the fiction of another theory of modality: namely, Lewis's modal realism. As a result, Rosen's fictionalism amounts to the following interpretation of modal discourse:

> Let *P* be an abitrary modal proposition. The modal realist will have ready a non-modal paraphrase of *P* in the language of possible worlds; call it *P**. The realist's assertions about possible worlds are guided by explicit adherence to the schema *P* iff *P**. The fictionalist's parasitic proposal is therefore to assert every instance of the schema: *P* iff according to the hypothesis of the plurality of worlds, *P**.[98]

This is a striking interpretation of modality. It affirms that an alternate account of possible worlds adequately captures the general character of modality; but, by treating Lewis's modal realism ("the hypothesis of the plurality of worlds") as a useful fiction, modal fictionalism avoids its extreme ontological commitments.

The motivation for fictionalism about possible worlds is largely a product of the ontological dispute over how possible worlds can be plausibly held to exist. Lewis's modal realism, which holds that an infinite number of worlds are as concrete as our own, is rejected by many on the grounds of *prima facie* implausibility; however, Lewis and others have provided good reason to reject many other compelling views of possible worlds. Rosen, in defending fictionalism, bypasses these problems by disavowing commitment to possible worlds as objects while still retaining the richness of modal discourse. The constructive component of Rosen's fictionalism consists, for the most part, in asserting that an interpretation of modal discourse is made possible by simply asserting the following

[98] Rosen (1990) p. 338.

biconditional: x (an arbitrary modal claim) is true if and only if according to modal realism the parallel claim x^* (x paraphrased in terms of the hypothesis of the plurality of worlds) is true.

In considering Rosen's fictionalism, an important question arises: Why is the modal realist fiction superior to alternative modal fictions? Field, in offering a fictionalist account of mathematics, endorses certain mathematical fictions (e.g., standard arithmetic) because of their conservativeness; however, in dealing with the nature of possible worlds, criteria like conservativeness are more difficult to employ. In the case of possible worlds, the criteria that seem relevant and sufficient for sustaining one fiction over other fictions, provided they all satisfy the basic criteria required for possible world semantics (e.g., a possible world fiction should be able to provide an interpretation of possible world semantics), are largely pragmatic in nature: utility, simplicity, economy. The vocabulary of Lewis's modal theory offers much in the way of utility by endorsing the most unrestricted domain of quantification, while avoiding problems surrounding representation and indeterminacy that would plague other possible world fictions.[99]

There are important analogies to be drawn between mereological fictionalism and both mathematical and modal fictionalism. Mathematics and modal logic are constituted by formal systems that, to varying degrees, seem to require ontological commitments that correspond to the constituents of these formal systems. Mathematics seems to entail the existence of numbers, while modal logic, given possible-world semantics, seems to entail the existence of possible worlds. In defending mathematical or modal fictionalism, the natural inference from the utility of a formal system (e.g., mathematics or modal logic) to the existence of its formal constituents (e.g., numbers or possible worlds) must be denied.

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[99] See, for example, discussions of pictorial and linguistic ersatzism in Lewis (1986).

An important feature of fictionalism to note is that the utility or applicability of mathematics or modal logic is not at issue. By defending fictionalism and denying that these formal systems require ontological grounding, one does not call into question the utility of the results either system produces. Only the inference to ontological commitment from the utility of a formal system is denied by the mereological fictionalist. Like mathematics or modal logic, mereology is a useful axiomatic theory; however, the ontological commitments some hold it to require are, *pace* adherents of IMH, not defensible. Avoiding these commitments allows one to avoid a number of undesireable results; and fictionalism, by denying the inference of existence from formal utility, makes avoiding these commitments feasible.

In the two previous chapters, I have outlined why we have good reason to reject IMH and the mereological commitments it entails. In doing so, I have taken the first step towards providing a case for mereological fictionalism. An account of why a given mereological fiction is "good" is now required. If such an account can be given, then mereological fictionalism can be made into a defensible view of mereology and the metaphysics of material objects.

3. Fictions and Objects

There is no shortage of mereological fictions. In fact, there are a plurality of ways to divide up the concrete world into composites and simples. Given this vast number of possible fictions, what could serve as a satisfactory criterion for determining the "best" mereological fiction? This is, of course, a loaded question. Up to this point I have denied IMH and claimed that the OC is coextensive with the HS-base. If the HS-base is held to exist *simpliciter*, why wouldn't the best mereological fiction be the fiction that is coextensive, in

terms of entities posited, with the HS-base? The best and, I think, decisive answer to this question is that utility motivates us to adopt a variety of fictions in a variety of cases. Moreover, the utility afforded by a fictionalist interpretation of mereology is actually sufficient grounds to think it true. If, as Lewis claims, the serviceable character of a hypothesis is reason to think mereological fictionalism true, then the best argument for mereological fictionalism rests, not on the objectionable commitments of IMH, but on the benefits fictionalism provides.[100]

A hindrance common to all views that entail IMH is that there is no way to accommodate instances in which a given view seems to yield counterintuitive results, since, according to most philosophers, an answer to the Composition Question is perfectly general. This ensures that there can be no exceptional cases. In denying the possibility of exceptions, otherwise serviceable hypotheses about composition become problematic and demand high metaphysical costs. Consider the problems faced by the four main accounts of composition:

(i) Universalism: Universalism requires that, for any *x*s, there is an object *y* that the *x*s compose. If true, Universalism, as earlier indicated, entails the modal claim that there can be no world with only two objects. The impossibility of only two objects existing seems strikingly absurd and, if principled exceptions were available to the Universalist, this would seem to be a case where such an exception would need to be granted.

(ii) Nihilism: The most intuitive objection to Nihilism is that it seems to entail that, as commonly conceived, I do not exist. As human beings, we conceive of ourselves as objects

[100] One potential benefit worth considering is the application of mereological fictionalism to puzzles of material constitution. If there are indeed no composite objects, then there are, strictly speaking, no puzzles about how such things are constituted. See Rea (1995) for discussion.

that are spatially extended and composed of multiple parts. The Nihilist, unlike the Organicist, is forced to reject this intuition, for principled reasons, and deny the existence of composite human beings along with all other macro-level objects.

(iii) Organicism: The Organicist, in attempting to provide a principled exception to an otherwise Nihilistic position, relies on the metaphysical import of life as somehow determining what entities are composite objects. The cost of endorsing an Organicist account of composition arises because life and participation in the life of an organism are vague concepts. If composition and, therefore, existence are bound up with vague concepts, then a purely epistemic or semantic account of vagueness is no longer adequate; vagueness must be afforded ontological weight. But there is good reason to think that the phenomenon of vagueness is not ontological, given that ontological vagueness entails vague identity.

(iv) Brutalism: Brutalism about composition might be compatible with our intuitions about objects, but it might be utterly at odds with these intuitions. There is, as shown earlier, simply no way to know. Because Brutalism specifies no reductive criterion for determining when composition takes place, no assessment of its benefits or costs is possible apart from the skepticism about mereological analysis it generates.

A chief virtue of fictionalism is that the insights that motivate these various views can be respected without incurring any of the metaphysical costs. By adopting varying fictions in different instances, our elastic mereological intuitions can be validated without requiring principled and exceptionless endorsement. We can posit mereological fictions, which accommodate whatever intuitions one has, while avoiding commitment to plural

composition, which Nihilists find objectionable. We can retain the ability to interpret discourse about material objects and, therefore, hold that I and other people exist, in a fictional sense, while avoiding the strange modal consequences of Universalism and commitment to ontological vagueness.

If one adopts mereological fictionalism, then, when claims are made about physical objects other than those objects constitutive of the HS-base, these claims must be held to be true only in fiction. But, because different contexts warrant the adoption of different fictions, a specification of what fiction is to be adopted in a given context is required. Our everyday discourse about objects need not be subject to scrutiny of this kind; but, if ontologically serious discussion is required, then the mereological fictionalist must specify what composition and what fundamentality fictions are being applied in the context of quantification. A composition fiction will determine under what conditions it is true in fiction to say that some *x*s compose object *y*. A fundamentality fiction will determine what, if any, objects are such that it is true in fiction that they have no parts (i.e., if it is true in fiction that there are simples or gunk and what objects are to be considered to be simple or gunky).

The utility of mereological fictionalism is considerable because of the possibility of adopting different fictions in different quantificational contexts. Given the possibility of adopting different mereological fictions, a mereological fictionalist can offer a solution to at least one problem posed in Uzquiano (2004). If certain "groups" do not obey the axiom of transitivity (i.e., a part of a group-member is not a group-member), unlike fusions, but also change their members, unlike sets, then they seem to be collections that are neither sets nor fusions. Consider Uzquiano's example of the United States Supreme Court:

> Our problem is this. If the Supreme Court is not a set, then what is it? What ontological category does the Supreme Court belong to? It is not difficult to provide reasons to exclude some familiar candidates. The Supreme Court seems not to be a material object or a mereological fusion of them, since

> membership in the Supreme Court is very different from the part-whole relation on material objects. The part-whole relation on material objects is a transitive relation. Thus if one identified the Supreme Court with a material object and Justice Breyer with a part of it, then one would be forced to conclude that Justice Breyer's arm must be a part of the Supreme Court as well. Yet, it is plain that Justice Breyer's arm is neither a part nor a member of the Supreme Court.[101]

The mereological fictionalist can solve this problem and avoiding positing the existence of groups as a new ontological category, as Uzquiano does, by identifying the Supreme Court with a mereological fusion that has as its parts only Supreme Court justices. The Supreme Court justices are, in this fictional context, held to be mereological simples and so, according to mereological fictionalism, a mereological account of the groups can be offered.[102]

Other quantificational contexts will require other objects to be viewed as simples and, given variation across contexts, further puzzles of mereology can be resolved. Consider a difficulty outlined by Markosian:

> Why should it not be possible that the only physical object that exists is a perfectly solid sphere? This seems to me like a perfectly possible state of affairs. But the Pointy View of Simples [i.e. the Point-Sized Answer] is inconsistent with this possibility. If the Pointy View of Simples were true, then if a sphere of the sort described existed, then it would have to have an infinite number of parts, and so it would exist in a very highly populated world. More generally, if the Pointy View of Simples were true, then worlds that contain just one physical object, which happens to be spatially extended, would all be impossible.[103]

Markosian's disbelief that a world where only a perfectly solid sphere exists is impossible is understandable. Such a world, along with worlds that have only two objects, do seem perfectly possible. Given mereological fictionalism, there is a relevant sense in which

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[101] Uzquiano (2004) p. 136.

[102] Adopting mereological anti-essentialism, which allows for objects to change their parts over time, as an element of the relevant fiction might also be required.

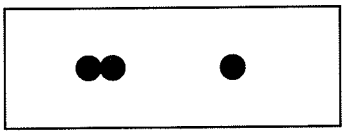
[103] Markosian (1998a) p. 8.

the intuition that such a world is possible can be supported. If one adopts a fiction compatible with, say, the MaxCon Answer, then there is a world where there is only one spherical thing. This may be true only in fiction; but, if all of our myriad intuitions about material objects are accommodated only in fiction, then this resolution to Markosian's worry is the best possible. And no other resolution, short of endorsing something like the MaxCon Answer, will suffice.

4. Thinking Outside the Box

Fictionalism about mereology, like mathematical or modal fictionalism, allows for a formal system to produce mereological analyses of any physical objects and, speaking in fiction, these analyses will be true. Truth in fiction does, however, come apart from truth *simpliciter* when we ask the following sorts of questions: What does our discourse commit us to? Or what objects are we ontologically committed to? The answer that is true in fiction is "the totality of objects that arise in our best mereological fiction or, when asked in a particular context, whatever the best mereological fiction in that context happens to be." The answer that is true *simpliciter* is "the sparse ontology of point-sized objects instantiating point-sized properties, which bear fundamental spatiotemporal relations to one another (i.e., the HS-base)."

Drawing on a common explanatory heuristic, one might finally ask how many objects the mereological fictionalist believes populate the box below.[104] Assume the following dots are mereological simples:



[104] The box example is taken from Rosen and Dorr (2002).

The mereological Nihilist holds that the box above contains only three objects. The Universalist holds the box to contain seven objects. Common opinion arguably holds the box to contain two objects (if contact is thought to fuse two objects into one). The mereological fictionalist denies that there are, strictly speaking, any objects in the box. This is because, strictly speaking, being a simple is not a sufficient condition to count as an object. In fact, according to the fictionalist, there are no such simples. As a result, the question about the objects in the box is not one that the fictionalist can offer an answer to. So, unlike the Nihilist, the fictionalist is forced to deny the intelligibility of this question and is able to answer questions about what actually exist only with reference to the HS-base.

The fictionalist can, in principle, offer any answer whatsoever as to how many objects are located in the box, provided this answer hold only according to a given mereological fiction. As a result, if motivations of utility or economy make the Universalist answer appealing in a given context, then it is true in fiction there are seven objects in the box. If the parsimony of the Nihilist answer is relevantly compelling, then it is true in fiction that there are three objects. Or if the fiction of the layperson is to be trusted, then it is true in fiction that there are two or perhaps three objects.

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