But What Kind of Thing Is a 'Fusion'? :

Circular Reasoning in Sider's Argument from Vagueness

By

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Abstract

Ordinarily, we suppose that material objects sometimes do, and sometimes do not, form a further object. In his book *Four-Dimensionalism*, Theodore Sider develops an argument that attempts to show this assumption is mistaken. Sider's argument from vagueness is one of the most influential arguments in support of universalism, the thesis that composition is unrestricted: whenever some concrete entities exists, so does their mereological fusion. The argument from vagueness is defective – I submit – because it begs the question. Sider distorts the notion of a 'concrete object' so that it does not coordinate with ordinary object-sortals and so that it presumes any arrangement of matter forms a unit, thereby assuming the very claim his argument intends to prove. I begin by reconstructing the argument from vagueness and assessing its two crucial denials: that there can neither be sharp cut-offs in composition, nor indeterminate cases of composition. I survey a variety of responses to these claims, which prove either unsatisfactory or ontologically burdensome, and offer my own response, which avoids ontological burdens. My strategy forces Sider into the dilemma of either recanting one of his two denials, or admitting that the fusions generated by his argument cannot bear ontological weight. Neither option can support a universal theory of composition. My purpose here is to refute the argument from vagueness; this paper does not advance a novel theory of composition. Nonetheless, the flaws I identify in Sider's position advocate that an adequate theory of composition should countenance vague objects and attend to the distinct mereological nature of non-individuative physical substances, which requires further exploration.

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The unfailing confidence and support of my Mom and Dad gave me the resolve to pursue philosophy. I dedicate this thesis to them.

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Chapter 1. Introduction

Pre-philosophical thought tells us that the physical world contains many material objects, and that some material objects have parts. The world as we know it through everyday experience contains ordinary kinds of objects like apples and people, and the empirical sciences extend this inventory to include extraordinary kinds of objects such as viruses and galaxies. These diverse material objects all seem to consist of parts: the apples have stems and seeds, the people have legs and heads, and the galaxies have gas and dust, stars and planets. All these things, their parts, and the parts of their parts – molecules, atoms, and particles – all these are physical substances in their own right; and, often enough, they come together to form *compositions*. Composite material objects – 'compositions', for short – can be vast like a galaxy or infinitesimal like a particle, and can occur naturally or be man-made. The desk at which I work is among the man-made artifacts; it consists of four posts, a drawer, and a tabletop. It seems entirely reasonable to conclude that this desk is a composition, and it is equally reasonable to say that the four posts of my desk, my head, and the dust in Saturn's rings *do not* form a composition: There is no object whose parts are these four posts, my head, and the dust in Saturn's rings. We can conclude, then, from everyday experience as well as the empirical sciences that material objects sometimes do, and sometimes do not, form further objects.

That there are both composed objects and non-composed objects prompts this philosophical question: Under what conditions do objects compose, or add up to, or form, a whole?[1] While Peter van Inwagen posed this question nearly three decades ago, the compositional relations between parts and wholes is still an important subject of philosophical discussion. One candidate position, widely held and defended by contemporary metaphysicians,

[1] Inwagen 1990, p. 25

is universalism, the claim that objects *always* compose a further whole. In his book *Four-Dimensionalism*, Ted Sider develops what is regarded as the strongest support for universalism: the argument from vagueness. This paper reconstructs Sider's argument from vagueness, surveys many attempts to dispose of its conclusion, and ultimately argues that the mereological fusions for which the argument advocates are ersatz objects, thus signalling that the argument from which they spawn is ill-formed.

The argument from vagueness proposes to answer what van Inwagen calls the Special Composition Question. We can pose van Inwagen's question as follows:

> The Special Composition Question (SCQ): What necessary and jointly sufficient conditions must any *x*s satisfy in order for it to be the case that there is an object composed of those *x*s? [2]

In general, answers to the SCQ must logically fall into three main categories: (a) nihilism - there are no objects composed of two or more parts (that is, there are no apples, desks, or galaxies), (b) universalism - any objects whatsoever, no matter how disjointed, heterogeneous, or generally unrelated, compose a further object (not only are there apples, desks, and galaxies, but also innumerable other incredible objects completely at odds with our standard, pre-philosophical intuitions), and (c) restrictivism - objects come together to form a further composition only when certain conditions are met, whatever these conditions be. These categories are summarized below in Table 1: Summary of the types of answers to the Special Composition Question.

[2] I borrow this formulation of the SCQ from Ned Markosian's *Brutal Composition*, 1996, p. 212

Category	Nihilism	Universalism	Restrictivism
Summary	Composition never occurs	Composition always occurs	Composition sometimes occurs [3]
Conditions	There are only simples, and no such things as composite objects	Every class of simples and ordinary objects forms a fusion	There are simples and composite objects, as well as classes of matter that do not form compositions
Examples	Simples	Simples, apples, humans, and a fusion of a crater in the moon, my copy of the Canadian constitution, and your pinky finger	Simples, apples, humans, and galaxies

Table 1: Summary of the types of answers to the Special Composition Question

As a universalist, Sider answers the SCQ by claiming there are no restrictions on composition, for he says that "any filled region of spacetime is the total career of some object" (Sider 2001, p. 120). Along with ordinary physical objects such as apples, people, and the parts that compose them, Sider claims that a countless number of material objects he calls 'fusions' populate the physical universe. There is a fusion of the apple and the desk, and a fusion of the apple's stem and the desk drawer, and another of the stem, the desk, and Ted Sider. Despite their undoubtedly odd assemblage, Sider considers these fusions to be no more and no less genuine material objects than the apple, the desk, or he himself. In number, however, the fusions far

[3] Restrictivism is a general label that applies to a variety of moderate theories of composition. Every brand of restrictivism agrees that there are both composite and non-composite objects, but each brand advocates for different sufficient and necessary conditions of composition; thus each differs with respect to how many objects there are. Van Inwagen, for instance, proposes that the only composite-material objects that exist are living organisms, while Ned Markosian defends a view of composition that he believes is consistent with our ordinary, pre-philosophical intuitions about material objects. See van Inwagen 1990, and Markosian 1996.

exceed ordinary physical objects. According to Sider, there are as many fusions as satisfy the following principle:

The Principle of Universal Fusions: Every class of objects has a fusion.[4]

With this rough sketch of Sider's thesis that composition is unrestricted, it is easy to see how the universalist's answer to the SCQ has been rejected on the basis that its metaphysical conclusions are absurd. Although universalism carries outrageous implications, many philosophers have developed strong arguments that unrestricted composition is the preferred mereological position. Sider himself considers that an unrestricted theory of composition finds its strongest support in the argument from vagueness (Sider 2001, p. 120).

There are two parts to Sider's version of the argument from vagueness.[5] The first half of the argument sees Sider advancing his universalist thesis, while in the second half Sider argues from universalism to four-dimensionalism.[6] This paper addresses only the first half of the argument intended to support universalism.[7] I begin in Chapter 2 by reconstructing Sider's argument from vagueness. In Chapters 3 and 4, I dissect the two most controversial premises of Sider's formal argument and assess a variety of possible responses that attempt to falsify these premises. Chapter 3 addresses the problem of sharp cut-offs in compositional state, and Chapter 4 concerns the premise of indeterminate cases of composition. I find the available responses to these premises prove either unsatisfactory or ontologically burdensome, so I offer my own

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[4] Ned Markosian coins this principle in his essay "*Two Arguments from Sider's Four-Dimensionalism*" (2004, p. 665)

[5] Sider presents the argument from vagueness in his book *Four-Dimensionalism* as part of a larger argument for a four-dimensionalist theory of persistence.

[6] For the first and second halves of the argument from vagueness, see Sider (2001, p. 120-34) and (2001, p. 134-139), respectively.

[7] Note, however, that the second half of the argument depends upon the success of the first. The argument from vagueness can serve to support four-dimensionalism only if Sider successfully defends his universalist thesis.

response, which avoids ontological burdens. The strategy I build towards over these two Chapters is to force Sider into a dilemma: I argue Sider must grant that there are either indeterminate cases or sharp cut-offs with respect to composition, or he must concede that the notion of 'concrete object' at work in his argument is artificial and ontologically inconsequential.

I continue in Chapter 5 by connecting the artificial design of the concreteness predicate to a crucial presupposition of the argument. The argument from vagueness is question-begging: Sider presupposes that any arrangement of simples forms an object, and formulates his argument to preclude counterexamples, thereby assuming the very claim his argument intends to prove. Having demonstrated the circularity of the argument from vagueness, I then step back from the details of the argument and evaluate the ontological status of Sider's conception of 'fusions'. The argument from vagueness concludes that composition can never be indeterminate, and Sider believes that fusions avoid ontic indeterminacy by claiming that there is never a case where concrete objects fail to form a fusion. Sider buys his freedom from vagueness, however, at the cost of rendering a mereological theory that can bear no ontological weight.

Chapter 2. Reconstructing the Argument from Vagueness

Sider derives his argument from vagueness from an argument for unrestricted mereological composition first formulated by David Lewis.[8] The argument from vagueness concludes that wherever there are multiple objects, fusions of them must also exist. The argument takes the general form of endorsing a universal theory of composition by way of denying restricted and nihilist theories of composition – the logically alternative theories. Of these two alternatives, Sider sees only restrictivism as presenting a tenable theory of composition; thus the argument from vagueness aims to debunk restrictivism while assuming that the nihilist theory of composition is false.

Here is a formulation of Sider's version of the argument from vagueness (Sider 2001, p. 120-34):

P1. If there are restrictions on composition, then there must be a continuous series connecting an arrangement of some matter that is composed to an arrangement of the same matter that is not composed. (122)

P2. Each case in the continuous series is similar to the adjacent cases in all relevant respects. (123)

P3. Every continuous series must have *either* sharp cut-offs in whether composition occurs *or* indeterminate cases of composition.

P4. In a continuous series there cannot be sharp cut-offs with respect to whether composition occurs. (123)

P5. In a continuous series there cannot be indeterminate cases of composition. (125)

C. Therefore there are no restrictions on composition.

[8] Lewis's argument can be found in his book *On the Plurality of Worlds* (1986, p. 212-213). See also Heller (1990, 47-50).

Before presenting Sider's defence of these premises, I will explain three key concepts in the argument: a continuous compositional series, a sharp cut-off with respect to composition, and an indeterminate or borderline case of composition. These three concepts take center place in the argument from vagueness, and must be clearly laid-out in order to understand Sider's position and assess responses to it.

Sider's idea of a "continuous series" is not as contrived a philosophical puzzle as it sounds. In fact, it parallels our understanding of how manufactured objects come together along an assembly line. In a car manufacturing plant, for example, the manufacturing process begins by joining only a few car parts. More parts are added in sequence, until an assembled car is produced at the end. Somewhere along the line – for example, between the gradual process of welding the frame together, or fixing the engine in place – the number of objects increases: there is not only an assortment of parts, but also the car that is their ultimate composition.

A continuous series in the argument from vagueness operates analogously to an assembly line, although the continuous series defines the iterative process more precisely. For example, suppose we start with some thing that is determinately a unified object – a writing desk, for instance, whose proper parts are four posts, a drawer, and a tabletop. Suppose further that we single out one particle of the desk, and move it one trillionth of a centimeter to the left. We do the same for another particle, and then another. By continuing this process, the parts that form the desk eventually end up scattered across the universe. Each step in the series of infinitesimal displacements of the particles can be represented by a case, and each case is extremely similar to its adjacents with respect to qualitative homogeneity, spatial proximity, unity of action, comprehensiveness of causal relations, and so forth.[9] Intuitively, the series of cases has at one

[9] According to Sider, these are among the factors that our intuitions suggest are relevant to composition.

end a composite desk and at the other only scattered particles. These intuitions motivate restrictivism: the world is such that sometimes objects come together to form a further object, and sometimes they do not. If composition is restricted, then somewhere in the series the desk goes out of existence. A restrictivist must answer this: where in the series does a desk definitely exist, and where in the series does it definitely fail to exist?

Sider contends there are only two possible answers to this question. The restrictivist can say that there is a sharp cut-off in the compositional series. Sider defines a 'sharp cut-off' with respect to composition as "a pair of adjacent cases in a continuous series such that in one, composition definitely occurs, but in the other, composition definitely does not occur" (Sider 2001, 123). Sider instructs that we are to imagine each case in this series as being "extremely similar to its immediately adjacent cases in all respects that might be relevant to whether composition occurs" (123). Pinpointing in the series the two cases marking the transition between a state of composition and one of non-composition seems arbitrary: Each case is so extremely similar to the last that giving preference to any pair would be equivalent to saying "if one of the particles had been 0.0000001 nanometers displaced, then those particles would have definitely failed to compose any object at all" (124). Sider denies sharp cut-offs, arguing that it is metaphysically arbitrary that a pair of adjacent cases exist such that a composition exists in one, while a composition fails to exist in the other. I formulate his denial of sharp cut offs as P4 in the argument above.

The second, more tempting reply available to the restrictivist is to claim that the particles stop being a desk somewhere, but it is vague where this occurs. There is no sharp cut-off in the series, but instead a grey area where the existence of a composite desk is indeterminate. A borderline or indeterminate case of composition can be understood as what Roy Sorenson calls

an ‘absolute borderline case’. Absolute borderline cases are inquiry resistant. When a predicate is applied to one of its absolute borderline cases, no amount of conceptual analysis or empirical investigation can settle the question of whether that statement is true or false (Sorenson 2001, §1). Sorites paradoxes involve a grey area constituted by absolute borderline cases wherein it is uncertain whether a predicate (‘is a heap’, ‘is tall’, etc.) applies to, or fails to apply to, some assignment. For instance, a boy may count as a borderline case of ‘tall’ because his height is neither clearly tall nor clearly non-tall. Wanting to prove to his friends that he is indeed tall, the boy could try settling the matter by stipulating that being ‘tall’ means being above the national average height for his age. If the boy’s own height exceeds the average height for his age, then this method counts him as tall. Yet, this method is merely stipulative, and its calculation fails to be decisive because it renders different verdicts depending on the sample of heights, counting the boy as tall when Pacific Islanders are factored in, but not so when he is measured only against his Dutch peers. The boy will count as an absolute borderline case of ‘tall’ only if no basis for judgment could definitively settle whether he is tall. Since all methods can be only stipulative, there is no definitive basis; therefore it is vague whether the boy is tall.

Sider claims that there is likewise a lack of basis for judgment in borderline cases of composition. Picture again the continuous series that sees an intact desk at one end, and its particles scattered across the universe at the other. Somewhere in the middle there are a group of cases that we hesitate to claim represent a composed object. It cannot be settled whether the predicate ‘is a composition’ truthfully applies to any one case in this grey area. Sider believes that all attempts to settle whether each case in this grey area composes an object will fail; no analytical unpacking of the concept ‘desk’ or empirical study of each case can render a definite verdict. Therefore, it is vague whether each case composes anything at all. Borderline cases of

composition, then, are cases wherein it is vague or indeterminate whether some simples form a further whole. Moreover, borderline cases of composition are metaphysically troubling, for they represent instances where it is indeterminate whether some object exists or not: "there can be no vague restrictions on composition, because that would mean that whether composition occurs is sometimes vague" (Sider 1991, 121). For this reason Sider denies indeterminate cases of composition. I formulate his denial of indeterminate cases of composition as P5.

Having elaborated on the three key concepts in Sider's argument, I proceed over the next two Chapters to assess premises P4 and P5. Chapter 3 lays out Sider's support for the denial of sharp cut-offs, and Chapter 4 explains Sider's denial of borderline cases of composition. The argument from vagueness intends to undermine restrictivism by showing that any constraint on when matter forms a composition is inevitably either metaphysically arbitrary or troublingly vague. I disagree that sharp cut-offs and vague composition are to be avoided, and force Sider into the dilemma either of admitting one of the two, or conceding that his notion of 'concrete object' is ontologically superficial.

Chapter 3. Evaluating Premise P4: The case for and against sharp cut-offs in composition

Prima facie, when considering the premises of the sharp cut-offs and the borderline cases of composition, the former appears the less plausible. It seems absurd that an abrupt transition in compositional state can be attributed to, or grounded in, the slightest change in some particle's spatial proximity, qualitative homogeneity, causal relations, or any other criterion by which we judge objects to form a whole. To claim otherwise requires committing to 'brute compositional facts', and Sider denies that there are such metaphysical facts. Thus, we can formalize the defence of P4 as a *reductio*:

P4i. In a continuous series, there are sharp cut-offs with respect to whether composition occurs only if there are brute compositional facts.

P4ii. There cannot be brute compositional facts.

P4. In a continuous series there cannot be sharp cut-offs with respect to whether composition occurs.

The intuitive appeal of P4 follows from the intuitions that make P4i and P4ii seem plausible. P4i expresses our intuition that composition occurs when it does because of relevant criteria, such as particles acting in unity or being spatially close. These criteria seem to admit of degrees rather than of sharp cut-offs. If two particles are displaced by a near infinitesimal distance, their slight displacement would not mark a sharp cut-off in their proximity, which suggests it could neither mark a sharp cut-off in composition. Hence, spatial proximity cannot explain why the two particles definitely formed a composition only when they were slightly closer. Rather, an abrupt change must be explained by a factor dedicated to composition; sharp cut-offs with respect to composition must be explained by a brute compositional fact.

A fact is brute when it is not explained by another fact. If a fact is grounded in another fact, or follows in virtue of another fact, then it is not brute (Markosian 1998, p. 215). To say that there are brute compositional facts, then, is to say that in a continuous series, two cases differ with respect to composition, and no other facts about the case account for the difference in composition. Conceding that any theory "must admit *some* metaphysically 'brute' facts," Sider takes issue with composition being one such fact, saying that brute compositional facts "[seem] particularly hard to stomach" (Sider 2001, p.124). Sider denies that composition is brute because he finds such a notion to be 'metaphysically arbitrary'. If our intuitions follow Sider's hesitation, then we should agree to P4ii.

There are, however, reasons to doubt both P4i and P4ii that might persuade us to dismiss P4. First, I present an argument against P4ii by way of Ned Markosian's advocacy for brutal composition. Although Markosian's brute compositional facts offer a more plausible ontology than Sider's mereological fusions, brutal composition requires that we posit a new category of brute compositional facts and abandon the factors standardly assumed to determine compositional state. To preserve the standard conception of composition, we should, instead, reject P4 by denying P4i. Sider claims that nature has no sharp cut-offs, but I provide a counterexample at the micro-level that reveals this claim is merely an unsupported assumption.

3.1 The case for brute compositional facts

We can reject Sider's denial of sharp cut-offs by embracing the brutality of composition, thereby denying P4ii. To pursue this route is to say that the standard factors[10] we assume explain compositional differences – spatial proximity of simples, the unity of their action, etc. – are not

[10] Throughout this paper, I use the phrase 'standard factors' to refer to the factors that our intuitions suggest are relevant to composition, such as those factors Sider identifies in his paper: qualitative homogeneity, spatial proximity, unity of action, comprehensiveness of causal relations, etc.

the actual determinants. Ned Markosian argues for brute compositional facts, a view encapsulated in his following thesis:

> Brutality of Compositional Facts (BCF): if there is an object composed of some *x*s, then it is a brute fact that there is an object composed of the *x*s (Markosian 1998, p. 215).

Markosian admits brute compositional facts, but unlike Sider, he does not think it a great allowance. Clearly, some concepts must be brute. Certain facts must not obtain in virtue of other facts because otherwise we are committed to an infinite regress. Markosian identifies three characteristics that make a concept a good candidate for brutality:

a. Being relatively easy to grasp on an intuitive level,
b. Being such that there are clear-cut cases of both instantiation and non-instantiation,
c. Being such that no acceptable account of what it is in virtue of which some *x*s instantiate that concept seems to be forthcoming. (218)

Markosian argues composition possesses all three characteristics. He thinks it self-evident that composition fulfills both (a) and (b), and presents no arguments for either. For (a), what is "relatively easy to grasp" is subjective, but I think most people would agree that composition fits the bill. For (b), there are evidently clear-cut cases of composition and non-composition. Although there are also many cases – those belonging in the grey area – that are evidently not so clear-cut, this is compatible with composition fulfilling (b). While intuitions will guide many to accept both (a) and (b), a universalist such as Sider will reject (b).

To fulfill the third requirement, all accounts that attempt to answer the SCQ "there is an object composed of some *x*s iff _____" that do not appeal to brutality must be dismissed. Markosian groups all potential candidates into the same three categories I presented in Table 1: nihilist accounts, universalist accounts, and moderate accounts. Reaffirming that any adequate

answer to the SCQ must harmonize with our intuitions, Markosian eliminates universalism and nihilism because of their consequences for the nature and number of composite objects. Universalism entails that there are far more objects than our intuitions can countenance, while nihilism counterintuitively entails there are no composite objects at all (220, 228). Similarly, Markosian eliminates the variety of moderate accounts as they are either incoherent, or they admit counterexamples, or they entail genuine vague existence.[11] Given his appeal to intuitions in eliminating rival theories, the obvious question in response to Markosian's view is whether brutal composition is any more counterintuitive than the nihilist view or the universalist view.

This is a battle of intuitions. Sider adopts a principle of composition whereby it is always the case that some *x*s form a composition, while Markosian embraces brute compositional facts as explaining whether some *x*s form a composition. In Sider's corner, we have the intuitions suggesting that explanatory factors such as the spatial proximity of simples, the unity of their action, etc. are relevant to composition, and that compositional differences must be determined by general principles or they will be 'metaphysically arbitrary'. Markosian finds support in the intuition that some objects are composed while others are not, and that all other attempts to answer the SCQ are more counterintuitive.

If one is put off that the factors standardly assumed to be relevant to composition inevitably entail that composition always occurs, then that entailment might be reason enough to abandon these factors. Markosian thinks it is, and attempts to uproot the pre-theoretical, assumed relation between explanatory factors and compositional state with this analogy:

> Suppose someone claims that people who are left-handed are not left-handed in virtue of being any particular height. And suppose someone else argues against this claim by pointing to a series of possible cases ranging from a five-foot-tall left-hander at one end

[11] For Markosian's full process of elimination, see Markosian 1998, p. 219-233.

> of the series to a seven-foot-tall right-hander at the other end of the series. It would be implausible to argue that there could not be an "abrupt cut-off" in this series of people (i.e., a pair of adjacent cases in which two people who are near-duplicates with respect to height differ with respect to being left-handed), precisely because we don't think that a person's height determines whether that person is left-handed… Once we accept that composition does not occur in virtue of the number of simples involved in a given case, or the spatial proximity of those simples to one another, or the degree to which those simples are fastened together, etc., then we will see that there is nothing implausible about an abrupt cut-off in the series of cases described in the continuum argument. (Markosian 1998, p. 238-9)

Although Markosian argues that composition "does not occur in virtue of" the standardly assumed factors, such factors can still affect compositional state. Markosian's position allows that composition be brute without denying that compositional facts supervene upon non-compositional facts. The degree to which simples are fastened together, their coordinate causal relations, and their spatial proximity, for instance, can still play a role in determining whether an object is composed. Sider takes issue with accepting sharp cut-offs because doing so is "*nearly* as difficult as rejecting the supervenience of composition on the relevant factors [italics added] " (Sider 2001, p. 124). Sider's qualification is important, because supervenience is not thrown out the window when we accept brute compositional facts. Daniel Korman explains: "One may accept that cases must differ in some non-compositional respect in order to differ in compositional respects without accepting that any specific non-compositional differences are poised to explain, or ground, compositional differences" (Korman 2005, p. 898). Although there are no facts in virtue of which brute compositional facts are such that class A of simples makes an object and class B does not, the world might rearrange to form class A^1 and class B^1, and this rearrangement could change both classes' compositional state. Thus brutal composition allows

that compositional changes, while not determined by, are at least dependent upon, non-mereological changes.

Nonetheless, accepting brute compositional facts requires conceding that the intuitive factors heretofore believed to wholly determine whether some simples form a whole are not determinants of composition. The upshot of brutal composition is that it supposedly preserves our intuitions about what objects there are and what objects there are not. Crucially, however, this preservation is not guaranteed. The brutality of composition is consistent with there being both a body of compositional facts that align perfectly with our intuitions on compositional matters, and a body of compositional facts that is just as counterintuitive as nihilism or universalism; it might be a brute fact that there are compositions such as writing desks, people, and galaxies, or it might be a brute fact that there are compositions of desk-persons and person-galaxies. Of course, there generally are clear-cut cases of when composition occurs — there are apples, people, and stars — and when it does not – there aren't apple-person objects — and these clear-cut cases provide good reason to believe that the brute facts coordinate with our intuitions. Markosian argues that since no other theory of composition can coherently agree that my desk is an object while my head and my desk do not make an object, his theory that likely agrees with these intuitions wins out.

How we weigh the intuitions potentially secured by brutal composition against those it necessarily forces us to abandon should determine whether Markosian's view is preferable. Positing a new category of specific compositional facts, while claiming that spatial proximity, unity of action, and comprehensive causal relations do not determine objecthood is a high price to pay in order to avoid universalism. The Markosian method of denying of P4ii requires abandoning one set of intuitions in order to preserve a different set. The argument I offer in this

paper instead challenges P4i: the premise that sharp cut-offs entail brute compositional facts. Like Markosian's theory of brutal composition, my argument maintains a plausible, restricted ontology, but unlike Markosian's theory, my own preserves our intuitions about the standard factors relevant to composition.

3.2 False instances of sharp cut-offs in composition

P4 formulates Sider's denial that there is a series of cases within which a sharp cut-off in composition occurs. However, there are series where it seems correct that the infinitesimal movement of a single particle destroys the object in which that particle was just a part. A light bulb seems a good counterexample of a sharp cut-off.

That some class of particles forms an ordinary object such as a light bulb depends on the properties Sider lists in his book: spatial proximity, unity of action, comprehensiveness of causal relations (Sider 2001, p. 123). As an artifact, however, an incandescent light bulb could also be defined by its function. Artifacts are often produced to serve a functional role, and they can be crafted in such a variety of different ways that we have to appeal to the function they serve in order to determine whether or not we can properly call them an object. There are clocks of so many sorts that we might be hard pressed to find anything common to all of them aside from their shared function as time-tellers. Sun dials, smartphones, hour glasses, watches, and atomic clocks physically have very little in common with one another. Hence, we might enforce function as a sufficient and necessary criterion of identity for membership in artifact-sortals. There need be no brute compositional facts because the fact of whether some simples form a functioning object can determine whether the simples form a composition.

Let us stipulate that some class of particles composes an incandescent light bulb if and only if they form a filament wire that glows when heated by an electric current. There will then

be a sharp cut-off in the light bulb series where the tiny movement of a tungsten atom fractures the filament, breaking the electrical circuit. If this circuit is broken and no glow is produced, then under the stipulated identity conditions the class of particles no longer composes a light bulb.

The problem with this counterexample, however, is that is misunderstands the objections to the conditions of objecthood stated in the argument from vagueness. The argument is not concerned with classes of particles transitioning in and out of membership in object-kinds, but is rather concerned with their transition from forming a composition to being non-composed. The light bulb example is merely an instance of a sharp transition between being a light bulb and being a broken light bulb. Both are nonetheless cases of *composition*; a light bulb with a broken filament is still a composed object. Quine emphasizes that one should not mistake a class of particles failing to have membership in a sortal class for its failing to be a composition:

> Specific individuals such as 'dog' or 'desk'... suffer from vagueness on the score of the microphysical boundaries of their denotata, as well as vagueness on the score of the marginal denotata themselves, such as makeshift desks and remote ancestors of dogs; but all this is vagueness only of classification and of not of existence. All the variants qualify as physical objects. (Quine 1981, p.13)

Accepting the function criterion of identity stipulated above allows us to claim that some class of particles no longer composes a light bulb, but it does not allow us to say that it no longer composes an object. For Quine, the class forming the broken light bulb persists as an object - specifically, as one of his 'physical objects'.

Sider makes a similar claim, substituting Quine's 'physical object' for his own conception of a 'fusion': "It may well be indeterminate whether a given class of molecules has a fusion that counts as a *person*. This is not inconsistent with [P4] for the class may definitely have a fusion which is a borderline case of a person" (Sider 2001, p. 125). Sider would argue

that denying P4i requires a counterexample of a sharp cut-off not in objecthood, but in compositional state. It is worth here noting, however, that if an alleged composition fails to fall under any object-sortal, than Sider's concept of 'composition' is very thin, such that it can admit nearly anything. I will set aside this concern for now and return to it in Chapter 5.

3.3 Genuine instances of sharp cut-offs in composition

There seems to be a genuine instance of a sharp cut-off in compositional state that occurs at the quantum level.[12] Alpha particles are a kind of radiation. Each alpha particle is composed of two protons and two neutrons. A remarkable feature of their composition is that the mass of an alpha particle is less than the sum of the masses of two protons and two neutrons; the mass of the whole is less than the mass of its parts. The binding of the protons and neutrons accounts for this change (Fernflores 2012). It takes energy to form an alpha particle, and the energy is borrowed from the rest mass of its parts. Therefore, one way to determine whether there is a composite alpha particle rather than four scattered particles is by knowing whether the sum mass is less than the sum individual masses. A series of cases for an alpha particle would have four scattered particles at one end, and a composite at the other. With every case the neutrons and protons converge. Eventually, one infinitesimal displacement will cause the sum mass of the particles in one case to be less than in the previous case. This pair of cases in the alpha particle series marks the sharp transition that P4 claims is impossible. Moreover, we can explain the abrupt change in compositional state by appealing not to a brute compositional fact, but to the factual displacement of the particle's simples.

[12] In a personal communication, Joshua Mozersky suggested that alpha particles are plausible candidates for having sharp cut-offs, and I thank him for offering me this example.

Sider has only two available responses to this counterexample. To maintain that nature has no sharp cut-offs, suppose that the spatial distance at which the four particles cohere into an alpha particle is variable: sometimes it occurs at distance *x*, sometimes at distance *y*, or sometimes at *z*. For argument's sake, suppose that no two cases are ever the same, and that the distance at which the particles break their bond is different from the distance at which they cohere. Sider can propose that the compositional transition is too inconsistent to qualify as a sharp cut-off. This response, however, fails to disprove that there is a sharp cut-off between the alpha particle and its parts. Sider defines a sharp cut-off as two adjacent cases in the series that differ in terms of compositional state. Although the exact location of the sharp cut-off could differ in each particular series of alpha particle, the cut-off would exist nonetheless.

The second response is to claim it is not necessarily true that the transition in compositional state occurs over just a pair of cases. Rather, the change cannot be so precisely pinpointed because it occurs over a range of cases that constitute the grey area wherein the alpha particle is vaguely composed. This second response is reasonable, but for Sider to use it he must endorse indeterminate cases of composition — exactly what P5 in the argument forbids.

I argue that alpha particles stand as a genuine counterexample to the argument from vagueness; alpha particles present a restriction on composition. In order to account for the alpha particles, Sider is forced to choose between two alternatives — sharp cut-offs and vague composition — neither of which are allowed by the argument from vagueness. He *must* choose, however, because it is a plain fact that among the cases in the alpha particle series, the particles in some come together to form a further unified whole, and in other cases they do not. There is some point, whether it is a sharp line or a vague smear, at which at which the energy binding the particles together reappears in the individual particles. Because the point undeniably exists,

some assumption on Sider's part must be wrong. I am inclined to think that the alpha particle shows that Sider wrongly assumes nature has no sharp cut-offs.

There are two aspects to the disbelief of sharp cut-offs. The first is metaphysical: it is implausible that nature's joints are sharply cut. I have attempted to resolve this concern by presenting a natural composition that most probably admits a sharp cut-off. What gives the alpha particle counterexample its confidence is that such particles are subject to precise physical definition, allowing a clear understanding of their composition. Conversely, compositional identity conditions for objects at the macroscopic level are much more difficult. We can satisfactorily specify the arrangement of elementary parts required to form an alpha particle, but this is an arduous task in the case of a desk or a person. For ordinary kinds of artifacts or natural objects, both the number and kind of element parts, as well as their arrangement, vary from object to object and are much more complex. This raises the second concern, which is epistemological: it is implausible that we can know where nature's joints are sharply cut. The epistemic theory of indeterminacy, however, shows that this lack of knowledge is not problematic. The epistemicist contends that although no one could ever know where it falls, there is a sharp cut-off where a predicate determinately ceases to apply.

3.4 Epistemic Indeterminacy

Epistemic indeterminacy locates the source of vagueness in our own ignorance about the world. According to the epistemicist, predicates never admit borderline instances. Rather, cases where it seems indeterminate whether some predicate applies are in fact cases where the predicate either truthfully or falsely applies, although we cannot know which. Take the predicate 'is a heap', for instance. According to the epistemic view, there is a fact of the matter as to what counts as a heap:

x is a *heap* =df *x* has at least *n* grains [13]

Suppose that there is some aggregate *H* of sand composed of exactly *n* grains. Judging the aggregate, I say 'This is a heap', thereby expressing a true proposition. Since aggregate *H* is on the border of being a heap, however, I would have made the same judgement and corresponding utterance 'This is a heap' even if the reference-determining factors for the term 'heap' had differed slightly, resulting in me expressing a different and false proposition (Williamson 2004, p. 705). Williamson, a prominent proponent of the epistemic theory of vagueness, claims this is so because

> I cannot discriminate the counterfactual assignment of reference to my words from the actual assignment; the two semantic valuations are indiscriminable for me…. Our powers of discrimination are limited; we cannot make our judgements perfectly sensitive to all the reference-determining factors. Thus my actual judgement is unreliably based; even if true, it does not constitute knowledge. (706)

The epistemic response to the argument from vagueness is to say that even though no one could ever know where it lies, there are reference-determining factors that determine the (unknowable) sharp-cut off for the predicate 'is a composition'.

The epistemic view suggests that that there are two notions to knowing when some aggregate of matter forms a composition. Williamson distinguishes between the kind of knowledge which "has everyday uses because we are willing to apply it to subjects who do not meet a perfectionist standard for discriminating" that there is a composition, and the kind of knowledge for analysing vagueness, wherein "slight failures of discrimination are just what we are interested in" (708). This distinction allows that it can be epistemically vague whether some simples form a composition – thereby accounting for the indeterminacy in Sider's relevant

[13] 'Grain' is, perhaps, a vague term, but to my present purpose of outlining epistemic vagueness, this is beside the point.

numerical sentences – even though it is known that they form a composition – thereby accounting for the intuition that composition is restricted.

The epistemic approach to the argument from vagueness faces two challenges. The first objection is that the epistemic theory of indeterminacy presumes that nature's joints are sharply cut. The alpha particle offers a conceivable example of sharp cut-offs in composition, but like Sider I doubt that there are such cut-offs for a majority of individual objects in the world's inventory. This approach therefore succeeds only if P4 can be denied, which is unlikely. The second objection is that the epistemic approach requires that the relevant numerical sentences be indeterminate. This challenge can be overcome, and in the next chapter I demonstrate how Sider's numerical sentences are indeterminate.

3.5 The Argument Against P4 in Sum

P4 states that there cannot be sharp cut-offs in composition. To block this premise, I first attempted to falsify P4ii by presenting the theory of brute composition, as advocated by Ned Markosian. I argued that brutal composition makes two costly claims: first, that there is a category of facts specific to composition, and second that the factors intuitively assumed to be relevant to composition do not determine compositional state. A more reasonable approach to denying P4 is to deny P4i by demonstrating a sharp cut-off in composition that does not entail brute compositional facts.

I am inclined to think that the counterexample of the alpha particle shows that Sider wrongly assumes nature *never* admits sharp cut-offs. The possibility of there being a sharp cut-off in compositional state for a majority of macro objects, however, seems very unlikely, and I may not have even persuaded my reader that alpha particles are a rare instance proving nature has sharp cut-offs. Yet, I need not prove either claim: To counter Sider's argument, I need only

show that P4 and P5 are jointly incompatible, thus forcing him into the dilemma of denying one of his premises. The above discussion of the alpha particle suggests that P4 should be rejected, but in the following chapter I present a more compelling case against P5.

Chapter 4. Evaluating Premise P5: The case for and against vague restrictions on composition

In Sider's own view, the most controversial premise in the argument from vagueness is P5: the denial of vague cases of composition. The standard criterion of vagueness is the possession of borderline cases – cases where it is indeterminate whether some predicate applies or not (Sorenson 2001, p. 31). When we consider borderline cases of the predicate 'is tall', we suspect that our uncertainty is due to the concept of tallness rather than to our limited ability to measure height. In other words, we attribute vagueness of the term 'tall' to semantic indecision. The same holds for the predicates 'is bald', 'is blue', 'is a heap', and so on, for it seems all these predicates admit borderline cases because the imprecision of their concepts (heap, blueness, personhood) makes for flexible membership in their extensions (all heaps, all blue things, all persons). Since borderline cases of composition seem just as natural as borderline cases of heaps and tallness, Sider must argue why he forbids them in P5.

Before considering Sider's defence of P5, I will clarify the conceptual relations between two terms I have heretofore used synonymously: indeterminacy and vagueness. These terms have distinct meanings in the philosophy of language and logic. Elizabeth Barnes explains that indeterminacy describes the phenomena of unsettledness: "If there is unsettledness with respect to *p*, things do not quite seem to be a *p*-way but also do not quite seem to be a not-*p* way, so that it seems inappropriate to categorically assert '*p*' or to assert 'not-*p*' " (Barnes 2009, p. 371). Vagueness is a type of indeterminacy that gives rise to the sorites paradox, and only some forms of indeterminacy yield a kind of sorites paradox (371). The argument from vagueness concerns phenomena that are both indeterminate and vague. In his continuous series, Sider devises a sorites-like puzzle that depends on the lack of sharp boundaries for the predicate 'is a composition'; his puzzle is that if composition is restricted, then there is ontic indeterminacy

because the question of how many objects exist cannot be settled, and there cannot be such indeterminacy.

Sider maintains that ontological indeterminacy is problematic: whether a class of objects forms a composition has to be a non-vague question. He justifies P5 with these three seemingly plausible premises:

P5i. In a continuous series, there are indeterminate cases of composition only if it is vague how many concrete objects exist.

P5ii. If it is vague how many concrete objects exist, then an expression in some numerical sentence must be indeterminate in truth-value.

P5iii. No expression in the relevant numerical sentence can be indeterminate in truth value.

P5. In a continuous series there cannot be indeterminate cases of composition.

First, vague cases of composition do seem to entail that it is indeterminate how many concrete objects exist. If the legs and the tabletop are a borderline case of forming a composition – the desk – then it will be indeterminate whether there are just five concrete objects (the four legs and the tabletop) or whether there are six (the legs, the top, and the unified desk). The second premise seems acceptable, too. If it were indeterminate whether exactly two or three concrete objects exist, then that would mean that the following numerical sentence – a purportedly purely logical expression – stating that there are exactly 2 concrete objects would also be indeterminate:

$$\exists x \exists y \{Cx \,\&\, Cy \,\&\, x \neq y \,\&\, \forall z\, (Cz \rightarrow [x = z \;\vee\; y = z]\,)\,\}$$

A numerical sentence is a sentence that says, for some finite *n,* there are exactly *n* concrete objects (Sider 2001, p. 127). If a numerical sentence is indeterminate, then it must contain a semantically vague expression – an expression that admits multiple precisifications. The syntax and terms in the numerical sentence above, however, do not seem to hide any vagueness,

suggesting that the third premise is also true. Since there appears to be no logical term in the numerical sentence that can plausibly admit multiple candidate meanings, Sider reasons that the numerical sentence cannot be indeterminate. Therefore, he forbids indeterminate cases of composition on the grounds that they require impossibly indeterminate numerical sentences.

I begin by analyzing P5 from a semantic perspective. I agree with Sider that if there are indeterminate cases of composition, then the relevant numerical sentence must also be indeterminate. First, I consider whether the existential quantifier or the concreteness predicate can be a source of indeterminacy, and I argue that the numerical sentences can plausibly inherit vagueness from the concreteness predicate. To avoid importing vagueness into the numerical sentences by way of the concreteness predicate, Sider fashions a distorted, technical definition of 'concrete object' that I argue is problematically artificial.

Reorienting to an ontic perspective, I show that continuous compositional series for ordinary sortal kinds make a strong case that, contra Sider, there are vague objects. I conclude that any acceptable notion of 'composition' must coordinate with ordinary sortal kinds by reflecting that there are vague instances of objects, and must, therefore, be semantically indeterminate.

4.1 Semantic Indeterminacy

Sider focuses most of his defence of P5 on objections to P5iii, the premise that denies numerical sentences contain indeterminate expressions. We may counter P5 by claiming that the numerical sentences can be semantically indeterminate. We can permit vague cases of composition by identifying a plausibly indeterminate expression in Sider's numerical sentences.

The way we use natural language – including terms such as 'tall', 'blue', and 'heap' – is imprecise. Our language is precise enough to pick out Andre the Giant as a clear case of tallness,

and name Danny DeVito as clear case of non-tallness, but it is not at all clear where the exact boundaries of the predicate ‘is tall’ fall. The semantic theory of vagueness resolves sorites paradoxes by identifying that their source is our own semantic indecision, rather than a property of the world itself. David Lewis contends that vagueness is always the result of semantics:

> The only intelligible account of vagueness locates it in our thought and language. The reason it's vague where the outback begins is not that there's this thing, the outback, with imprecise borders; rather there are many things, with different borders, and nobody has been fool enough to try to enforce a choice of one of them as the official referent of the word `outback'. Vagueness is semantic indecision. But not all of language is vague. The truth-functional connectives aren't, for instance. Nor are the words for identity and difference, and for the partial identity of overlap. Nor are the idioms of quantification, so long as they are unrestricted. How could any of these be vague? What would be the alternatives between which we haven't chosen? (Lewis 1986, p. 212-3)

Lewis argues that by his lights, vagueness can come only from semantic indecision and cannot have ontological source. For Lewis, a theory can avoid vagueness by being stated in a logically regimented language that can never be indeterminate in truth-value. Sider concurs that vagueness always has linguistic source (Sider 2001, p. 125). By formulating P5 with numerical sentences, Sider attempts to eliminate the possibility that his argument can admit vague expressions.

A numerical sentence is indeterminate in truth-value when one of its expressions has admissible precisifications. The precisifications of an expression are the multiple candidate meanings for that expression, “no one of which has been singled out as the expression’s unique meaning” (Sider 2001, p. 125). Sider argues that numerical sentence *S* below cannot be indeterminate because it has no admissible precisifications:

$$S\text{:}\ \exists x \exists y\ \{Cx\ \&\ Cy\ \&\ x \neq y\ \&\ \forall z\ (Cz \rightarrow [x = z\ \vee\ y = z]\ )\ \}$$

Sentence *S* contains only logical terms and the predicate 'C', which stands for concreteness. Sider is cautious not to include in *S* any mereological terms, such as 'part of', since such expressions may admit multiple precisifications.[14] Therefore, objections to P5iii must find admissible precisifications to either the logical terms in *S* or its concreteness predicate. First, I address the possibility that one of its logical terms – the existential quantifier, specifically – is indeterminate, and then move on to consider whether the concreteness predicate is indeterminate.

4.2 Vagueness in the Existential Quantifier

Among the logical terms in a numerical sentence, I follow Sider in believing that "it seems overwhelmingly plausible that the boolean operators lack precisifications" (Sider 2001, p. 128). Only the existential and universal quantifiers seem to plausibly admit multiple precisifications. Moreover, it seems natural that if the source of indeterminacy of what exists is indeed semantic, then either the universal or existential quantifiers – the logical operators specifying the quantity of objects – harbour indeterminacy. We can deny P5iii by showing that the relevant numerical sentences are indeterminate because on some admissible precisifications of the quantifiers, the sentences are true, and on some others they are false.

For the purpose of argument, suppose that the existential quantifier '$\exists$' has two precisifications:

'$\exists_1$' ranges over *x* & *y*,

and '$\exists_2$' somehow ranges over *x*, *y*, and *z* (the object composed of *x* & *y*)

Since the numerical sentence S will turn out true when '$\exists$' precisely means '$\exists_1$' and will turn out false when '$\exists$' precisely means '$\exists_2$', we can say that *S* is indeterminate. This reply does

[14] For Sider's discussion of potential precisifications for 'is part of', see (Sider 2001, p. 125)

not claim that *z* vaguely exists, but rather claims that *z* definitely exists, and falls into the domain of $\exists_1$ but not into the domain of $\exists_2$. It follows then, that there are two distinct domains associated with the two different precisifications: $\exists_1$ ranges over the domain D_1, while $\exists_2$ ranges over the domain D_2. That each precisification of '$\exists$' subscribes to a different domain reveals the problem with this line of response. We cannot say that there exist different domains attached to the different precisifications of '$\exists$', because if there is something in D_2 that is not included in D_1, then D_1 does not include everything that there is.

Accordingly, $\exists_2$ is not an admissible precisification of '$\exists$'. To be admissible, any precisification of '$\exists$' must obey the logical operations of the existential quantifier. It must, for instance, be governed by the relevant introduction and elimination rules, and crucially, as an unrestricted quantifier, it necessarily must include *everything* in its domain. Although this is the existential – and not the universal – quantifier, the meaning of "everything" is relevant here. This occurrence of the existential quantifier does not assert existence relative to a limited physical domain (i.e. there is some x in the refrigerator, or in our solar system). Rather, this existential quantifier asserts the existence of some object among *everything physical.* As Sider astutely points out, "there seems to be only one 'everything' ", so this line of response requiring multiple domains fails (Sider 2001, p. 128). Korman recommends that proponents try to revive this strategy by finding "a way of characterizing the precisifications of the quantifiers which does not commit them to the existence of multiple candidate domains" (Korman 2010, p. 894).

One strategy that meets this criterion reasons that the quantifiers have precisifications, but that the precisifications are themselves vague. A proponent of this theory would claim that the precisifications of '$\exists$' generate different truth values, but they can describe these precisifications only vaguely; they could not define their domains or explain how they produce

different truth values. The relevant numerical sentences would then inherit semantic vagueness from the vague quantifiers, about which there is nothing more to say. Sider accuses this solution of taking "an unattractively quietist position (Sider 2003, p. 140)". I agree that it is too hollow an account of quantifier variance. The theory diagnoses that the quantifiers are vague, but painfully does not offer any reason why, apart from restating a belief in ontological vagueness.[15]

Neither of the attempts above succeeds, but at least they identify two criteria of an adequate theory of quantifier variance. To successfully deny P5iii by demonstrating that *S* is semantically vague, an account of quantifier variance must (i) not commit to multiple candidate domains, and (ii) describe its precisifications non-vaguely.

One final strategy I will now consider carves up the unrestricted domain according to different kinds of existence.[16] Since the argument from vagueness concerns different ways of carving up what exists, this strategy reasons that there are alternative ways of drawing boundaries within the domain of all that exists. Suppose one metaphysician believes that fictional entities have a kind of existence, but their kind of existence is not on par with that of concrete objects. She would include fictional entities among 'everything there is', but insist that in some cases '$\exists x$' ranges over fictional entities, while in other cases it does not. These

[15] Joshua Mozersky notes that someone could defend primitive ontological vagueness by appealing to Markosian's three criteria for bruteness. Following this line of response, there would be vagueness in the world, and it would not be due to a lack of epistemic access, nor of precisifications of language. I do not explore this response further, but if vagueness is brute, then it would support my position against Sider that there are vague concrete objects. If vagueness is not brute, that does not preclude there being vague concrete objects; it merely prevents them being primitively vague.

[16] This objection is intriguing, and it adds a new potential difference between the domains D_1 and D_2 in my earlier example. I constructed D_1 and D_2 such that the former includes objects *x* & *y*, and the latter *x*, *y*, & *z,* but I assumed that all objects have the *same kind* of existence. On this construal of the domains, Sider's response stands (Sider 2001, p. 128). However, if the different carvings correspond with different kinds of existence, then Sider's response falters, since we are working not with two separate domains, but rather within a single domain.

alternative boundaries within the unrestricted domain correspond with different precisifications of the existential quantifier, which accordingly would be semantically vague.

Van Inwagen considers this possibility of whether the existential quantifier can be indeterminate when it ranges over entities that have different kinds of existence.[17] He devises a universe that contains nothing but two cubes, exactly alike, whose sides measure one-foot. The two cubes drift together in such a way that it is indeterminate whether they are in contact. Now, consider the sentence 'There is something larger than a one-foot cube.' Van Inwagen contends it is indeterminate, and moreover, because its predicate is so precise, the indeterminacy cannot be explained by the linguistic theory of vagueness:

> The only predicate in this sentence is 'is larger than a one-foot cube'. Is there something in our imaginary universe that is a borderline case of a thing that falls under this predicate?... The obvious answer is: the thing the two cubes compose. But if there is such a thing, it definitely falls under this predicate , and if there is no such thing, then everything is such that it definitely does not fall under this predicate. What seems to be indefinite is this: whether there is an object that the two cubes compose. This suggests that the locus of vagueness in our sentence is not in its predicate but in its quantifier. But, really, what could that mean? How could the existential quantifier, as opposed to a predicate it is prefixed to, be vague? (van Inwagen 1987, p. 43).

Van Inwagen thinks that this situation involving the possible composition of the two-cubes can only be resolved by appealing to Meignonian objects. There would have to be, he reasons, a Meignonian object that is the composite of the two cubes. The Meignonian object has borderline existence, such that certain precisifications of the existential quantifier pick out this composite, while others do not. The vague existence of this Meignonian object generates indeterminacy in the existential quantifiers, thereby importing vagueness into the numerical sentence, effectively falsifying P5iii.

[17] See van Inwagen 1987, p. 43.

Van Inwagen reasons that this Meinongian resolution alleges three claims. The first is to commit to a Meinongian realm of non-existent objects, among which there is a Meinongian object, *K*, that is the nonexistent composition of the two cubes. The second claim is that the existential quantifier functions so as to pick out the items that belong only to the realm of the existent, and the third claim is that "the border between the realm of the existent and the realm of the nonexistent is vague" (43). The second and third claims depend upon the first. If Meinongian objects and the non-existent realm are indeed self-contradictory, then there are not two realms between which the quantifier selects, nor is there a vague border between them. Everything hangs on whether there is motivation to suppose there is this non-existent Meinongian object.

A Meinongian object, or a nonexistent object, is some entity that does not exist (Reicher 2014). On the face of it, nonexistent objects seem entirely paradoxical, for to say truthfully that there is an object that does not exist, it seems that one has to presuppose that it does. Nonetheless, philosophers have maintained this category of object in order to make sense of problems such as true negative existential statements. Pegasus, Santa Claus, the round square, pick out on the Meinongian view non-existent objects that allow us to truthfully make such claims as 'Santa Claus is too large to fit down my chimney.' For his part, Van Inwagen disagrees with the notion of a nonexistent object. He is dissatisfied with the Meinongian resolution to the argument from vagueness because the notion of a Meinongian object is incoherent: "I am convinced, as are many, that the idea of a nonexistent object is a self-contradictory one; therefore, in my view, there can no more be a thing that is a borderline case of a non-existent object then there can be a thing that is a borderline case of a triangular circle" (van Inwagen 1987, p. 43). I agree that the notion of a non-existent object is metaphysically

troubling. Such an object must, in some way or another, *be*, and the idea that there can *be* something that does not *exist* requires a coherent metaphysical distinction between *being* and *existing*. Assuming first that such a distinction can be made, it will inevitably be metaphysically burdensome. Committing to non-existent objects incurs an explosion of entities, whereby any object of thought becomes a constituent in some other ontological realm.

Accepting the Meignonian response to the argument from vagueness trades mereological fusions for non-existent objects, replacing one metaphysically mysterious object with another. Like van Inwagen, I think that the notion of a non-existent object should be dismissed as self-contradictory, but even if a non-existent object is metaphysically coherent, it bears heavy ontological baggage. We need not endorse this Meinongian solution when there is a much more simple and ontologically lightweight solution available. The response to the argument from vagueness I will now offer takes aim at the concreteness predicate, rather than the quantifiers, and does not incur heavy ontological commitments.

4.3 The Concreteness Predicate

I argue that the numerical sentence *S* can plausibly inherit semantic indeterminacy from the concreteness predicate 'C'. Evidently, the common notion of concreteness is vague, so Sider develops a technical definition of concreteness which he attempts to purge of vagueness. I argue that in purging all potential vagueness from the concept 'concreteness', Sider architects a wholly artificial concept defined purely abstractly. Since the argument from vagueness reasons to its conclusion with an artificial conception of concreteness, the argument cannot bear ontological weight.

Sider formulates the concreteness predicate as a list that restricts the relevant numerical sentences to include only those things that are *not* "sets and classes, numbers, properties and

relations, propositions, tropes, possible worlds, etc…" (Sider 2001, p. 127). No category on this list can admit borderline instances, for then 'C' would admit multiple precisifications, *S* would inherit its indeterminacy, and P5iii would be false. To demonstrate that the concreteness predicate is indeterminate, one could find admissible precisifications for any ontological kind on this list, such that this kind admits of borderline instances. Sider does not see this strategy as a threat because he invites us to add "any 'abstract' entities you believe in" to the characterization of 'C' (Sider 2001, p. 127). Because the (negative) definition of 'C' is open-ended, we might define the concreteness predicate by way of a list of *x* ontological kinds (L_1), but we might equally define it by way of listing *x* +1 ontological kinds (L_2). To avoid wasting time on this debate, I assume that there is a precisification L_x that captures all and only concrete objects.

The open-ended construction of the concreteness predicate is a noteworthy feature of its design. Elder is dissatisfied with this negative definition of the predicate, and he thinks that the burden of proof falls on Sider to positively define what is it for an object to be concrete:

> If Sider had some positive answer, he could argue that there cannot, in the nature of the case, be borderline instances of such objects - cases, for example, in which it is indeterminate whether concrete object *b* is a distinct object from concrete object *a*. (Elder 2004, p. 65)

The second noteworthy feature of the design is that Sider assumes the list characterizing the concreteness predicate contains only "fundamental ontological kinds that do not admit of borderline cases" (Sider 2001, p. 127). Furthermore, he supposes not only that there are no borderline cases of being a set, property, universal, trope, or situation, for instance, but also that "even if one of the members of the list is ill-defined or vague in some way, the vagueness is presumably of the kind not relevant to my argument: any way of eliminating the vagueness would suffice for present purposes" (127). The open-ended list characterizing 'C' and the

assumption that all ontological kinds on this list admit no borderline cases signal that Sider is working with an artificial notion of concreteness.

The reason Sider fashions a jerry-rigged concreteness predicate and avoids adopting a positive definition of concrete object is because it seems very plausible that usual concrete objects admit borderline cases. In the previous Chapter, I forced Sider into the dilemma of admitting that the in the continuous compositional series of an alpha particle, either there are vague cases of composition or there is a sharp cut-off. The compositional simplicity of an alpha particle inclines me to think that for simple objects, nature might admit sharp cut-offs. The majority of objects are more complex however, and as such do not seem to admit sharp cut-offs. Rather, I contend that kinds of objects like 'apple', 'person', and 'galaxy' all admit borderline instances.

Consider the compositional series that begins with a definite instance of an apple, and ends with its parts scattered a billion light years away. I agree with Sider on this: there are both cases that are apples and cases that are not, and that an apple ceases to exist somewhere along the series. If we alter the argument from vagueness by changing the predicate in the numerical sentence from 'is concrete' to 'is an apple', then Sider must admit that there is either a vague case or a sharp cut-off. Parallel arguments can be made for every object-sortal there is: the compositional series for 'apple', 'person', and 'galaxy' all admit either sharp cut-offs or (much more likely) borderline instances. Recognizing that his argument cannot work with the natural kinds of objects over which science quantifies, Sider retreats to a constructed notion of object, and tailors the generic notion of 'concrete object' so that it does not admit borderline cases. But if his artificial 'concrete object' is abstractly defined and does not align with any object-sortal, then what is the ontological status of concrete object? I will take this question up in Chapter 5.

For now, I will draw three conclusions from this discussion of semantic indeterminacy in the argument from vagueness. First, I agree with Sider that borderline cases require that the relevant numerical sentences are semantically vague. Second, the numerical sentences can inherit vagueness from the concreteness predicate. Third, Sider tailors the concreteness predicate to preclude borderline cases, revealing that he is working with an artificial notion of concrete object that does not align with any object-sortal. The argument from vagueness intends to deny that there can be borderline cases of concrete objects because it artificially conceives of concreteness as not admitting borderline cases. In the next section, I argue that there is a good reason to think there are borderline cases of concrete objects and that nature is ontologically indeterminate.

4.4 Ontic Indeterminacy

Historically, philosophers have rejected the view that the world is in some sense vague. In a 1923 address that contributed much to the modern fascination with vagueness, Russell claimed that vagueness is a feature of the relationship between language and the world, and not a feature of the world itself. In Russell's eyes, treating vagueness as ontological plainly commits "the fallacy of verbalism - the fallacy that consists in mistaking the properties of words for the properties of things" (Russell 1923, p. 85). Jesse Prinz nicely summarizes Russell's skepticism: "Postulating vague objects in order to explain linguistic vagueness is no more plausible than postulating ambiguous objects to explain linguistic ambiguity" (Prinz 1998, p. 2). Michael Dummett likewise dismisses ontological vagueness, claiming "the notion that things might actually be vague, as well as vaguely described, is not properly intelligible," (Dummett 1975, p. 314) and we have already seen that Lewis sides with them as well. Recently, however, many philosophers have revitalized the theory by sponsoring ontological vagueness of one kind or

another. Van Inwagen's ontology admits vague objects in the form of borderline cases of life; Parsons advocates for indeterminacy in the world, in the sense that there are vague states of affairs; and Hyde contends that there is no intelligible notion of the world that is pre-conceptual, thereby arguing that vague terms can designate vague objects (van Inwagen 1990; Parsons 2000; Hyde 2008). Dummett, too, changes his mind in later publications and admits that reality is vague (Dummett 2000). All this is to show that the vagueness in-the-world or of-the-world debate remains unsettled.

Sider addresses the argument from vagueness to an audience that locates the source of vagueness in language: "I simply assume that [the] theory of [ontological] vagueness is *not* correct" (Sider 2001, p. 129). The argument falls through if one believes that the world is itself vague. The ontic strategy against Sider must make a plausible case that the world is vague in and of itself.

Many philosophers resoundingly object to the ontological account of vagueness, but there is no consensus as to which argument best undermines its tenability (Barnes 2009, p. 82). There is, however, one particular paper that has taken center-stage in this debate. In 1978, Gareth Evans published a one-page argument that purportedly presents a *reductio* of the position that there are vague objects. Evans begins by considering

> that the world might itself be vague. Rather than vagueness being a deficiency in our mode of describing the world, it would then be a necessary feature of any true description of it. It is also said that amongst the statements which may not have a determinate truth value as a result of their vagueness are identity statements. Combining these two views we would arrive at the idea that the world might contain certain objects about which it is a fact that they have fuzzy boundaries. But is this idea coherent?

He proceeds to answer this question with the following proof. The operator "∇" expresses the notion of indeterminacy, such that he intends "∇A" to mean that A is indeterminate in truth-value:

(1) $\nabla(a = b)$

(2) $\lambda[\nabla(x = a)]b$

(3) $\sim\nabla(a = a)$

(4) $\sim\lambda[\nabla(x = a)]a$

(5) $\sim(a = b)$ [from (2) & (4), by Leibniz's Law]

And (5) suggests, contra the assumption in (1), that the identity statement "a = b" has a determinate truth-value. Evans notes, however, that (5) and (1) do not strictly contradict, yet he further reasons that he can strengthen his proof:

> If 'Indefinitely' and its dual 'Definitely' ('Δ') generate a modal logic as strong as S5, then (1) - (4) and presumably Leibniz's Law can each be strengthened with a 'Definitely' prefix, enabling us to derive
>
> (5') $\Delta \sim(a = b)$
>
> which is straightforwardly inconsistent with (1).

Despite appearances, the Evans argument is not an air-tight case against vague objects. Barnes points out that the argument "is a *reductio* of metaphysically indeterminate *identities*, not metaphysical indeterminacy or metaphysical vagueness *per se*" (Barnes 2009, p. 374). The Evans arguments assumes that ontic vagueness will entail ontically indeterminate identity, and the argument can be blocked either by showing that this entailment is fallacious, or by denying that it proves a case against ontically indeterminate identity.

For those tempted to countenance vague objects because of their restrictivist leanings, Williams presents an argument showing that the entailment of (5) in Evans's argument is fallacious. Williams responds to the Evans argument by suggesting there are many cases where ordinary names are referentially indeterminate. To illustrate Williams's position, suppose that we use the name 'Queen's University' to refer to any one among the distinct spatial regions Q_1, Q_2, or Q_3 . Whether we assign either Q_1, Q_2, or Q_3 as the referent of 'Queen's University', each utterance comes out true because "no particular one of these appears to be better placed, metaphysically or in point of fitting linguistic usage, to be the unique referent of the term" (Williams 2008, p. 139). The name 'Queen's University' is referentially indeterminate. Williams argues that the truth of the statement (i) 'it is indeterminate whether Queen's University is Q_1' crucially does not entail the statement (ii) 'there is something that is indeterminately identical with Q_1.' Put another way, statements expressing that Queen's University is indeterminately identical to Q_1 does not entail that there is some object which is indeterminately identical to Q_1. The identity claim cannot move to predicate something of an object as in (ii) because "with respect to imprecise designators no object is determinately denoted by the relevant singular term" (Hyde 2008, p. 117). Williams's strategy claims that it is impermissible for Evans to abstract properties in (2) and (4). This response to Evans finds that the *terms* in the argument are referentially indeterminate. There is no vague object here at all, but simply multiple candidates for the referent of 'Queen's University'.

Of course, there are many other reasons why one might reject or affirm the existence of ontically vague objects. Of those I have covered, the Williams counter-argument makes no more a definitive case against Evans than the Evans argument does against vague objects.[18] Rather

[18] For other attempts to rescue vague objects from the Evans argument, see (Hyde 2008, p. 114-127) and (Barnes 2009)

than taking up further arguments for and against vague objects, I will now present a second account of ontic indeterminacy, the 'vague-arrangement' possibility, that embraces an ontic theory of vagueness without committing to vague objects.

Sider asserts that if it is indeterminate how many objects exist, then there is an indeterminate numerical sentence that lacks a determinate truth value because one of its expressions is vague (P5ii). We can respond to Sider by claiming that the numerical sentence *S* lacks a determinate truth value not because *any one* of its terms are vague, but rather because the proposition expressed by *S* is *itself* vague. Given the simple predication 'F*x*', particulars and properties can be arranged such that a corresponding utterance is true, or arranged such that a corresponding utterance is false. Neither of these seems problematic, which raises the question of whether they can be arranged such that a corresponding utterance is indeterminate. In this case, no particular constituent of the indeterminate proposition 'the *x*s form a composition*'* is solely responsible for its indeterminacy, in the same way that no particular constituent of the proposition expressed by "I will have eggs for breakfast tomorrow" is single-handedly responsible for its indeterminacy (Korman 2010, p. 897). Hawley considers ruling out this possibility to be mere bias. That the world might be arranged such that utterances about it would be indeterminate

> is undoubtedly mysterious, but it is no greater mystery than that concerning how a particular and a property can be 'arranged in such a way' that an utterance concerning them is determinately true or determinately false. If we concede the possibility of indeterminate utterances, then ontic indeterminacy is in principle no more objectionable than semantic indeterminacy. There are simply two possible sources for indeterminacy in utterances: one is semantic indecision, and the other is vagueness in the world. (Hawley 2001, p. 112)

Hawley argues that we must have good reason to rule out the possibility that the world admits vague arrangements; ruling out this possibility otherwise is merely to express a bias against ontic indeterminacy. Yet general disbelief in ontic indeterminacy persists.

This disbelief is partly grounded in the strong evidence for the semantic theory of vagueness: referential indeterminacy can largely be explained by the imprecision of ordinary language. It is a mistake, however, to hold semantic indeterminacy and ontological indeterminacy as mutually incompatible. It is plausible that some instances of referential vagueness arise because our representations of the world are vague, while others arise because the world itself is intrinsically vague. Indeed, the argument from vagueness presents a strong case for vague objects. Continuous compositional series for ordinary object-sortals evidence that it is not indeterminate how many concrete objects exist because our representations of the world are vague, but rather because it *actually is* indeterminate what exists.

4.5 Vague Objects

To make the case that nature is ontologically indeterminate and that there are borderline cases of concrete objects, I have presented resolutions to the Evans argument, Hawley's advocacy for propositional vagueness, as well as the notion that ontological and semantic vagueness are compatible. Giving a full assessment of the logical coherence of an ontological theory of vagueness requires more than can here be explored about the nature of reference. Instead, I will now use Sider's compositional series to advocate for ordinary examples of ontological vagueness, and thereby disprove P5 in the argument from vagueness.

The continuous compositional series for the object-sortal 'person' has at one end a definite case of a person, and at the other end a case that is definitely not a person. Somewhere along the series it is not at all clear whether a set of particles forms a person; there are cases

where it is indeterminate whether the particles form a person. Sider and I agree on this point; in this previously quoted passage, Sider states that "it may well be indeterminate whether a given class of molecules has a fusion that counts as a *person*" (Sider 2001, p. 125). Sider must make this concession because many ordinary situations confirm that there are vague cases of personhood.

In discussing how the indefinite concept of 'personhood' affects dialogues in bioethics, Sarah Merrill writes "'Person' is inconsistently defined and used, loosely understood in general, and has fuzzy boundaries since it applies to creatures that come gradually into existence, grow, and then cease to exist" (Merrill, p. 45). Vagueness of the term 'person' reflects the looseness of the concept. Merrill identifies twenty-six features of the concept 'personhood' - among them physical appearance, autonomy, rationality, and the ability to express emotions - no one of which can be singled out as a necessary criteria of personhood (48). Many examples present ordinary instances of vague persons: someone who has suffered substantial brain damage, who is severely cognitively decayed in certain ways, who is on the verge of death, or who has died but still has residual neural communications passing through her brain.

Moreover, one can plausibly conclude that there can be borderline instances for many object-sortals, not just person.[19] The same argument can be run using the object-sortals 'apple', 'tree', 'galaxy', for all these are like 'person' in that their inclusion criterion cannot plausibly be precisely determined, and often enough there are borderline instances of each kind. Lewis criticizes that embracing vague objects commits to things "such that it sort of is so, and sort of isn't, that there is any such thing" (Lewis 1986, p. 213). Lewis words his criticism to highlight that vague objects are a kind of ontic mystery, the kind of funny business that metaphysicians

[19] Probably not all object-sortals admit borderline cases. In his comments on this paper, Joshua Mozersky suggests that there may not be physically possible scenarios where photons, for example, admit vague cases.

should avoid. Certainly, accepting that the world sort of is so and sort of isn't so makes for a less tidy metaphysical landscape. Although the ontological picture is less tidy, vague objects can account for what occurs when an apple is digested, or a tree is felled, or a person dies. There are instances where there is actually no answer in the universe itself whether some matter is or isn't an apple, a tree, or a person.

4.6 The Argument Against P5 in Sum

Having argued a plausible case for vague objects, I conclude this Chapter by presenting the whole argument against P5. First, I propose that there are vague objects. Second, I agree with Sider that borderline cases of composition require that the relevant numerical sentences are semantically vague, so I must explain where the sentences are indeterminate. To account for their indeterminacy, my third claim is that the concreteness predicate admits multiple precisifications. There are vague cases of composition, and the concreteness predicate should reflect this fact.

In Sider's book, the concreteness predicate fails to reflect that there are borderline cases of composition because of its fallacious design. Sider grants that there are vague cases of falling under an object-sortal, but he maintains that none is a vague case of a concrete object. If an alleged composition fails to fall under any object-sortal, however, then Sider's concept of 'composition' is very thin. The negative, open-ended definition of the concreteness predicate, which assumes the predicate is determinate, signals that Sider's conception of concrete object is artificial. For many other kinds of sortal other than Sider's abstract notion of 'concrete object', to say it has to be non-vague and to not admit sharp cut-offs is implausible. Sider attempts to block borderline cases of concrete objects by conceiving 'concreteness' as not admitting borderline cases. Sider faces this dilemma: he must adopt a notion of 'concrete object' that

aligns with ordinary kinds of sortals and permits vague objects, on pain of conceding that his artificial conception of ‘concrete object’ cannot bear ontological weight.

Chapter 5. Circular Reasoning and Ersatz Objects

Chapters 3 and 4 work towards forcing Sider into a dilemma: he must either recant P4 or P5, or he must concede that his notion of 'concrete object' cannot bear ontological weight. Neither option can support a universal theory of composition. The first option plainly denies universalism; asserting that there are either sharp cut-offs or, much more likely, that there are indeterminate cases of composition introduces restrictions on composition by respectively drawing either a fine line or a smear between composed matter and non-composed matter. To explain why an artificial notion of 'concrete object' cannot support universalism, I will now examine the nature of 'fusions', the objects populating the universalist inventory.

The Principle of Universal Fusions contends that any portion of spacetime forms a concrete object, a fusion. But what kind of thing is a 'fusion'? What ontological work do fusions do that makes universalism, according to the argument from vagueness, the only tenable theory of composition?

The answers to these questions reveal deep problems with universalism. Consider a dog and a ball: their fusion is neither a dog nor a ball. The dog-ball fusion is some sort of artificial, unrelated, even arbitrary, thing. Sider is not saying this fusion exists in some cohesive sense, held together in virtue of some relevant relations or new causal power, or that the laws of nature recognize the fusion as something different from its distinct parts. The world does not change in any sense - the ball and the dog remain as they always were - but the argument from vagueness nonetheless forces us to admit that there is also an object that is the fusion of the dog and the ball. In whatever kind of way a fusion is an object, it goes above and beyond any familiar use of "object".

Sider explicitly maintains that fusions are, indeed, genuine objects. Sider's fusions are not a kind of abstract entities like a set or the aforementioned Meinongian objects; they are concrete objects as real as any one of their parts. We can deduce this directly from the structure of the argument from vagueness. The argument from vagueness crucially depends on the claim that there must be a definite number of concrete objects. Sider defines concrete objects "as those which do not fit into any of the kinds on the following list: sets and classes, numbers, properties and relations, universals and tropes, possible worlds and situations" (Sider 2001, p. 127). He then says that any concrete objects form a fusion. Because the argument is cast in terms of concreteness, by extension we should understand that the fusions of concrete objects are themselves concrete objects. Yet, their ontological status still seems unclear.

The reason why the nature of a fusion is so unclear is that whether composition definitely occurs or definitely does not occur "is not concerned with the nature of the resulting fusion, only its existence" (125). Here Sider makes two claims about the continuous series for my desk. First, there is a composed desk that stops being a desk somewhere along the sequence, and it may stop being a desk as you move a single particle one trillionth of a nanometer, and second, whether or not any case in the sequence contains a desk does not affect whether the case contains a fusion, for every case forms a composite in virtue of being a fusion. It may well be indeterminate that a given class of simples counts as a desk, yet "this is not inconsistent with [P5], for the class may definitely have a fusion which is a borderline case of [a desk]" (125). Simply put, sequences start with an object and end with no object, but no sequence starts with a composition and ends with no composition. Sider's understanding of composition has to be more general than that of a sortal kind. Fusions *must* amount to an utterly general understanding

of composition. But, if a fusion is so abstract as to admit any material aggregate, then the notion of a fusion is question-begging.

5.1 P2 Begs the Question

Sider operates with a notion of composition that by definition is non-vague and not admitting of sharp cut-offs, then lo and behold, the argument from vagueness concludes that composition is such that there are no vague cases nor are there sharp cut-offs. Sider writes out the possibility that composition admits sharp cut-offs into the design of continuous compositional series, formulated in P2.

P2 states that each case in the continuous series is similar to the adjacent cases 'in all-relevant respects'. Sider defines the sequence connecting a definite case of composition and a definite case of non-composition as

> a finite series of cases in which each case in the series is extremely similar to its immediately adjacent cases in all respects that might be relevant to whether composition occurs: qualitative homogeneity, spatial proximity, unity of action, comprehensiveness of causal relations, etc. (Sider 2001, p. 123)

The qualification "in all respects that might be relevant" is both extremely important and highly suspicious. Sider lists only a few examples of the relations relevant to composition, concealing a myriad of other potential criteria behind a privative 'et cetera'. If we extended his shortlist to its long form, we might find ourselves equipped with enough diagnostic tools that we can identify cases that are extremely similar, but which actually differ in terms of composition. Obviously, 'qualitative homogeneity' is poorly suited to this task, but we should append not only standards that apply in most cases, such as 'preserving function', but also standards specific to certain cases.

We can imagine a continuous series for any possible combination of matter, but that does not entail that there is a general criterion that can distinguish two adjacent cases for every possible composition. Some continuous series will involve natural objects and others artifacts, and certain of these will be animate while others inanimate. The generality of the concept of composition stretches over such a great diversity that it is implausible for a general criterion to determine when any grouping comes together and when it does not. A complete compositional system needs to be elastic, multifaceted, and tailored to each case. Even if there were a complete compositional system, however, it seems implausible that it would determine the sharp cut-off for every compositional series. The set of criteria for personhood, as delineated by Merrill, suggests that many complex objects will admit vague instances rather than sharp cut-offs. Nonetheless, for many cases of composition, such as the alpha particle, a fleshed-out set of relevant criteria might reveal the precise threshold distinguishing a group of scattered parts from a unified entity. Since Sider obscures the extensive relevant criteria, P2 is not as innocuous as he would have us believe.

At the same time, Sider emphasizes that *whatever* the relations, the cases will be exactly similar in that respect. He formulates his premise to hold irrespective of how discriminating the relevant criteria may be: adjacent cases are "extremely similar…in *all* respects that might be relevant [emphasis added]" (123). In other words, the cases will be as similar as is required to confound attempts to deny its status as a composition. But that is the question: could adjacent cases be the same in every way *except* as to whether composition occurs? Sider is begging the question, and this is a sufficient reason to doubt the argument from vagueness.

5.2 Fusions are False Objects

Sider's design of continuous compositional series creates circularity in the argument from vagueness by presuming composition does not admit sharp cut-offs. Sider likewise writes off the alternative possibility by manipulating the notion of 'concrete object' to artificially not admit borderline cases. My argument that the notion of a 'concrete object' is question-begging appeals to distinction between a strong ontological claim and a weak ontological claim.

In one sense, we can interpret Sider's Principle of Universal Fusions as making a strong ontological claim. On the strong reading, there is no difference in kind between the most bizarre fusion of my laptop, my left thumb, and the dust in Saturn's ring, and the matter making up my writing desk. This is an improbable claim, and it requires substantial evidence. If Sider intends fusions to be genuine concrete objects, his argument fails because it operates with a conception of 'concrete object' that simply assumes it does not admit borderline cases. Alternatively, we can read Sider as making a weak ontological claim. The ontologically weak interpretation understands a fusion as merely a logical grouping of matter equivalent to a set. On the weak reading, the argument from vagueness merely concludes that there is no limit to when matter can be logically grouped together. If Sider defines the notion of 'concrete object' as any material grouping whatsoever, and probes this notion by asking 'When do those groupings fail to occur in this continuum?' the answer is, trivially, that they always occur. Sider can either have a very trivial conclusion that he can establish very easily, or he can have a strong conclusion that is question-begging: neither interpretation of 'concrete object' or 'fusion' can bear the ontological weight required to support universalism.

That the argument from vagueness must assume the broadest possible understanding of composition is its undoing. In answering the SCQ question 'Under what conditions do objects

compose, or add up to, or form, a whole?', Sider retreats to a radically general and technical notion of a fusion. I argue that to avoid circular reasoning, we can only interpret Sider as making a weak ontological claim. On their weak interpretation, fusions do not expose a portion of the world's structure; they are merely logical superficies that are metaphysically uninformative. Since any arrangement of matter forms a fusion, knowing that something is a fusion goes no further than saying that we are dealing with a concrete thing – in Sider's words, that we are dealing with "any filled region of space-time".

Joshua Mozersky sees fusions as being nothing more than an object collected in human thought. He writes: "It is not only that a fusion may be an indeterminate instance of any ordinary object; it may determinately *not* be any ordinary object at all: Russell's nose, a teacup, a spacebar and an office door have a fusion, but if so, this fusion won't fall under any existing sortal predicate. Fusions may, of course, be admitted as objects of *thought*, but that is not to be a distinct entity in the inventory of the world." (Mozersky 2015, p. 336). That there is a fusion of A and B is merely the claim that there is nothing logically impossible about the union of A and B. Logic, like set theory, is completely unrestricted in this way, meaning "[some fusions] are irreducibly plural and do not constitute a unit or individual in any concrete sense" (339). Some fusions are so general that they are too thin to be metaphysically informative; fusions cannot bear any ontological weight.

George Boolos once sat at his breakfast table, contemplated his bowl of Cheerios, and remarked: "But is there, in addition to the Cheerios, also a set of them all? And what about the $>10^{60}$ subsets of that set?... It is haywire to think that when you have some Cheerios, you are eating a set – what you're doing is: eating THE CHEERIOS" (448). Boolos thought that one can group things together without forming a new object, yet Sider says they always form a new

object. Sider would claim that the bowl contains more than 10^{60} concrete objects at any moment of time. Yet these purported objects do no work in determining that there are many rings in the bowl, or that each bunch of grains forms a Cheerio. To do this, we have to appeal not to fusions but to ordinary sortal-kinds, so why not limit ourselves to the Cheerios, not the Cheerios-fusion? Boolos would agree that a fusion, like a set, is merely a logical grouping of matter, but not a genuine object.

Fusions are merely ersatz objects because they can exist when the relevant objects do not (Mozersky, p. 339). The kinds of entities that fall into the extensions of ordinary sortal predicates are more than mere groupings of parts, and fusions make composite objects out to be nothing more than their parts. But it is clear that many composite objects *are more* than their individual components, because the arrangement of matter is relevant to whether it forms an object. The car on the assembly line, for instance, is not just a mereological sum of axles, wheels, seatbelts, and airbags. All these parts and their mereological sum exist not only throughout the car's lifespan, but also before the car comes into existence and after it ceases to exist. Unlike the car, the mereological fusion exists when the car's parts are scattered along the assembly line, and also when the car is disassembled, and also when its remains are compacted into a steel cube. Universalism claims that objects are coming into and going out of existence under all *any* conditions whatsoever, which Kathrin Koslicki argues is equivalent to claiming "that it is entirely irrelevant to the question of whether objects come into (or go out of) existence how particular bits of matter are arranged at any given time" (Koslicki, 122). Fusions do no metaphysical work because they cannot distinguish between a composition that merely forms a mereological sum, and a composition that forms a bonafide object. Accepting the existence of a fusion requires a commitment to nothing more than the existence of the objects that make up the

fusion. In Koslicki's words, this is a disturbingly "deflationary conception of what it means to be an object" (129).

5.3 Restrictions on Composition for Non-Individuative Physical Substances

Sider carries out his entire argument from vagueness just in terms of individual objects. Individual objects are physical substances with built-in individuating principles, such that they are referenced by count nouns such as 'person', 'desk' or 'alpha particle'. Following Sider's lead, I have so far limited my discussion of his argument to just this category of physical substances, but this limitation of Sider's argument omits an entire category of matter: stuff - physical substances without individuating principles, such that they are referenced by non-count nouns such as 'clothing', 'gold' or 'whisky'. Since Sider intends his universalist thesis to apply to matter generally, his argument should consider every kind of physical substance and take into account not only individual objects, but also amounts of stuff. Yet Sider has nothing in his argument to show that composition cannot be restricted in the case of stuff. I argue that it is restricted.[20]

To determine whether there are restrictions on composition for stuff, two questions need answering. First: does an amount of stuff form a composed whole? Second: granting that there are stuff-compositions, are there restrictions on when stuff composes a further whole? I cannot properly attend to the first question within the constraints of this paper. Initially, this does not seem a major concern; since the second question asking whether there are restrictions on

[20] This paper centrally concerns my attempt to show that Sider's argument from vagueness can only support a weak interpretation of the Principle of Universal Fusions, according to which fusions can merely be logical groupings of matter. I need not weigh-in on the ontological status of amounts of non-individuative stuff to demonstrate that the argument from vagueness is ill-formed, since I have demonstrated it is question-begging using individual objects.

composition seems more relevant to my discussion, I can simply stipulate that there are indeed stuff-compositions, and then discuss the possibility of their being restricted. Yet, the two questions seem knotted together: To determine whether there are restrictions on composition, one must know what it is for some stuff to form a composition in the first place. Keeping in mind that the question of whether stuff forms compositions requires more exploration, I offer the following example that I believe presents a plausible account of the restrictions on composition for non-individuative physical substances.

Suppose there is a cask of aged whisky.[21] The whisky is distributed into fifty bottles, which are shipped off to various destinations around the world to be sold. Although the whisky is now scattered across the U.S., Germany, China, and Canada, the bottled whisky is no less an actually existing amount of whisky now than when it was in the cask. Applying our two questions to this scenario, we can ask: does the whisky, whether in the cask or in the bottles, form a composition(s), and if so, what is (are) its nature(s)?

The structure of language suggests that there is a unified object that is the whisky, whether it is collected in the cask or scattered in the bottles. An utterance such as 'That fine batch of whisky' illustrates how a unity can emerge out of an amount of stuff when a single term is used to designate it. In uttering the phrase, the thinking goes, we have collected the whisky. Yet we have only collected the stuff in a thought expressed by a phrase; the phrase does not generate an object out there in the world. The troubling feature of plural references such as 'these bottles' and mass noun phrases like 'this whisky' is that they reduce *many things* and *so much* to a single reference. It is mistaken to think that this semantic reduction reflects an ontological unity. In other words, it is mistaken to believe that referring to a number of things

[21] Henry Laycock proposed this situation in a personal communication, and I thank him for prompting me to address this oversight in Sider's argument.

and referring to one thing are equivalent. We should not think that there is a genuine, unified object that is the scattered whisky on these grounds alone. Analyzing mass noun reference exposes the mechanics of a convenient way to think and talk about stuff; it does not reveal how stuff - like whisky - is in and of itself. 'Whisky', (or 'water', 'gold', or any non-count noun) refers to an amount of stuff. In and of itself, the amount of whisky is not a number of things, since the idea of a singular individual is absent from the concept 'whisky'. Is the amount of whisky a single thing? Consider again the phrase 'That fine batch of whisky'. The amount is there all right; whether it is collected in the cask or scattered in the bottles, it is so much whisky. But is this amount of stuff a unit: Is it a kind of entity that warrants being included in the inventory of the world as a unified composition?

Applying the factors standardly assumed to be relevant to composition, a case can be made that the whisky forms a composition. Whether it is collected in the cask or in each individual bottle, the whisky fulfills many of these factors: it is spatially connected, qualitatively homogenous, and contrasts with its environment. While the whisky fails to fulfill *all* the factors assumed to be relevant in the case of individual objects, such as unity of action, it seems plausible that the factors determining whether non-individuative physical substances form compositions differ from those factors relevant to individual objects. There are substantive physical laws determining how liquids operate in the world, and on these grounds, it can be argued that there are principles restricting when stuff is composed. It can be argued that the whisky forms a composition when it is contained in the cask, and when bottled, it forms fifty distinct compositions.

The counter argument reasons that compositions of non-individuative physical substances are not genuine objects. Both the cask and the bottles collect the whisky extrinsically; the

whisky itself has no natural units. If the amount of whisky, whether in the cask or in the bottles, is a unit, it is an artificial unit imposed by its container. I accused Sider's fusions of being merely logical groupings of matter, and this counter argument alleges that whisky-compositions are likewise artificial objects. Nonetheless, there is an important difference between the two that suggests that whisky-compositions are more than mere logical groupings of matter. Unlike Sider's fusions, compositions of non-individuative physical substances cannot be reduced to their individual members. With fusions, we have the individual things, and I argue that there is *not* an additional thing - their combination. Conversely, a composition of stuff cannot be reduced to its atomic parts, since it has none. To say that the whisky in the cask is an artificial composition requires some logical fancy footwork, but it seems equally difficult to claim that an amount whisky lacks artificiality, since it is collected extrinsically by its environmental niche.

In sum, for an amount of whisky to be considered a composition, what is needed is some way of moving from an amount of stuff *as much*, to the idea of a unified composition. It is outside the scope of this paper to supply such an account, but it is possible that stuff forms compositions. If there are such things, it seems entirely plausible that substantive considerations about matter determine the constraints as to whether stuff forms a composition, just as I have shown that there are substantive considerations that determine whether individual objects form compositions. It is not obvious a priori what is the ontological status of the whisky when it is collected in a cask or scattered in bottles, but it seems plausible that its physical and metaphysical properties determine whether it forms a composition or not. Sider assumes that there could not be any such principles at work. That the argument from vagueness has nothing to show that composition cannot be restricted for non-individuative physical substances signals that

Sider tilts the argument in advance to favour his conception of a fusion, which is non-substantive.

Chapter 6. Conclusion

The argument from vagueness argues for mereological universalism, the thesis that for any arbitrary collection of objects, there is a further object that is the mereological fusion of those objects. Sider asserts that since there is no principled reason why an arbitrary aggregate of matter does not form a composition, when an aggregate composing some familiar object does form a composition, we should adopt an unrestricted principle of composition. The idea that any portion of space-time, however arbitrarily assembled, composes a genuine object challenges nearly all human intuitions about, and experiences in, the physical world, and inflates the ontology of physical objects to unbelievable proportions. I argue that we are not resigned to the bizarre metaphysics proposed by the argument from vagueness.

The strategy I take in this paper forces Sider into the dilemma of either recanting his denial of indeterminate cases of composition or sharp cut-offs with respect to composition, on pain of conceding that his notion of 'concrete object' is ontologically weak. Chapter 3 attempts to persuade the reader that there are plausible cases of sharp cut-offs in composition. Chapter 4 makes a stronger argument that there are cases where it is indeterminate whether some matter forms a composition and that we should therefore embrace vague objects.

The positive counter-suggestion to Sider's universalism theorizes that composition is restricted, and that the lines between composed matter and non-composed matter may occasionally be finely drawn, but in general are blurred. This restricted view of composition is more consistent with the natural science of physical objects.

In Chapter 5 I combined my positive counter-theory of composition with an analysis showing that the argument from vagueness is question-begging. The argument from vagueness ultimately rests on the point that we have no clear idea where to draw the line between being and

not being an object, while at the same knowing that it is clear that the object occurs in some cases but does not in others. This is the undoing of the argument. To avoid circular reasoning in the notion of 'concrete object', we must interpret a 'fusion' as ontologically weak.

On the ontologically weak interpretation, Sider's universalism is too general an account of composition to provide an informative answer to the Special Composition Question. We can answer the SCQ by saying that composition always occurs because any set of objects forms a 'fusion', but this answer misses the mark. The SCQ, it seems to me, is not asking under what conditions do some parts form a mereological sum; rather, the SCQ asks when do some parts form a further object - an apple, a desk, a person, or a galaxy. Given that any physical aggregate counts as a fusion, but only a subset of fusions count as kinds of objects, I argue that the conception of a fusion makes no ontological commitments. Sider carves out an utterly generalized ontological entity, but he fails to demonstrate sufficient reason to accept this entity as a kind of ontological category apart from its utility in resolving the argument from vagueness. We can have a fusion that surely overlaps with a person, and we can have a fusion that is the borderline case of a person, and we can have a fusion that is definitely not a person. By saying that every concrete thing comes together as a fusion, Sider purports to have answered the Special Composition Question. His answer, however, simply generates another question: under what conditions is a fusion an object? Universalism offers no answer, but *this* is the question that is metaphysically substantial.

By limiting ourselves to sortal kinds and dismissing fusions, we can say that sometimes composition occurs, and sometimes it does not. Hold two apples your hand. The weight being held in hand is just the weight of the one and of the other, the nutrients being held in hand are simply those contained in the one along with those contained in the other. All empirical

evidence suggests that what is is just the two objects: why believe there is a third concrete object, let alone millions? If we are compelled by the idea that ontology should operate under empirical load, that we should object to fusions because physical laws do not apply to randomly assembled aggregates, and that fusions are metaphysically uninformative, then the argument from vagueness offers no substantive objection to restricted theories of composition. Sider can eat his cake and have its fusions, too, because in the end, only the cake genuinely exists.

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