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Natural Objects

ABSTRACT: *This paper introduces a framework for thinking about ontological questions—in particular, the Special Composition Question—and shows how the framework might help support something like an account of restricted composition. The framework takes the form of an account of natural objects, in analogy with David Lewis's account of natural properties. Objects, like properties, come in various metaphysical grades, from the fundamental, fully objective, perfectly natural objects to the nomologically otiose, maximally gerrymandered, perfectly non-natural objects. The perfectly natural objects, I argue, are the mereological simples, and (roughly) a collection composes an object of degree-n naturalness if and only if its members are arranged F-wise, for some property F that appears in the degree-n natural laws. Arbitrary composites turn out to be perfectly non-natural objects and are metaphysical bystanders. Ordinary composite objects fall in between. Some—e.g., atoms—are very (though not perfectly) natural; others—e.g., tables—are highly non-natural.*

KEYWORDS: metaphysics, ontology, mereology

Molecules are composed of atoms, and atoms are composed of protons, neutrons, and electrons. Tables are composed of tops, legs, and miscellaneous bits of hardware. I myself am a composite object, made up of a head, arms, legs, etc. But not every collection composes another object. For example, my cat, Blixa, and the Eiffel Tower compose nothing—there is no *Blixa-Eiffel*, no object that has exactly Blixa and the Eiffel Tower as parts.

So much is common sense, anyway. But these commonsense judgments invite van Inwagen's (1990: 21ff.) *special composition question*:

> (SCQ) Under what conditions does a collection of objects compose another object?

An answer to (SCQ) that respects common sense, a *restrictivist* answer, will deliver *restricted composition*: some, but not all, collections compose objects. But finding

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the *right* account of restricted composition is hard. The account must deliver the right composite objects ('yes!' to tables, 'no!' to the Blixa-Eiffel). The account ought to be noncircular and non-question-begging—it ought not simply *assume* the existence of composite objects nor make use of the notion of composition. (So we can't, for example, answer it with 'whenever the collection is a collection of the parts of some object' or with 'whenever the collection composes an atom or a molecule or a table or . . . '.) The account ought not be arbitrary or brute—we can't simply list the collections that compose something, as we'd like our answer to (SCQ) to tell us why *these* composite objects and not others. (Though see Markosian [1998] for a defense of mereological brutalism.)

Some philosophers have despaired of finding an adequate account of restricted composition and so have endorsed one of two extreme answers to (SCQ). According to the mereological nihilist, objects *never* compose anything. There is no Blixa-Eiffel, but there are no tables either. According to the mereological universalist, objects *always* compose something. There are tables, but so too is there a Blixa-Eiffel; in some versions of universalism, there are even objects that appear to violate the laws of physics.[1] Both extreme answers to (SCQ) are non-question-begging, nonarbitrary, and nonbrutalist. Each, according to its partisans, helps us disentangle various philosophical snarls. But since they either deny the existence of tables or admit the existence of the Blixa-Eiffel, nihilism and universalism violate common sense. They are error theories.

In what follows, I'll present some work toward an account of (something like) restricted composition, in the form of a theory of *natural objects*. There are really two parts to this task that, though separable, I won't try very hard (here) to separate. First: a framework for thinking about what sorts of objects there are—in particular, what sorts of composite objects there are. This is the *basic* theory of natural objects, and it can be adopted by all parties to the mereological debate. The basic theory relies on some minimal claims about objects, properties, and natural laws; but it leaves a great many important questions about these issues open, and it doesn't by itself settle any mereological questions. Second: an attempt within the framework to answer some of the mereological questions. This *extended* theory of natural objects is the account of composition proper. The extended theory rests on more substantive assumptions about objects, properties, and laws; for the most part, I'll leave these implicit and undefended. Of course, these assumptions need to be explicated and argued for eventually, and I intend to take up this burden—along with an exploration of alternative ways to extend the basic theory—elsewhere.

1 Dorr (2002, 2005) and Cameron (2010) advocate mereological nihilism; Merlo (2010) argues that Leibniz is also best construed as a nihilist. Van Inwagen (1990) and Merricks (2001) are *almost* nihilists, claiming that the only composite objects are living organisms. Lewis (1986: 211–13) and Sider (2001: 121–32) argue for universalism. See Hudson (2002, 2003), Balashov (2003a, b), and Hawthorne (2006: ch. 6) on objects that appear to violate natural laws (Hudson pro-, Balashov anti-, Hawthorne nuanced). Thanks to two anonymous reviewers for directing me to this latter literature.

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1. Some Preliminaries

Answers to (SCQ) will have the following form:

(SC) ($\exists y$) the x's compose y if and only if _____,

where the right-hand side of the biconditional specifies a condition on the x's. But I want to start out by considering the special composition question from a slightly different perspective. Instead of considering what it is for some things to be *parts* of another (e.g., to be in contact, or to be connected, etc.), I first want to consider what it takes for there to be an object—or, at least, for there to be an object of a certain 'metaphysical grade'. That is, in trying to fill in the right-hand side of the answer schema (SC), I think we should begin by looking for a condition connected to the '($\exists y$)... y' portion of the left-hand side, rather than looking directly for a condition on the x's. Of course, we can't *rest* with such an answer, for then we would beg the question against the nihilist, who thinks that there are no composite objects—and so no composite objects that could meet the proposed condition. (The restrictivist and the universalist both think that there are *some* composites; they just differ over cases.)

In tackling the left-hand side of (SC), I want to make use of David Lewis's (1983) theory of natural properties. Here are the key features:

- Properties are (perhaps cross-world) sets of individuals. Properties are abundant: every property is a set, every set is a property.
- Some properties are more *natural* than others; some properties are *perfectly* natural. The perfectly natural properties are sparse.
- Natural properties ground relations of objective similarity, causal relations, etc., and they form (part of) the minimal basis for the characterization of worlds.
- We identify natural properties through the roles they play in natural laws.
- Laws, like properties, are more or less natural. The laws of fundamental physics are more natural than, for example, the laws of chemistry.
- The perfectly natural properties are those treated by the perfectly natural laws.

There's a lot more work to be done here, fleshing out the relevant notion of naturalness, and some of the details may make a difference to the ultimate account of composition we end up with. But for the moment, I'm just going to take all of this as given and in order. (Lewis himself suggests that the theory of natural properties may help with an account of how we distinguish objects though he puts it in semantic, rather than ontological, terms: objects with 'boundar[ies] well-demarcated by differences in highly natural properties' are 'highly eligible referent[s]' [1983: 48–49]—see section 2 below for some brief discussion of this suggestion.)

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I should also mention what I'm *not* assuming: extreme modal realism (nor, in fact, any other particular account of the nature of possible worlds), Humean supervenience, or a fundamental ontology of space-time points (perhaps along with point-sized occupants of space-time). I'm not even tied to counterpart theory being *the* right treatment of metaphysical modality. I'm inclined to take counterpart theory and Lewis's account of properties as a formal tool that's handy for modeling certain philosophical problems, among them problems in mereology and ontology. (See Paul [2012, especially section 2], for an elaboration and defense of metaphysics as modeling.) Thus, what follows, though in some sense Lewisian, is most definitely *not* Lewis.

2. Natural Objects

I think we can make progress on (SCQ) by extending the notion of naturalness to objects: some objects are more natural than others, and some objects are perfectly natural. What does it take for an object to be perfectly natural?

Answer one: An object is perfectly natural just in case different perfectly natural properties are instantiated on either side of its spatiotemporal boundaries (cf. Lewis 1983: 48–49).

Objection: It seems possible for two distinct perfectly natural objects of the same type—two objects that share their perfectly natural properties—to be spatiotemporally contiguous. Likewise, it seems possible for two distinct perfectly natural objects to overlap spatiotemporally for all or part of their lifetimes. (Suppose, for example, that electrons are perfectly natural; on some interpretations of quantum mechanics, the two electrons in a ground state helium atom occupy the same space.) Answer one, however, rules out both of these possibilities.

Answer two: An object in world w is perfectly natural just in case it appears in the fundamental inventory of the objects of w. The perfectly natural properties are the fundamental properties of a world. But for a full account of a world, we need to augment the laws with a list of the world's fundamental objects. An object is perfectly natural if and only if it appears on this list.

Objection: Certainly, the perfectly natural objects are the fundamental objects, and vice versa. But unless we have some independent means of determining which objects are fundamental, this is no help in figuring out which objects are perfectly natural. And answer two offers no such means. The problem of determining which objects are fundamental is simply coextensive with the problem of determining which objects are perfectly natural.

Answer three: An object is perfectly natural just in case its unit set is a perfectly natural property. (Call the unit set of an object its *haecceity*. Lewis has no objection to haecceities conceived of simply as unit sets of objects—see Lewis [1986: 225].)

Objection: Though I'm not entirely convinced he'd endorse this consequence, Lewis's (1983: 27) definition of duplication entails that haecceities aren't perfectly natural—at least not if duplication is possible. According to Lewis, two objects are perfect duplicates just in case they both have all the same perfectly natural

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properties. Properties are sets and are had exactly by their members. Since haecceities have only one member, no two objects can share a haecceitistic property. Thus, perfect duplicates do not share haecceities, and haecceities aren't perfectly natural. This argument takes the grounding of objective similarities to be a *necessary* feature of perfectly natural properties.

We reach the same conclusion if we insist that any perfectly natural properties *must* figure in the perfectly natural laws. The laws are, presumably, general—and so don't cite haecceities. They may treat of electronhood, but not of being-this-particular-electronhood. So: all perfectly natural properties appear in the perfectly natural laws; no haecceity appears in the laws; therefore, no haecceity is perfectly natural.

Despite these arguments, I think there's good reason to accept that some haecceities *are* perfectly natural. Haecceities don't contribute to objective similarities, and they don't provide grist for the laws. But another crucial role for the perfectly natural properties is carving reality at the joints—and this haecceities *can* do. The perfectly natural haecceities carve reality into *objects*. Taking this route, we must modify the Lewisian definition of duplication: two objects are perfect duplicates just in case they have all the same perfectly natural non-haecceitistic properties (cf. Sider 1996: 4, especially the quote he draws from Moore [1951: 262]). And we must allow that some perfectly natural properties—the haecceitistic ones—can be instantiated without figuring in the natural laws.[2]

Still, admitting perfectly natural haecceities gets us no closer to identifying the perfectly natural objects; for now we face the question: under what conditions is a haecceity perfectly natural? It obviously won't do to answer: when it is the unit set of a perfectly natural object. And as we've just seen, the usual tools we use to pick out perfectly natural properties—investigation of the natural laws, reasoning about what is and is not preserved by duplication—are ill-suited for working with haecceities. Thus, answer three, even if correct, is in the same boat as answer two: it doesn't give us any way to get an epistemic grip on the perfectly natural objects.

Answer four: An object is perfectly natural just in case it has only perfectly natural properties.

Objection: Every intra-world and cross-world set of objects is a property. Given the abundance of properties, no object has only perfectly natural properties. Indeed, every object has infinitely many—uncountably many—non-natural properties. So, on answer four, there are no perfectly natural objects at all.

The final answer: An object is perfectly natural just in case it has some perfectly natural property. Consider what the perfectly natural properties are: they are the properties that appear in the perfectly natural laws of some world w and regulate the fundamental order of that world. If F is a perfectly natural property, then any

2 There's a further odd feature of haecceities in the context of Lewisian property theory. Since according to Lewis (1983: 26), property F is intrinsic just in case any two perfect duplicates either both have or both lack F, haecceities aren't intrinsic, either. But *surely* an object's haecceity is intrinsic to it if any property is! Sider (1996: 4) addresses this worry by distinguishing qualitative and nonqualitative intrinsicality and insisting that Lewis's account is an explication only of the former. Instead, we could define intrinsicality thus: property F is intrinsic just in case (a) it is haecceitistic, or (b) any two perfect duplicates either both have or both lack F.

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object (at w) with F is directly subject to the perfectly natural laws of w. Thus anything that has a perfectly natural property is the kind of thing that plays a role in the fundamental order of w.

It may seem that *mass* provides a counterexample to the final answer. Tables, for example, have mass, and mass is a good candidate for a perfectly natural property. But surely whatever role tables play in the world isn't a fundamental one. Thus tables have at least one perfectly natural property but aren't perfectly natural objects. It gets worse: since *every* collection of massy particles itself has mass—including the collection arranged Blixa-Eiffel-wise—the final answer threatens to count all manner of odd objects as perfectly natural. A criterion for perfect naturalness that can't distinguish electrons and Blixa-Eiffels isn't fit for purpose.

The nihilist, of course, doesn't face quite the same worry here—there *are no* tables, so tables don't have mass. Still, the nihilist may still want to distinguish between *pluralities* that are highly natural (e.g., those arranged isobutane-wise) and those that aren't (e.g., those arranged Blixa-Eiffel-wise). For the next few paragraphs, nihilistically inclined readers should make free use of van Inwagen's (1990: ch. 11) method for paraphrasing talk of composite objects and their parts away in favor of talk of pluralities and their members.

In response to the objection from mass: tables (and Blixa-Eiffels) aren't treated by the laws of mechanics, gravitation, etc., *in addition* to their particles being so treated. A table's mass *just is* the sum of the masses of the particles comprising it. As far as the basic laws of physics are concerned, the table itself might as well not be there. Indeed, it *can't* be there: if, in the context of Newton's second law, we were to treat the mass of the table as distinct from the masses of the particles that it comprises, we would systematically misdescribe the behavior of the system. Once we account for the role played by the masses of the particles, there's just no role left for the mass of the table (cf. Merricks' [2001: ch. 3] overdetermination argument for the nonexistence of most composites and Zimmerman's [1995] and Rea's [1997] discussions of the problem weight poses for colocation).

We might take this argument to show that tables and other nonfundamental objects don't have mass. But this conclusion conflicts with both common sense and the Lewisian account of properties. For example, consider the class of objects with parts whose masses sum to 20 kilograms. Since properties are abundant, this class is a property, and I see no good reason to deny that it's the property *having mass of 20 kilograms*. Recall, though, that the perfectly natural properties are *sparse*; as Lewis (1986: 60) says, 'there are only just enough of them to characterise things completely and without redundancy'. Since—with respect to the fundamental laws—the masses of composites are rendered redundant by the masses of their proper parts, the right lesson is this: not all mass properties are perfectly natural because not all mass properties are fundamental. The masses of electrons and other fundamental particles are, plausibly, perfectly natural; the masses of tables and Blixa-Eiffels are not.

Many philosophers have recognized the need to distinguish between basic properties—say, the mass of a fundamental particle—and closely related properties had in virtue of composition, constitution, or membership—say, the mass of a

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table (see, for example, Sider [1993: 33–34], Hawthorne [2006: 124–26], and Baker [2007: 166–69]). We can implement the insight by following Sider's (1993: 33–34) treatment of *charge*. Distinguish *having mass of 20 kilograms* from *having net mass of 20 kilograms*. Object x has mass n if and only if x has net mass n and no proper part of x has any net mass, and x has net mass n if and only if the sum of the masses of the proper parts of x is n. *Mass* properties are perfectly natural; *net mass* properties are not.

With the objection from mass out of the way, we have the following definition of perfect naturalness for objects:

(PNO) Object o is perfectly natural if and only if o has some perfectly natural property.

We can generalize (PNO) to less-than-perfect naturalness. Let degrees of naturalness run from 1 to 0, with degree-1 being perfect naturalness and degree-0 being perfect non-naturalness. Then:

(NO) Object o is degree-n natural if and only if o has some degree-n natural property and has no degree-n' natural property for $n' > n$.

The second conjunct of the definiens is needed because of the abundance of properties; if it were omitted, objects could have multiple degrees of naturalness. Indeed, every object—including every perfectly natural one—would count as a perfectly non-natural object.

Note that, depending on how the natural laws turn out, an object's degree of naturalness may be a vague matter. Suppose that there are degree-n laws of biology that, given the background facts, demand the presence of a single cat in some general region of spacetime—say the region currently occupied by my cat Blixa. Now consider the myriad cat-like collections in that region: Blixa with all his hairs, Blixa with all but one particular hair, Blixa with all but another particular hair, etc. Which of these collections composes the cat?[3] If exactly one of the collections is best suited to satisfy the laws—if just one has the relevant degree-n property—then that collection unproblematically composes a degree-n object. The remaining collections compose (presumably) less natural objects, if they compose anything at all.

However, Lewis (1993: 172) finds it implausible that exactly one of the cat-like collections can be thus distinguished: 'nature is gradual, no handy joint in nature picks out one of the [collections] from all the rest'. The various collections are all too alike in their cat-likeness. So suppose that many—even all—of the collections *could* serve the biological laws, but the laws (plus background facts) rule out more than one collection actually doing so. In that case, exactly one collection satisfies the relevant biological laws, but it is indeterminate *which*. It is also indeterminate

3 This is the problem of the many, due to Unger (1980) and Geach (1980: 215–16). The presentation in terms of cat-like objects comes from Geach by way of Lewis (1993). Thanks to an anonymous reviewer for pointing out the consequences of the problem for the account of natural objects.

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which of the collections has the relevant degree-*n* natural property (thus composing Blixa, a degree-*n* natural object) and which have only less natural properties (thus composing less natural objects). This is, roughly, Lewis's own (1993: 171–72) 'better solution' to the problem of the many.

The perfectly natural objects of a world, then, are those objects that have properties appearing in the fundamental laws. Objects of a degree of naturalness between 1 and 0 don't have any perfectly natural properties, but they do have properties of some other nonzero degree of naturalness, properties that don't appear in the fundamental laws but do appear in nonfundamental laws. Perfectly non-natural objects have only perfectly non-natural properties, properties that don't appear in any laws at all, fundamental or otherwise. Perfectly non-natural objects are otiose in an account of the functioning of the world.

3. Special Composition

With the basic framework of natural objects in place, I'd like to consider a slight variation on (SCQ), the *modified* special composition question:

(MSCQ) Under what conditions does a collection of objects compose an object of degree-*n* naturalness?

Answers to (MSCQ) will have the form

(MSC) ($\exists y$) the x's compose y and y is a degree-*n* natural object if and only if _____.

We can ask the modified special composition question for any particular degree of naturalness. And so we can now discern various strengths of the standard mereological positions, distinguished by how they answer these different instances of (MSCQ):

- *Hard nihilism:* For every *n*, no collection ever composes degree-*n* natural objects. There are no composite objects of any degree of naturalness whatsoever, not even degree 0. (This, I think, is the most plausible way to read the nihilist.)
- *Soft nihilism*: No collection ever composes degree-1 natural objects. No composite object is perfectly natural.
- *Moderate nihilism*: For every $n > 0$, no collection ever composes degree-*n* natural objects. Every composite object is perfectly non-natural.
- *Hard universalism*: Every collection composes a degree-1 natural object. Composition is universal, and all composite objects are perfectly natural.

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- *Soft universalism*: Every collection composes a degree-n object for some n, and some collections compose degree-0 objects. Composition is universal, but some—perhaps all—composite objects are perfectly non-natural. (This is likely the most plausible way to read the universalist.)
- *Moderate universalism:* Every collection composes a degree-n object for some $n > 0$. Composition is universal; some composite objects are less than perfectly natural, but none are perfectly non-natural.
- *Hard restrictivism*: Some, but not all, collections compose objects of some degree of naturalness. Some collections don't compose anything, not even a perfectly non-natural object.
- *Soft restrictivism:* Some, but not all, collections compose degree-n objects for $n > 0$. Some, but not all, collections compose non-perfectly non-natural objects.

A few comments are in order. The nihilist views are united by the claim that no collection composes a perfectly natural object; they differ in whether they allow composites of other, lesser degrees of naturalness. Hard nihilism entails moderate nihilism, which entails soft nihilism. The universalist views are united by the claim that every collection composes at least a perfectly non-natural object; they differ in whether they require that composites have some higher degree of naturalness. Hard universalism entails moderate universalism, which entails soft universalism. How much of a real difference there is between moderate and soft universalism depends on what we make of perfectly non-natural objects. In section 4 below, I'll argue that such objects are, in some sense, metaphysically lightweight. If this is right, then soft universalism holds that at least some composition is ontologically innocent (see Hawley 2014), whereas moderate universalism insists that it is always guilty.

The account of composition I suggest below is ultrasoft, combining soft nihilism, soft universalism, and soft restrictivisim.

4. Naturally Restricted Composition

How, then, ought we answer the various instances of the modified special composition question?

Let's begin by considering the mereological simples. Is every simple perfectly natural, or are there less than perfectly natural simples, too? Suppose in world w we have a simple, o, of a degree-n naturalness for some $n < 1$. Object o has some degree-n natural properties—properties that figure in the degree-n laws of w—but no degree-n' properties for any $n' > n$. In particular, o has no perfectly natural properties. So o is governed by the laws of w but not directly by its perfectly natural laws. And since o is, by hypothesis, a mereological simple, it has no parts directly governed by the perfectly natural laws either—o doesn't have its degree-n natural properties in virtue of its parts' perfectly natural properties. It thus looks as if o is unconnected to the perfectly natural laws and objects of w. But the

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perfectly natural laws, properties, and objects are supposed to provide a minimal basis for characterizing *w*, and if there were such an object as *o*, it's hard to see how they could do so: any adequate characterization of *w* would have to include *o* independently of all that is perfectly natural. And so I think we ought to conclude that every mereological simple is perfectly natural.

The priority monist (see, e.g., Schaffer 2010 and 2013) will see another way *o* could be tied up with the perfectly natural laws: by being a *part* of the world itself, the only perfectly natural object there is. The less natural degree-*n* laws then govern *o* in virtue of the perfectly natural laws governing the world entire. I here set monism aside and take parts to be metaphysically prior to the wholes they compose. To borrow a line from Hudson (2002: 204): 'chalk up another controversial metaphysical assumption'.

What about worlds in which some objects behave so irregularly as to be ungoverned by natural laws? (Andy Egan raised this question in conversation.) There are a few ways we might treat such worlds. The first is to insist that the laws have to capture everything—the laws must be complete—and so such worlds will simply have some very particular laws that simply state the behavior of the unruly objects. (This response sacrifices the idea that laws should be general.) The second is to admit that the unruly objects aren't law-governed but to insist that since we have to include them in any minimal account of the world, they must be perfectly natural. (I favor this tactic, I think.) The third way to treat worlds with unruly objects is compatible with the second: say that the objects have perfectly natural properties, properties that figure in the laws of *other* worlds. Then, though the objects are not in fact law-governed, they *could* be.

Now, what of composite objects? How should we answer (MSCQ), most generally? Let's start with the following account of *naturally restricted composition*:

> (NRC) ($\exists y$) the *x*'s compose *y* and *y* is a degree-*n* natural object if and only if there is some degree-*n* natural property *F* such that the *x*'s are arranged *F*-wise, and there is no degree-n' natural property *G*, $n' > n$, such that the *x*'s are arranged *G*-wise.

That is, a collection of objects composes a degree-*n* natural object if and only if the collection is arranged *F*-wise for some *F* that figures in the degree-*n* natural laws. (*F* may or may not be a sortal.) The idea is that the degree-*n* natural laws take notice not just of the individual *x*'s, but of how the *x*'s are arranged: the laws treat the *x*'s collectively *apart* from the *x*'s themselves. This is not to say, of course, that the degree-*n* laws may not also directly govern the individual *x*'s, nor is it to say that how the *x*'s are arranged at the degree-*n* level is independent of the *x*'s other degree-*n*-or-higher properties.

For example, let the quantum mechanical laws be degree-n_1 laws, and let the laws of chemical combination be degree-n_2. Suppose, plausibly, that $1 > n_1 > n_2 > 0$. Being arranged isobutane-wise is a degree-n_2 natural property, one that does not appear in the more natural laws of quantum mechanics and cannot be reduced, in any obvious way, to quantum mechanical properties: quantum mechanics does not

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deliver molecular shape (see Ramsey 1997; Scerri and McIntyre 1997; and Hendry 2010, along with citations therein). Being arranged isobutane-wise is not just a degree-n_1 property in disguise. Some collections of four carbon and ten hydrogen atoms are arranged isobutane-wise; these collections compose isobutane molecules, which are degree-n_2 natural objects.

Here, an orthodox Lewisian might object. Lewis (1983: 40) has shown that structural universals are anathema, hasn't he? And doesn't (NRC) just suggest structural universals? To the first question: well, maybe. And to the second: I don't think so. Briefly, Lewis's worry about structural universals is that he doesn't understand the supposed necessary connection between structures and properties—for example, the connection between a collection of carbon and hydrogen atoms arranged isobutane-wise and the property of being isobutane. The necessary connection looks like *magic*. But the current suggestion posits no such baffling necessary connection. Whatever necessity attaches to the relationship between structures and properties is just ordinary nomological necessity. And given that the natural laws are contingent, this isn't much necessity at all. Furthermore, there's no need for the relevant arrangement property to be a *structural* property in, say, the sense of Armstrong (1978)—arrangement properties are simply collective properties of the x's. (This also helps distinguish the current account from Koslicki's [2008] neo-Aristotelian program, according to which composite objects have structures as proper parts.)

Given (NRC), are there any perfectly natural composite objects? Alas, the answer is not straightforward. Consider gunk. In a gunky world, there are no mereological simples—everything is composite (see Zimmerman 1996). There are a few ways to go here. We might deny that gunky worlds have any perfectly natural objects at all. This is not, perhaps, as crazy as it sounds; for a gunky world is as good a candidate as any for being a world with no fundamental laws, laws that treat of perfectly natural properties, for the simple reason that there is no fundament. Going this route, we reject what Schaffer (2010: 37) calls *metaphysical foundationalism*—the thesis that there must be a level of ultimate metaphysical priority. (Cameron [2008] argues that there are few good arguments for metaphysical foundationalism and that the best one suggests the thesis is metaphysically contingent.) If we instead insist on metaphysical foundationalism—so that there *must* be perfectly natural objects, even in gunky worlds—then we must allow perfectly natural composites. One possibility is that such worlds are *monistic*: there is exactly one perfectly natural object, the entire world, and any proper part of the world is thus less natural than the world itself. Schaffer (2010: 61–64) argues that gunky worlds are monistic. He *also* argues that gunk is possible and that monism is either necessarily true or necessarily false; he thus concludes that monism is—necessarily—true. I reject Schaffer's necessitarianism—monism, even if true, is merely contingent—and so I admit the *possibility* of gunk without committing to monism (see Miller 2009).

Outside of gunky worlds, the intuitive case against perfectly natural composite objects is as follows. The perfectly natural objects are metaphysically fundamental, but composite objects are never fundamental since they are metaphysically dependent upon their parts. (Here again I assume that Schaffer's [2010] priority

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monism is false.) So no composite object is perfectly natural—soft mereological nihilism is true.

Here's another way to spell out the argument. Start with Schaffer's (2010: 38–39) *tiling constraint*: the fundamental concrete objects collectively cover the world without mereological overlap. The fundamental objects collectively cover the world because if they didn't, a portion of the world would be metaphysically independent of all that is fundamental. The fundamental objects do not mereologically overlap since if they did, some fundamental objects would be metaphysically redundant. Note that the tiling constraint is an independently plausible thesis about fundamentality; we can accept it without also buying priority monism. Now: composite objects and their parts mereologically overlap. By the tiling constraint, then, if a composite's parts are fundamental, the composite itself is not. Every simple is perfectly natural—and so fundamental. And since every composite has simple parts, no composite is fundamental. Thus no composite is perfectly natural.

It would be nice if we didn't have to rely on the intuitive argument and could, instead, derive soft nihilism directly from (NRC) itself. But I don't think we can. Consider a world containing a perfectly natural composite object. What that amounts to, according to (NRC), is that there are some (perfectly natural) *x*'s arranged *F*-wise, and *F* is a perfectly natural property, a property figuring in the perfectly natural laws. Since *F* is perfectly natural, the *x*'s being arranged *F*-wise isn't reducible to or supervenient upon any other of the *x*'s collective or individual properties. (If it were, those properties, and not *F,* would be a part of the minimal basis for characterizing the world.) Thus, in this world, some collections have properties—and are gripped by the laws—independently of the properties of their members.

Such a world isn't inconsistent, but it is somewhat bizarre. It's a world in which both collections and their members are fundamental (thus, a world in which the tiling constraint fails). It's also a world in which (some) mereological facts are *emergent* or *brute*. If we deny that such brute worlds are possible, of course, we get soft nihilism. But I don't have a good argument against these worlds, and so I think the best position to adopt is a modest one: brute worlds are possible, but until we have good evidence that ours is one, we ought to presume that soft nihilism is true.[4]

Every mereological simple is perfectly natural, and presumably every actual composite object is less than perfectly natural. Does every collection compose an object of some degree of naturalness, possibly zero? Is soft universalism true? (NRC), together with the principle that the degree-*n* properties figure in the degree-*n* laws, suggests the following *general composition principle*:

4 Merricks (2001) argues that we *do* have such evidence: persons (and at least some other creatures) have emergent conscious mental properties that are causally nonredundant. If this is right, then these conscious mental properties may well count as perfectly natural; persons, then, are perfectly natural composites. There's no room here to take up Merricks' argument, but see, e.g., Dorr (2003) for some doubts. See also Barnes's (2012) illuminating account of emergent objects as 'fundamental dependent' entities.

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(GCP) ($\exists y$) the x's compose y if and only if there is a property F and a degree of naturalness n such that the x's are arranged F-wise and F figures in the degree-n natural laws.

(GCP) allows for degree-n composite objects for $n > 0$. But there are no degree-0 laws, perfectly non-natural laws. Perfectly non-natural properties aren't law-governed; they don't play any role in the order of the world. By (GCP), then, there are no perfectly non-natural objects. Thus, so long as the natural laws of our world work out right, (GCP) delivers restricted composition; if the laws are such that some collection is arranged F-wise, F figuring in the laws, there are composite objects, and if some collection has no property figuring in the laws, not every collection composes another object. Of course, it's a further step to argue that (GCP) delivers the right composite objects—tables but not Blixa-Eiffels—a step that involves determining all of the even minimally natural laws.

If we stop here, we've settled on hard restrictivism—some collections don't compose anything, not even a perfectly non-natural object—and so have restricted composition. But I think there's a case to be made for soft restrictivism, the view that though not every collection composes a minimally natural object, those that don't *do* compose perfectly non-natural objects. So every collection composes something, but not every collection composes an object of a degree of naturalness greater than zero.

There are, of course, the various arguments in favor of universalism, and some of these—in particular, a version of the Lewis-Sider vagueness argument (Lewis 1983: 211–13; Sider 2001: 121–32)—still go through, I think, if we allow that some composite objects are perfectly non-natural. There's also an analogy between objects and properties. Every set of objects is a property, even if that set plays no role in the natural order of any world. Likewise, we might think, every collection of objects composes another object, even if the composite object is a bystander to the natural order. Considerations of theoretical simplicity nudge us in this direction (though I admit that considerations of ontological economy push in the opposite way). And just as there's work for even non-natural properties, there's similar work for non-natural objects: they are well-suited to be semantic values. 'The Blixa-Eiffel', for example, refers to a perfectly non-natural object composed of my cat and the Eiffel Tower.

The theory of natural objects can help assuage some of the intuitive antipathy toward bizarre composites like the Blixa-Eiffel. Universalism seems implausible in part because it insists that the Blixa-Eiffel is an object that is, in some sense, just as metaphysically good as, say, a molecule of isobutane. But we have the strong intuition that any such object would be metaphysically second-rate. Perhaps it would even be superfluous—whatever role it played in the workings of the universe would be better played by its parts alone. Soft restrictivism, though it admits arbitrary composites, vindicates these suspicions. Perfectly non-natural objects—which most arbitrary composites are—are, indeed, very unlike isobutane molecules and are of a lower metaphysical grade. And they are nomologically inert, adding nothing to the order of the universe but themselves. So arbitrary composites are just as our intuition would have them—but that is no reason to reject their existence.

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And so, rather than the hard restrictivist (GCP), I endorse the following principle of natural composition:

> (NC) ($\exists y$) such that the x's compose y and y is a degree-n natural object, $n > 0$, there is a property F and a degree of naturalness n such that the x's are arranged F-wise and F figures in the degree-n natural laws; otherwise, the x's compose a degree-0 natural object.

(NC) is equivalent to soft universalism plus soft restrictivism (given the right laws).

Now, one might reasonably wonder what the difference is between an account on which arbitrary composites don't exist and one on which they exist but are perfectly non-natural. Bad news: I don't think there's much that can be said here, at least not without a good analysis of the concept *existence*. And I don't think there is any such analysis; *existence* is a basic concept (see, e.g., Azzouni [2010] for some of the troubles that bedevil attempts to analyze *existence*). Thus, the difference may simply come down to whether or not we scruple to quantify over them. Good news: this is exactly what we ought to expect (and want) of perfectly non-natural objects. There is no substantive metaphysical distinction between there being a perfectly non-natural object and there simply being no object at all.

This, indeed, is what makes soft restrictivism (even when combined with soft universalism) a suitable substitute for 'real' restricted composition—that is, for hard restrictivism. Following Hawley (2014: 70–72), call an object (or class of objects) *ontologically innocent* just in case accepting it does not add to one's ontological commitments—ontologically innocent objects come along for free, in some sense, with the other entities one already countenances. On soft restrictivism plus soft universalism, perfectly non-natural composites are ontologically innocent. Once we posit the perfectly natural objects, accepting the perfectly non-natural composites is costless, or nearly so: they have only perfectly non-natural properties and are nomologically and causally otiose. (This is a 'leveling down' account of their innocence—see Hawley 2014: 85.) Other composites—composites that are at least minimally natural—on the other hand, are ontologically guilty, as they carry the cost of positing real metaphysical structure in the world in the form of natural properties and laws.

5. Where to Look for Tables and Chairs

A collection composes an (n-level) object, roughly, just in case the collection is arranged F-wise for some F that figures in the (n-level) laws. The perfectly natural laws of fundamental physics—whatever they turn out to be—deliver the perfectly natural, presumably simple, objects. Less fundamental—and so less natural—physical laws deliver electrons, protons, neutrons, and perhaps atoms. The laws of chemistry provide molecules as slightly less natural objects, and biological laws furnish the world with all manner of (even less natural) biological objects, from cells

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on up to tigers and persons. What of tables, chairs, and other ordinary medium-sized objects? It's not obvious—indeed, it seems unlikely—that *being arranged table-wise* figures in the laws at any level of naturalness. This is a bit worrying; after all, we want an account of restricted composition that vindicates common sense—and common sense demands tables and chairs.

First, a methodological point. A 'perfectly restrictive' account of composition, one that *perfectly* captures our intuitions, is likely out of reach. But, really, we ought not expect such an account in the first place—why think that we are inerrant detectors of objects, even those of medium size? The vindication of common sense doesn't require that all of our intuitions turn out to be correct, only that our intuitions aren't mistaken wholesale. An account of restricted composition that makes us right *by and large* is the best we can insist upon.

Still, the theory of naturally restricted composition doesn't seem to deliver even this much; a world without tables, chairs, cars, coffee mugs, and other artifacts isn't a world that common sense would recognize. I'd contend, though, that it's at least closer to common sense than either the nihilist's or the universalist's world. (Or even van Inwagen's!) For though that world lacks artifacts, it does have many of the composite objects we take to exist, and it omits arbitrary composites.

In any event, I don't think we need to resign ourselves to such an imperfect restrictivism quite yet. What follows is preliminary and speculative, but I can see three places where we might look for tables and chairs within the account of restricted composition being developed here.

- Midlevel physical/chemical/biological laws. Tables might not count as objects in virtue of their parts being arranged table-wise but in virtue of the collection of parts having some other, fairly natural corporate property. There might, for example, be fairly natural laws governing objects chemically and/or mechanically bound to each other.
- Basic psychological laws. There appear to be universal principles underwriting the ability of infants and adults to individuate objects. For example, visual cognitive processes provide representations of individual objects as 'coherent, spatially separate and separately moveable, spatiotemporally continuous entities' (Carey and Xu 2001: 181).
- High-level psychological, behavioral, and sociological laws. Particles arranged table-wise play a certain functional role in our interactions with the world. If there are law-like generalizations to be found here, they would serve to ground the composition of table-wise arrangements of particles.

I suspect that the last two proposals are most promising. Note that on either of these, many commonsense objects may turn out to be significantly less natural than, for example, atoms, molecules, and tigers since psychological and sociological laws are presumably less natural than physical, chemical, and biological laws. Should this

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worry us? Well, it depends on how attached we are to the thought that tables, etc. are metaphysically 'just as good' as the objects of the more fundamental sciences. I find my attachment fairly easy to shed. As properties get more and more natural, they correspond to sharper and sharper joints in the world, joints that are closer to being inherent, objective features of reality itself. Does the world intrinsically divide into tables and non-tables as neatly as it does into carbon atoms and non-carbon atoms, tigers and non-tigers? Any urge to say it does so seems to me the residue of an unreflective anthropocentrism.

6. The Theory Summarized

Putting all this together, we end up with the following theory of natural objects:

(NO) Object o is degree-n natural if and only if o has some degree-n natural property and has no degree-n' natural property for $n' > n$.

Simple perfection. Every simple is perfectly natural.

Supersoft nihilism. If the world is neither a brute-composition world nor a gunky world, then no composite object is perfectly natural.

(NC) *Soft restrictivism plus soft universalism*. A collection composes an object of degree-n naturalness, $n > 0$, if and only if there is a degree-n natural property F such that the objects in the collection are arranged F-wise; otherwise, it composes a perfectly non-natural object.

This extended theory rests on various substantive assumptions about the nature of naturalness, about properties and laws, assumptions that I haven't here defended (or even, for the most part, explicated). It's certainly not the only way to flesh out the basic account of natural objects into an account of composition—perhaps it's not even the best one. But it's at least plausible, and it has the advantage of suggesting how we might be able to have something like restricted composition.

JOSHUA D. K. BROWN
GUSTAVUS ADOLPHUS COLLEGE
jbrown8@gustavus.edu

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