Composition, Supervenience, Identity: A Unified Theory

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In this paper, I propose a bundle theory of object identity that accounts for essence and haecceity and thereby allows for distinct indiscernibles. Centrally at work is a closure principle for properties that, taking intrinsic properties as primitive, accounts for relational properties. This closure principle is also shown to be a criterion of composition that serves as a "one-tiered," "Series"-style answer to Peter van Inwagen's Special Composition Question. A multiple-domain supervenience description of bottom-up object composition in terms of the closure principle is also given. In the last two sections, I survey the theory's applications, benefits, and implications.

Are the principles universal or particular?

—Aristotle, *Metaphysics* β [**955a**]

There is certainly a sense in which anyone would want to say, with David Lewis, that there are no philosophical problems about identity. After all, "[e]verything is identical to itself; nothing is ever identical with anything else except itself." (1986: 192) Still, in philosophical practice we have seen views on identity as diametrically opposed as those of Peter Geach (1967–8), whose "relative identity" thesis is such that there is no such thing as absolute identity, and such as David Wiggins (1980, 2001), who forcefully argues that there is nothing but, and thus no two things can be "the same *F* but different *G*s." Between these, and out of the spectrum of emphases that fall somewhere in the middle, one can see at least one source of perplexity, and that is the relationship between identity and indiscernibility. Strict numerical identity, at least, would seem easy enough to grasp, yet Max Black's (1952) two-sphere universe is enough to give one pause about any quick judgments on the matter. In addition, there is that putative relation of almost-identity, "constitution," that has led many theorists to outline theories thereof that allow one to explicate what it is that makes a statue and its clay, say, to be numerically distinct yet coincident. On the other hand, many others have contended that there is no such relation, and constitution *is* identity.

Of identity itself we want to say that it is in some sense irreducible and primitive. Yet it is undeniable that objects have properties—features that make them the *way* they are—and the notion that these properties integrate into an object's identity seems quite compelling, to say the least. To sort this out, clearly one question needing an answer is: what objects are there—indeed, just what is an *object?* While even many metaphysicians will, following ordinary discourse, take objects for granted,[1] there is also available the "bundle theory" approach, exemplified by the "trope" conception of D.C. Williams (1953), of taking properties as primitive, and objects as "bundles" of them. But properties, if not identified with universals, should certainly be something like them, and so there looms large the question: What does it mean, exactly, for a universal or property to be multiply located—indeed, located at all? Following on its heels is yet another vexed question, with its antithesis close at hand: What would a property be without an object? and What would an object be without properties? Traditionally having been pulled in one of the two directions, recently most metaphysicians seem content to skirt around the issue. I believe it is clear, though, that one must take the perennial problem of universals and particulars seriously before meaningful answers can be made to the host of questions

[1] A notable recent exception is Ned Markosian (2000).

mentioned in this and the previous paragraph. Otherwise, stipulative rules of discernment[2] and the clashing of brute intuitions can only prevail.

The task of reconciliation must begin somewhere. In this paper, I will grasp one of the horns of the universal/particular dilemma, and take properties as primitive. It should be reason alone that, while it may seem odd to conceptualize properties without objects, the idea of an object with no properties can only be a non-starter. Based on the starting point of properties per se, I will delineate a metaphysic that also accounts for objects—bearers of *haecceity*—as one of the basic constituents of the reality we find. Call such a theory a "bundle theory with teeth." I believe that the theory to be proffered has much to offer in answering some basic metaphysical questions, and that it allows the intuitions that motivate opposing theories of identity to shake hands. It may, in fact, even represent the way the world really is.

I. A Maximally Intrinsic Property Set and a Closure Principle for Properties

Following Sydney Shoemaker's (1980) rich and canonical treatment, I shall identify properties with *necessary causal powers.* The "necessity" involved is to be construed as a fundamental nomic necessity based on the particular causal power of the particular property—something a property cannot fail to have, due to logical necessity of identity. All physical, *de re,* necessity is to be considered as derived from the necessary causal powers inherent in properties themselves.

I take properties most fundamentally to be the "atoms," or monads, of the world, rather than recognitional qualities *simpliciter,* such as the trope theory of D.C. Williams, for at least two reasons. First, although tropes as rough-and-ready components of reality

[2] See the helpful discussion of Kathrin Koslicki (2005).

seem to be able to provide an exhaustive account of the nature of objects, it is hard to see just what they *are.*[3] Secondly, and more importantly, it is known that objects are in fact made of physical *atoms*, and the picture of objects presented by brute trope-style bundle theory is at best incommensurable with the knowledge presented to us by physical science. Anti-realists with respect to science may simply find this concern a point of departure, but for us realists, we need some metaphysical theory of composition—and a hierarchical one, at that—to comport with the physical one. If all goes as well as might be hoped, in fact, the two would mesh together and interface completely.

The present bundle theory will consider the simplest possible properties as *property-atoms.* What are these, if not tropes? One may identify property-atoms with the fundaments of matter according to present science: quarks and leptons. And while thinking of fundamental particles as physical objects themselves may seem natural at first, it is problematic in terms of the physical theory into which these entities are embedded; in the same way, thinking of property-atoms as objects themselves may serve as a kind of entry point, but doing so in a thoroughgoing way will shortly become untenable, and it is at least not necessary for understanding them, in terms of the discourse of the present theory. It is enough to say that property-atoms give objects their causal powers because they *are* causal powers.

A natural further question is: How is "intrinsicness" defined for these property-atoms? Everyone seems to have a good intuitive grasp of what an intrinsic property is,

[3] One may well sympathize with Peter van Inwagen when he comments that "I have never been able to think of tropes as anything other than idealized coats of paint" (2001: 2)

but a fully satisfying analysis of intrinsicness has turned out to be somewhat slippery. I think the reason for this is that such analyses tend to take space-filling objects for granted and *then* attempt to delineate conditions on intrinsicness.[4] The routes of analysis needed in this strategy are rather torturous and seem to me to veer dangerously close to *ad hoc*-ery. As has been said, I shall take the opposite tack and build objects out of bare properties; in doing so, I will avoid the tangled bramble of having to consider supposed properties like "being such that a cube exists" or "being one of at most seventeen spheres"[5] as potential test cases, but at the cost of having to introduce some not-inconsiderable abstraction at the outset.

Consider property-atoms themselves as maximally intrinsic. To understand what this would mean, consider a sort of proto-universe consisting of only property-atoms; there is only one of each kind in this proto-universe, and this is because two of the "same" property-atoms cannot exist until there are extrinsic—that is, relational—properties to set them apart.[6] Lacking relational properties, there is no space. The identity

[4] See Yablo (1999) and Weatherson (2001), for instances.

[5] Pretheoretically, I cannot understand why such monstrosities should be considered properties in *any* sense. This is one reason I find Shoemaker's account so appealing and sensible; one very nice advantage to considering properties as causal powers, of course, is that wildly extrinsic, "mere-Cambridge" "properties" are disallowed.

[6] Brian Weatherson (2004) opines that it seems a mistake to simply define relational properties as those that are not intrinsic, but in the framework of the present theory, I shall feel free to do so. According to the present theory, any property that is not intrinsic is to do essentially with relative location in space.

of each property-atom is unmistakably absolute; there is no question yet of there being distinct indiscernibles. So the primitive relation between property-atoms, as such, is one that I shall call *incongruence.*

Whence relational properties? To demarcate extrinsic properties from intrinsic properties, some form of "closure" principle has been proposed by some. Stephen Yablo (1987) makes use of the notion of closure for sets of properties that constitute an essence, which is just such a thing as we are after, but it takes objecthood (his "α") for granted. Brian Weatherson (2001), working even closer to our aim, defines some closure principles (Boolean, mereological, spatial, and combinatorial) explicitly for the purpose of demarcating extrinsic properties from intrinsic ones. But, again, Weatherson takes objects for granted and thereby falls afoul of the usual intractable complexities. What I propose is a closure principle based, not on the object-presupposing identity- or mereologically-based principles, but on the causal powers of properties themselves. (It is, however, rather similar in spirit to Weatherson's combinatorial closure principle.) Such a closure principle is to act as a sort of fundamental law that governs what certain property sets intrinsically add up to, and that allows property-atoms and sets thereof to be duplicable. Sets of properties are represented by P_ns according to the property closure principle (PC), the schema under which any set of intrinsic properties will be a set P_1.

(PC) P_1 is closed iff

$$\Diamond(\exists P_2)[(\exists P_3)(\exists P_4)[(P_1 \cong P_2) \ \&\ (P_1 \subset P_3) \ \&\ (P_2 \subset P_4) \ \&\ \sim(P_3 \cong P_4)]]$$

Consider, now, our proto-universe undergoing a "Big Bang," in which property-atoms duplicate,[7] either singly or as certain sets, thereby creating relational properties (that is, space) as a result, in accordance with the principle (PC). In this event, in going from "duplicable" to "duplicated," relational properties are created between sets P_1, thus creating space and the objects that fill it.

According to my present purposes, what (PC) does most importantly is generate haecceities out of pure property sets. This idea thus falls right into place with the common practice of conceiving thisness as a sort of limiting case of suchness.[8] In terms of set membership, *de re* modality, and congruence (≅), (PC) encapsulates the possibility for relational properties, having taken intrinsic properties as primitive and duplicable. For any indiscernible objects composed of congruent intrinsic property[9] sets P_1 and P_2, $P_3 - P_1$ and $P_4 - P_2$ are the relational properties that them apart. Any set of properties that can

[7] Really, I mean "replicate," because it is not just a single extra copy that is generated but many, many more than that; however, I shall henceforth use "duplicate" in keeping with the tradition of thinking of intrinsics in terms of "duplicability," whose spirit is precisely my aim.

[8] See, for examples, Adams (1979), and the notion of a "maximal property" appealed to in Sider (2001).

[9] I cite "intrinsic property" here in a way that may, in the present context seem synonymous with "property-atom." But in §3 I apply (PC) to characterizing objects composed of intrinsic properties that are not simply property-atoms; I foreshadow them here by way of the more general "intrinsic properties" only to have what I say here about (PC) apply equally to them.

be an instance of P_1 in (PC) is duplicable and thus qualifies as a set of intrinsic properties.[10] In allowing for nonduplicable, relational properties, (PC) generates the possibility for space and therefore for objects:[11] these are but two ways of explicating the same logical property.

Much of the beauty of what (PC) does is to divide right through the dilemma of identity and indiscernibility by not smuggling in either concept at the outset. Instead, it makes sense of both in terms of congruence, which itself encompasses both identity and indiscernibility.[12] (PC) allows for congruence between property-atoms, and therefore also spatially separated objects. Indiscernible objects with congruent sets of property-atoms P_1 and P_2 are set apart only by their relational properties, $P_3 – P_1$ and $P_4 – P_2$, respectively. P_1 (and P_2) is what one might call an "intrinsic identity," sharable between objects by relative identity; P_3 and P_4, likewise, may be called "exhaustive identities" giving objects with intrinsic identity P_1 (and P_2) their unique relative locations in space. An exhaustive identity might also be called a *haecceity:* the set of properties that is *that* very object.

The reason that a pair of indiscernibles are set apart only by their relational properties is that individual and unique property-atoms themselves, in becoming duplicable and congruent according to (PC), never actually become numerically distinct

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[10] Cf. David Lewis' (1983) treatment of intrinsicness in relation to duplicability.

[11] This seems very much in accord with the "Spatial Location" criterion for objecthood proposed by Ned Markosian (2000).

[12] Cf. David Wiggins : "Congruence should indeed flow from identity, but congruence as such will scarcely encapsulate the whole of identity. (*Unless identity is already incorporated within congruence….*)" (2001: 184) (emphasis mine)

in the sense of objects *simpliciter.* They are never, in themselves, separated by space, because generation of relational properties—that is, space—comes *as a result of* duplicability by (PC).[13] Therefore, congruent property-atoms remain numerically the same in their various instances. What duplicated property-atoms represent, then, are genuinely immanent universals: *universalia in rebus.* Furthermore, it allows us to make sense of not only absolute identity, but relative identity just as well: distinct objects that are indiscernibles because $P_1 \cong P_2$—that is, because the intrinsic properties they have in common are just *the same, simpliciter*—can be considered "the same *F*," where *F* is the predicate calling out the set of property-atoms possessed in common between the two indiscernible objects.[14] The differences in conceptions of identity can be accounted for in terms of the scope of what is being identified. Whatever property set falls under *F,* in the sortal-relativized identification scheme just described, can be thought of as a natural kind.

[13] Cf. Gonzalo Rodriguez-Pereyra: "Consider relationism about space. The location of a thing stems from its spatial relations to other things. So the location of an instance is given by its spatial relations to other instances. But the bundle theorist should say that the location of an instance is metaphysically prior to the location of the bundle. A bundle is in a place because it has an instance there, not the other way around" (2004: 79).

[14] Cf. John Perry's (1970) discussion of relative identity. Perry's central objection to the Geachian relative identity thesis is that it only allows attention to types, cripplingly preventing reference to tokens per se. What the present discussion of relative identity shows, I think, is that you can in fact have identity either way, depending on the scope of sameness in question. The present theory allows for tokens, just as well as types, due to the haecceity-generating that is encapsulated by (PC).

Any P_1 satisfying (PC) can thus be considered a natural kind. David Wiggins' challenge for a "stable formulation of restricted congruence" (1980: 39) by which anything less than absoluteness of sameness could be recognized, then, is met squarely by (PC), which vindicates both relative identity as well as absolute identity, as understood in terms of this theory.

It must be quickly noted that not only entire intrinsic property sets P_1 satisfy (PC), however, but subsets thereof may do so as well. For any P_1, any $P_{1-x} \subset P_1$ represents a natural kind had in common with anything sharing intrinsic properties P_{1-x}, even P_1s which are, between themselves, incongruent. Consider two objects that share some of their intrinsic properties in common, but not all. Taking the shared set of intrinsics as constituting a P_1, the incongruent intrinsic properties between the two objects come out "relational" according to (PC), at this scope. So it turns out that (PC) is a *downward* closure which, on some scopes, may leave intrinsic properties of an object outside P_1, but cannot fail to exclude relational properties from the duplicable set: the various P_1s in existence collectively represent an upper limit to intrinsicness.

The overall applicability of (PC) may be summed up thus: *Any* intrinsic property will fall under a P_1 for *some* application of (PC). And, for *any* application of (PC), *no* relational property will fall under a P_1. Objects P_3 (as opposed to P_3s that are sets of intrinsic properties, some shared and others not) with relational properties $P_3 - P_1$ are not taken for granted: given our "proto-universe" as the starting material, and the duplicability principle (PC), the only further stipulation necessary for the existence of objects is that the duplicability of P_1s of property-atoms is in fact actualized in the form of our "Big Bang." (P_3s of partly shared intrinsic properties will be expected to occur in the higher-level object construction described in the next two sections.) And, the treatment of kinds according to (PC) allows for an assessment of relative identity at any scope. Subsequently in this paper when citing P_1s, it will be in reference to those maximal sets that compose intrinsic properties of objects per se, but any point made with respect to those should be assumed to apply *mutatis mutandis* to P_1s that are themselves subsets to other P_1s.

The limiting test case for the ability of a bundle theory to deal with haecceities is Black's universe, as mentioned above, which consists of only two indiscernible spheres. The present bundle theory, I think, deals with it rather neatly. As any bundle theorist will have to say, the set of universals/properties of both indiscernible spheres is *a* bundle. This property set being duplicable (and in fact duplicated), it is a P_1. This is the same, so far, as a universe consisting of just one of the two spheres. What makes there be two of them is that there are extrinsic properties that set them apart. Thus, there is at least a P_3, according to this theory. What else is there? The P_1 we have already accounted for; this is the same bundle whether is instantiated once, twice, or a billion times over. $P_3 – P_1$ is the set of extrinsic properties that account for the space between one instance and the other, *whether we start from one instance or the other.* (Remember, the two spheres are perfectly indiscernible and without any other relative point of reference.) So the P_3, the set of the bundle and the extrinsic properties between the instances, is all there is in this universe. One might describe Black's world as captured by this theory as consisting of a single bundle "at some distance from itself,"[15] but this sort of phraseology invites confusion, as "itself" in this usage equivocates between the bundle and the spatially

[15] As suggested in passing by Zimmerman (1997: 306).

located instance. Still, it captures something right, because it is the numerically same bundle that is bilocated.[16] Other potential confusions about objects and their properties, with respect to the present bundle theory, will be addressed in §3.

II. Composition and Supervenience

What we have in (PC) is also a principle of composition that I think answers Peter van Inwagen's Special Composition Question (SCQ) (1990: 21–32): it gives us a criterion and justification for saying that simples genuinely compose something, over and above just their set. That is, membership in P_1 of (PC) is the relation R in an answer of the form "(∃*y* the *x*s compose *y*) if and only if the *x*s stand in R" (1990: 62), where the *x*s are intrinsic properties, and *y* is an object whose intrinsic properties, the *x*s, fill the set P_1, and whose exhaustive identity, including relative location in space, fill the set P_3. In addition, to give this answer is to also implicitly answer van Inwagen's General Composition Question—What is the composition relation?—by maintaining that composition is property closure.

(PC) is about duplicability; how does this count as a principle of composition? The key to this idea is the nonduplicability of relational properties. The sorts of property sets that do *not* satisfy (PC) are simply those that include relational properties *simpliciter*. To see the significance of this, consider the question: When two Lego™ blocks are locked together tightly, is (PC) thus satisfied by the two of them together, and a "new," duplicable object thus made by their sum? Grant for now that each Lego block is

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[16] Also, note that the self-contained nature of this P_3 Black's world staves off Bradley's Regress.

composed of a set of intrinsic properties.[17] What if we simply add the intrinsic properties of the two? Any set of intrinsic properties, in and of itself, satisfies (PC): this goes for any subset of a P_1, as was discussed above, and also for sets of intrinsics found in spatially separated objects. In the realm of automatic fusions and Lewisian unrestricted mereology, the sum of the two Lego blocks compose an object automatically, no matter what their spatial configuration is with respect to each other. But what is offered here is an alternative, one of restricted composition. Any account of restricted composition that treats of this case will need to take into account the space between the two blocks and claim that, if they do compose something, they are (at least) in some unique spatial configuration together. So what we will need to model in terms of (PC) is to include the relational properties of the two blocks.

Consider two Lego blocks b_1 and b_2, locked together to create a putative new object, B_1, and a pair of blocks b_3 and b_4, respective duplicates to b_1 and b_2, fastened likewise to form a putative B_2. (Each b_n and B_n is to be considered a set of intrinsic properties; that is, a P_1 or candidate for such.) If b_1 and b_2 genuinely compose a B_1, then B_1 itself will be (PC)-satisfiable. When considering the two blocks as fastened together, how do the relational properties between the two blocks stand? The locking together of the two blocks, per se, is not such that they are truly, at the most microscopic level, in "contact." At *any* interfacing surface where, at the macroscopic level, the two seem to be in contact, the closeness between them is actually not such that you could not fit an

[17] See n. 9, above, on my present use of "intrinsic property."

electron, or an atom, or perhaps even a tiny speck of dust, between them.[18] But if the smallest object can be fit anywhere between the surfaces of b_1 and b_2 without altering *them* or the relational configuration between them, such that the sum of b_1 and b_2 is still indiscernible from b_3 and b_4, then you have made a difference to the region of space containing B_1. So, regardless of whether there is in fact another object interposed between b_1 and b_2, B_1 is discernible from B_2 on the basis of its having a unique relational property in amongst its putative "intrinsic properties" due to the space between b_1 and b_2, and therefore B_1 (as well as B_2, naturally) fails to satisfy P_1 of (PC).

As a principle of composition, (PC) serves specifically as a *Series*-style answer (1990: 63–71), at that, buying us not only the initial particles composed only of sets of property-atoms, but also larger entities composed of the particles, and so on. Still more specifically, (PC) is in itself a *one-tiered Series*-style answer to the SCQ; as van Inwagen has said, "it would be *nice* if we could find a 'one-tiered' answer to the Special Composition Question—that is, an answer that did not involve the generation of certain composite objects in one way, and the generation of 'the rest' out of these in other ways." (66) A third desideratum is "[c]ouldn't an answer to the Special Composition Question simply quantify over multigrade bonding relations without actually mentioning any of them, as Davidson's account of causation quantifies over causal laws without mentioning any of them?" (68) To this excellent question, we can answer that this is precisely what (PC) does. (PC) describes a single condition on composition that makes good for all the different means of composition we find in the world—subatomic forces, chemical

[18] See also van Inwagen's comments (1990: 34) on *Contact*, an initial "representative answer" to the SCQ.

bonding of all varieties, etc.[19] The key to this will be to add to (PC) the concept of supervenience.

In the most general terms, what makes supervenient objects possible is that certain relational properties can be included in P_1 of (PC): those that are, in fact, duplicable. Relational properties that are duplicable will be those among the subvenient parts *inside* an object. What makes these duplicable is that there can be another object, indiscernible to the first, containing those same subvenient relational properties; the only way those relational properties are set apart is by relational properties of the objects *themselves.* Return to the case of the Lego blocks presented above. The relational properties between the blocks remained unique and nonduplicable even when the blocks were pressed together. In contrast, if they had been melted and fused together, their molecules (subvenient properties) would have merged, making for a property closure and thus a new object. Chemical bonds would then have to have been broken to alter the relational properties inside this new object, which would destroy the object. Van Inwagen says elsewhere that "The distinction between intrinsic and relational properties is sometimes explained in terms of the concept of a 'real change in a thing': if the gain or loss of a property would be a real change in a thing, then that property is intrinsic; otherwise, it is relational." (2002: 33) This principle is precisely the key to the account of composition given here: change in intrinsic properties between two objects makes for genuine composition of a new object with its own intrinsic properties. Thus, you cannot compose—*i.e.,* bring into existence—a new object from the two blocks without making a

[19] Such will be discussed by a survey of examples, in §3. See also van Inwagen (1990: 67–68).

difference to the blocks themselves and the molecules of which they are made. A maxim that might be stated *you can't make a difference without making a difference* is just that of the covariance described by any theory of supervenience. So, according to this theory, genuine composition—adding to the furniture of the world rather than rearranging it, as van Inwagen says—is also a case of supervenience.

III. Multiple-Domain Object Supervenience

The application of the concept of supervenience to the present theory will allow us to cite (PC) at successive levels of composition, defining intrinsic properties of objects as generated from subvenient properties. The result will be a theory of composition by supervenience that is nicely nonreductive, which is what many have hoped to find in a theory of supervenience. Such a supervenience thesis will also allow us to preserve the concept of *identity* in the "strict and philosophical sense," and also account for the near-identity relation of constitution in terms of the overall theory. The present object supervenience theory will make use of the notion of multiple-domain supervenience (the idea of which was originally introduced in Kim (1988)). The basic idea is that instead of supervenience as usually defined in terms of a relation between families of properties of a single thing, *domains* of properties, each of numerically distinct things standing in a certain relation to each other, stand in a supervenience relation to each other.

Let us define the domain of property-atoms themselves as D_0. At the "Big Bang," property atoms duplicated, and certain of them, when doing so, combined to compose particles by satisfying (PC) as instances of P_1. The initial property closure on this domain D_0 is defined as follows.

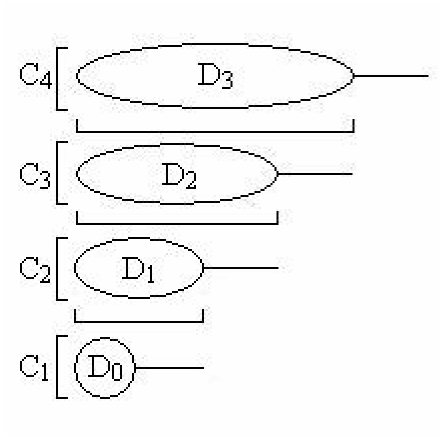
> Initial closure (C_1): properties of domain D_0 duplicate according to (PC) to generate objects with intrinsic properties P_1 of domain D_0.

The intrinsic properties of the particles (smallest objects) that are composed at this initial level of closure are simply sets of property-atoms just additively and combinatorially derived directly from the property-atoms themselves. So far there is no special need to invoke supervenience. But these particles compose larger objects, and (PC) will be the key to this multilevel composition, too. At those higher levels of closure, relational properties will need to be included in the property set P_1. The only relational properties that can be included in a P_1 will be the unique set of relational properties that makes for the closure of each set of intrinsic properties. The instantiation of duplicable relational properties has the result of generating a supervenient domain of intrinsic properties. When particles with intrinsic properties in domain D_0 combine to form a second-order object (say, protons and neutrons subatomically fusing to form an atomic nucleus), this object has its own intrinsic properties of domain D_1, and these supervene on the closure of the sum of property-atoms (domain D_0) and relational properties among them. At this point, it becomes necessary to make clear the nature of the interdefinability between levels of closure and domains of supervenience.

> Interdefinability between closure C_{n+1} and supervenient domains: For $n \geq 1$, any P_1 of domain D_{n-1} that includes relational properties of that domain and is duplicable according to (PC) generates an object with intrinsic properties P_1 of domain D_n.

The initial level of closure, C_1 (the "Big Bang"), is between property-atoms (domain D_0), and accounts for relational properties between sets P_1 of property-atoms. A new domain D_1 of intrinsic properties is generated when the next level of closure, C_2, is achieved between initial particles (with D_0 properties) and the right relational properties among them. **Figure 1** is a schematic of the successive levels of property closure and supervenience domains: each ellipse represents a domain of intrinsic properties, the line next to which represents relational properties among objects with those intrinsic properties. Each domain D_{n+1} of intrinsic properties supervenes on the closure of intrinsic properties in D_n and relational properties among the latter. Levels of property closure C_{n+1} thus generate, and thereby determine, domains of intrinsic properties D_n. One might say that our dictum that relational properties be, by definition, nonduplicable is preserved in a sense by the supervenience of a separate set of purely intrinsic, duplicable properties, which then composes the new object proper, on the prior domain of properties that includes relational properties.

Fig. 1



The supervenient domains of intrinsic properties are, like the initial level of closure, generated directly by the necessary causal powers of the subvenient properties. To capture this necessary causal efficacy, it is a *strong* variety of supervenience that we want. We are now ready to state the wanted supervenience thesis formally (where *congruence*, the basis of comparison for properties according to this overall theory, is cited in place of the usual *indiscernibility*):

> (PC)-based multiple-domain supervenience: For $n \geq 1$ and any objects x and y (that is, any P_1s of (PC)), D_n properties strongly multiple-domain supervene on D_{n-1} properties just in case for any objects x and y with D_{n-1} properties and any worlds w_1 and w_2, if x in w_1 is D_{n-1}-congruent with y in w_2, x in w_1 is D_n-congruent with y in w_2.

When turning to application of this scheme, some confusion may set in, whose source may be voiced by one of two interrelated questions: Where are the objects? and Which properties, exactly, are the ones falling under the P_1s of (PC) at the various levels of closure? Turning to the second question first, the answer is twofold and constitutes the root of the present supervenience thesis. A set of properties closes just when the right set of relational properties are instantiated among intrinsic properties of domain D_{n-1}. This closure generates a new set of intrinsic properties of domain D_n, but the subvenient properties do not simply "disappear" at that point: they are ontologically prior to the supervenient domain, which is in turn rooted in them. At that supervenient domain D_n, the P_1 property set of the property closure C_{n+1} can be described alternatively as including intrinsic properties of D_n, or intrinsic properties of D_{n-1} at the closure-level C_n plus relational properties. Really, returning explicitly to the question at hand, it is both: a complete description of an object with intrinsic properties of domain D_n will include the fact that those D_n properties supervene on a certain collocation of D_{n-1} intrinsic properties, which in turn (if $n \geq 2$) supervenes on a certain collocation of D_{n-2} properties, and so on (if $n \geq 3$). The highest-domain set of intrinsic properties P_1 of an object can be considered simply as bundled tropes (after the manner of D.C. Williams, or perhaps after that of the trope theory recently given by Laurie Paul (2002), for examples) of which composition is intrinsic identity for the object. What gives this bundle theory its "teeth" is the role of (PC) in delineating those intrinsic properties as separate from those reflecting the object's location in space, and in grounding the supervenience thesis that describes how such intrinsic properties are rooted in subvenient domains of properties. An object's intrinsic identity (see §1, above) is the set P_1 at its top-level property domain. The property-composition of an object with respect to any or all of its subvenient domains—say, its D_{n-1} properties (intrinsic plus relational)—is not quite its identity, but according to our supervenience thesis it will be strictly determinative of such. Scope of discourse will determine properties singled out for attention, but the full picture as described by the supervenience thesis cannot but include closures of properties and domains from D_n all the way down to D_0.

As to "Where are the objects?", one may well balk at the cleavage between intrinsic identity and exhaustive identity that (PC) reflects. This may well be expected, as where we might expect to find an object's identity *qua* object would be right smack dab in between the two. But there is nothing between the two, except the ersatz "bare particular" hypostatized by the grammar of natural language. We speak in normal discourse of objects "having" properties, just as a person has attributes. But it turns out, according to the present theory, that the metaphysics of the matter do not reflect its ordinarily-language grammar, and so this would be one of those counterintuitive bullets that just has to be bitten.

According to the present theory, the universe looks like the following. Besides (C_1-combined) property-atoms and relational properties, there are supervenient intrinsic properties. For $n \geq 1$, each level of closure involves *two* domains, and an object with D_n intrinsic properties only exists, as such, because of the C_{n+1} closure on the D_{n-1} intrinsic properties plus relational properties. This is essentially what captures the nonreductionism of the present theory. A limitation to supervenience theses generally that is often invoked is that they are not explanatory: a supervenience thesis simply states covariance conditions without explaining how they come to obtain in the first place. While supervenience conditions themselves can only describe without explaining (and indeed, what this theory treats of is certainly at the point where explanation must yield to description), a much- and unfortunately-neglected source that I think has the resources to fill this gap is scientific explanation. It is the supervenient properties that are discovered first, and subvenient properties connected in lawlike ways to the former are discovered by way of scientific investigation and theory.[20] For any object with intrinsic properties in D_n, those properties are not eliminable to just D_{n-1} properties plus relational properties: the property closure and consequent supervenience described in this theory reflect generation of empirically manifest properties, right up to the most ordinarily recognitional. The role of scientific explanation in unifying the property domains, supervenient in terms of

[20] For further discussion, see Newman (forthcoming).

subvenient and vice versa, will be discussed in terms of some key examples in the next section.

Finally, a suggested approach toward an analysis of *constitution* based on the present theory. The notion of subvenient objects, plus what David Sanford (1993) has called *naïve mereology,* can help us make sense of the relation of constitution that has recently undergone considerable scrutiny from metaphysicians, and in a way that seems to me to do justice to the pretheoretical intuitions motivating such theories. Sanford invites us to distinguish between *part* and *a part,* specimens of the latter of which qualify as objects in their own right, the former of which serve as the primitives of "classical," Lesniewskian mereology. If we consider the standard-example clay statue, its D_n properties supervenient on its D_{n-1} properties, we can understand its shape, or configuration (a D_n property) as being determined by the relational properties among the sum total of its clay particles;[21] each such particle is *a part* according to naïve mereology, with D_{n-1} intrinsic properties. It seems to me that the "lump" of clay that is standardly considered to "constitute" the statue is just the sum of clay particles without regard to the relational properties among them: the lump is said to survive changes in shape, whereas the statue does not. So in these and similar cases, I suggest that *x* constitutes *y* just in case *y*'s intrinsic properties are in domain D_n, *x* and *y* are spatially co-located, and *x* is the sum of those intrinsic properties in domain D_{n-1}.

IV. Examples and Applications

[21] It is an oddity particular to this example that, strictly speaking, there is no such thing as *a* clay particle, it being the case that *clay* is a hodgepodge of organic, mineral, and H_2O molecules—the subvenient D_{n-1} objects, in this case.

One indispensable measure of a metaphysical theory is its applicability; as D.C. Williams has said, "[m]etaphysics is the thoroughly empirical science. Every item of experience must be an exemplar and test case for the categories of analytical ontology." (1953: 3) The theory offered thus far, on intrinsic properties and their multiple-domain supervenience, successfully describes reality. This will be demonstrated by canvassing the deliverances of the physical sciences and showing how the structure and mechanisms of physical things, as so described, manifest themselves as instances of the bundle-theoretic and supervenience-based scheme presented thus far.

After the "Big Bang," according to this theory, there are particles composed of (D_0) property-atoms. We find that the world contains, according to current science, particles that exactly fill this role: hadrons; mainly protons and neutrons, each of which is composed of a trio of quarks, which themselves would be considered property-atoms. "Up" quarks having a fractional charge of +2/3 and "down" quarks –1/3, the two "up" and one "down" that compose protons add up to a charge of +1, while the two "down" and one "up" that compose neutrons add up to a charge of 0. Protons and neutrons have it in their intrinsic powers to combine, when subjected to the energies of nuclear fusion, into atomic nuclei, held together by the strong nuclear force. Due to the inherent charge imbalance of having a number of protons in a nucleus, electrons (which seem to be indivisible and thus should probably be considered property-atoms themselves), according to their intrinsic powers, will fall into place around the nucleus in "electron clouds." This unique configuration of D_0 properties constitutes a level of property closure resulting in an atom, whose own intrinsic properties are of domain D_1, supervenient on those of the protons, neutrons, and electrons of which it is composed. There are also those atoms, of the nuclide hydrogen-1, whose nuclei are bare protons that have not undergone fusion, whose intrinsic properties are also in the domain D_1, each supervenient on just the proton and electron of which *it* is composed.

Atoms of most elements in nature do not exist in isolation, but are found bonded to other atoms in the form of chemical compounds. One especially energetically-favorable such combination is that of two hydrogen atoms with one oxygen atom. For each of the two hydrogen atoms, a pair of electrons is shared between it and the oxygen atom, giving a full quantum configuration for each atom's electrons (two for hydrogen and eight for oxygen). The formation of these shared electron pairs, covalent chemical bonds, makes for a property closure resulting in a molecule of H_2O with intrinsic properties of domain D_2. The intrinsic properties of H_2O molecules are such that when the mean kinetic energy of a group of them are within a certain the range (that is, that reflected in the temperature range of 0 ºC–100 ºC; but we have not yet gotten that far, as that is a property whose domain is still to supervene as we go "up"), they are close enough to interact in such a way as certain intermolecular forces are in effect: the charge distribution over each H_2O molecule is uneven, with the electrons favoring the electronegative oxygen atom, leaving a partial positive charge at the end of the molecule that the hydrogen atoms occupy. This charge dipole means that the partially-negative side of one H_2O molecule loosely attracts the partially-positive side of another H_2O molecule, and so on. The result is that H_2O molecules at this mean kinetic energy range are loosely associated but can easily slide past one another. The overall result of the intermolecular associations between H_2O molecules is another level of property closure, with resulting D_3 intrinsic properties that are readily recognizable as those of a liquid, specifically, that liquid known as “water.” Its temperature is a D_3 property supervenient on the kinetic energy of the subvenient H_2O molecules. When the mean kinetic energy of the H_2O molecules decreases enough that the water’s temperature drops below 0 ºC, the intermolecular forces between the H_2O molecules overcome the motion of the molecules, which begin to lock into place in a crystalline network. The solid which now supervenes on the H_2O molecules associated in this way is known as ice. The particular H-O-H bond angle of the H_2O molecules confers a hexagonal structure to the crystalline network, on which supervenes the characteristic hexagonal shape of snowflakes. On the other hand, “water” in the gaseous state is just separated H_2O molecules with no additional level of closure, so its properties end at D_2.

Because any contiguous sample of water has its own supervening intrinsic properties P_1 generated by (PC), it qualifies as an *object* according to this theory, interestingly enough. A water droplet is an object. A cloud, being simply an area containing a relatively large concentration of water droplets, is not an object. So we can say that there are no clouds (so much for *that* “problem of the many”), in exactly the same sense as van Inwagen says there are no chairs.[22] A glass of water is two objects: the

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[22] Incidentally, van Inwagen (1990) fails to adequately (or at all, really) consider the nature of chemical bonding, as such, as a candidate for satisfying the desiderata posed by the Special Composition Question. His very short §6, “Answers: Some Type of Physical Bonding,” in which chemical bonding should be considered, seems to preempt any such discussion with the putative result of the proposed “Alice and Beatrice” case (59), wherein identical twins each have a hand severed and are fused at the wrist by a “mad surgeon.” Since on the basis of physical bonding this results in a single object where we

glass and the water (which are not chemically bound together). The ocean, along with all its dissolved solutes (but not the organisms and other solids submerged in it), which intermolecularly interact with surrounding H_2O molecules in a manner similar to the interaction between H_2O molecules themselves, is an object (cf. Earley 2005). As to the relation of water to H_2O, it is, strictly speaking, never true that "water = H_2O:" such an identity statement might be called a category mistake. Since the subvenient *parts* (of naïve mereology; see above) of water are molecules of H_2O, water (and ice) should be said to be *constituted* by H_2O.[23] However, that nomological necessity described by the present theory's supervenience thesis ensures that the properties of H_2O convened in a certain relational state cannot but bring about the intrinsic phenomenal properties of water, so there is at least a strict implication from one to the other.

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would want to say there are still two (or, at least, two *persons*), this approach to composition is summarily eliminated: such is one of the ways in which van Inwagen's approach, although largely illuminating, seems designed to lead straight to the *Life* answer (§9). Given that in other respects, van Inwagen's attention to facts of physics and of biology is well-paid, it is the more remarkable how the nature of chemical bonding is completely neglected in his discussions. I think it is worth taking physical-bonding factors into account if they yield positive results with regard to questions of composition, and to consider whether identity of organisms might need a different account from that of inanimate objects (cf. Sanford's (1993) "many composition questions").

[23] See Johnston (1997) for an extended defense, from a phenomenological level, of this perspective.

For an example of a solid, a tree's wood, through the cell walls and plasmodesmata connecting the cells, consists largely of cellulose, a long-chain polymer of sugar subunits. As in the previous example, covalent bonding, in this case between the carbon, hydrogen, and oxygen atoms (objects with D_1 properties), makes for a level of closure that generates molecular, D_2, intrinsic properties. These properties are such that when *they* are suitably collocated, the phenomenal properties of a solid result, determined by the rigid character of the long-chain cellulose molecules. When a tree is cut down and is no longer living, the cellulose that makes up wood endures for long after. A cut-down tree is an object, and when it is cut into pieces, chemical bonds are broken, and therefore at that point becomes several objects. When the various pieces of lumber are later made into, say, a table, the various lumber pieces and nails are not chemically fused, but are fastened together in a manner qualitatively similar to that of the Lego blocks discussed above in §2. So a table made in this way is a not an object over and above its lumber and nails. A bonding adhesive, however, does do the trick of composing a table out of lumber, because unlike in the wood-and-nails and Lego cases, chemical bonds are actually formed between the surface and adhesive, forming a molecularly continuous surface. The general rule, then, in determining whether a new object has been formed is to look at whether there has been a change among the intrinsic properties of the subvenient domain: if yes, yes; if no, no. As with any supervenience thesis, you cannot make a difference to one domain without making a difference in another.

Objects constituted of covalent compounds seem to have phenomenal properties in D_3. But when we turn to cases involving metallic bonding or ionic bonding, the situation is somewhat different. Take a sample of any metal: atoms of a metallic element, whose intrinsic properties are in domain D_1, have a loose outer “shell” of electrons that are shared freely and interchangeably among adjacent iron atoms. The result is a type of bonding, different from covalent bonding, which is sometimes modeled as an “electron sea:” this makes for a metal’s characteristic malleability (adjacent atoms are not rigidly locked together but have some freedom of motion among them), thermal conductivity (atoms of a metal can knock back and forth, easily transmitting kinetic energy), and electrical conductivity (electrons within a metal can easily pass from atom to atom, effectively transmitting charge), *et alia.* These and all other characteristic metallic phenomenal properties would seem to fall right into D_2; a sample of iron, say, with 10^{20} atoms of iron in it is, by analogy to covalent bonding, like a single huge molecule with chemical formula $Fe_{100,000,000,000,000,000,000}$. In the case of ionic bonding, take sodium chloride: positively-charged sodium and negatively-charged chloride ions are attracted to one another electrostatically, and so form a three-dimensional lattice with a cubical configuration in which any ion is surrounded by six ions of opposite charge. This type of bonding, like those covalent and metallic, makes for a level of property closure, but as in metallic bonding, phenomenal properties come at that very level: a single crystal of sodium chloride is like a single huge molecule with chemical formula, say, $Na_{312,467,098,110,452,787}Cl_{312,467,098,110,452,787}$. So phenomenal properties of ionic compounds and metallic substances, it would seem, fall in D_2 while those of covalent compounds are in D_3. I do not like this result; it would seem much evener and neater if all phenomenal properties ended up across the same domain. There are issues, to be briefly discussed in §5, of causal efficacy across domains, that become especially acute in cases like this, where properties that seem to be in different domains have comparable causal powers. But further work may show it is not such a problem as one may think.

Not only do all phenomenal properties not seem to "even out" across the same domain, but I can think of at least one example where an additional domain is generated from properties that are themselves at the phenomenal level; that is, two domains of objects in a direct supervenience relation both end up at the phenomenal level. A link of a chain is itself a middle-sized object, and when links of a chain are linked up, this represents a unique configuration generating supervening properties of a chain, a duplicable object in its own right. Properties of a chain supervene on the links configured in an interlocking manner, and these properties are not generated by the sum of the intrinsic properties of the links in any other configuration.

In summary, what is needed for a suitable criterion of restricted composition is an all-or-nothing standard, and this is given by (PC). Upon examination of the physical facts, we find that among the possible arrangements of things, some are in fact unique, and suffice to place those things in an unambiguous composition relation to *other* objects.[24] We find characteristic causal powers manifested in each property domain that fill this role: nuclear forces in D_0 generate atoms in D_1, which chemically bond to form molecules in D_2, and so on. Given the metaphysical criteria defined in terms according to this theory, therefore, characterizations of things according to physical science give us applicable cases on which to determine that cases of composition and supervenience are instantiated.

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[24] For more on the chemical principles, long-overlooked by philosophers, that serve as instances of restricted composition, see Earley (1998) and Earley (2000).

V. BENEFITS AND IMPLICATIONS

I have already at least hinted at many of the benefits, and answers to questions, that the present theory provides. With an eye toward wrapping-up and taking stock, I shall enumerate some such answers that I think are at least implicit in the foregoing. I will then go on to suggest some further implications of this theory with regard to such salient topics as modality and personal identity.

A. Benefits

(1) A workable intrinsic/relational property distinction in holistic terms, and one that does not give rise to Bradley's Regress, is given by this theory.

(2) This theory includes, as a central feature, immanent universals, which reconciles the basic tension of universal vs. particular.

(3) This theory provides a workable one-tiered *Series*-style answer to the Special Composition Question. To my knowledge, this is the first of such that has been suggested.

(4) This theory involves a nonreductive multiple-domain supervenience thesis that accounts for the hierarchical composition of physical objects in a way that neatly jibes with the picture of such given by chemical science.

(5) This theory reconciles the opposite-pole conceptions of identity, relative (Geachian) and absolute (Wigginsian): (PC) is the "suitable restricted notion of congruence" that is required for relative identity to be coherent, and it also makes sense of absolute identity according to nonduplicable relative location in space.

(6) This theory explicates, in terms of the supervenience thesis, the relation of constitution.

(7) This theory gives a "restricted indiscernibility" criterion for objects that does not, it seems to me, fall afoul of what Kathrin Koslicki (2005) has called "The Suspect Strategy:" the attempt to exclude troublesome contexts from comparisons involving certain almost-identity relations by purely stipulative criteria.

(8) Thomas Hofweber (2005) has recently argued that there is a central tension between the idea of object supervenience on the one hand and object-dependent (that is, haecceity-dependent) properties on the other.[25] The result is that direct reference seems to be inconsistent with supervenience. It is possible that the present theory, in its accounting for haecceity as well as supervenience, provides a way through this problem.

(9) The idea that objecthood has essentially to do with occupying, and having a relative location in, space, is one that can be found elsewhere in the philosophical literature, for example, Markosian (2000). As well, Robert Adams, in §3 of his (1979), spends some time tracing out the implications of different conceptions of space to Black's universe. The present theory of object-generation by (PC) gives every object relational properties that are defined by an object's location relative to other objects, so it is a theory that, as a central feature, satisfies requirements of the nature of space required by a theory of thisness in terms of suchness.

(10) The present theory seems to me to have a lot of consonance with modern physics, in at least the following ways. (a) In an overall sense, the holistic ontological scheme presented here meshes well with relativity theory, especially General Relativity. The picture presented by General Relativity is, in a nutshell, that space and the matter

[25] See also James Van Cleve's (1985) suggestion that his "third version" of the bundle theory leads to fictionalism about objects.

that fills it are intimately interrelated; this is what makes for gravity, as well as the "curvature" of spacetime. The picture presented by the present theory seems to me to fit perfectly into that mold: there are no objects without space, and the character of space (*viz.:* relational properties) is itself shaped by the objects that fill it. (b) I have spoken of a "Big Bang" in scare quotes, but the role of that event in this theory is directly parallel with the cosmological origin event referred to by that phrase without quotes. That all matter-energy was once concentrated into a dimensionless point that exploded, with the result of the creation of space, is exactly what this theory postulates about the origin of space, and space-filling objects. (c) The fact that property-atoms themselves are not numerically distinct in their various instances may have something to do with the phenomenon of "quantum entanglement," or "action at a distance."

<u>B. Implications</u>

(1) There may still seem to be a "Where are the objects?" problem when considering essence and counterfactual identity of objects according to this theory. (I will not address counterpart theory.) Every object necessarily has both a P_1 and P_3, determining essence and haecceity, respectively. It is most natural to consider all of an object's intrinsic properties as essential to it (at least, this theory provides no, and I know of no other, reasons for thinking otherwise), so counterfactual variations in an object can only consist in that object's career, or variations in relational properties, $P_3 - P_1$ (henceforth abbreviated P_{3-1}), over time. Indiscernible objects share a P_1 and are set apart only by their relational properties. Cross-world identification of an object is (by definition, really), enabled by its essence, given according to this theory by P_1. Consider two indiscernible objects *x* and *y* with world- and time-indexed relational properties

$P_{3-1}(x, w_1, t)$ and $P_{3-1}(y, w_1, t)$ in the actual world w_1. Also consider a counterfactual world w_2 indistinguishable from w_1 except that at a certain time t_1, $P_{3-1}(x, w_2, t_1)$ and $P_{3-1}(y, w_2, t_1)$ diverge from $P_{3-1}(x, w_1, t_1)$ and $P_{3-1}(y, w_1, t_1)$[26] (thus, w_2 is a world that *branches* from w_1): the positions of x and y relative to the rest of their world differ after t_1 in w_2 from w_1. At another time t_2 in w_1 and w_2, $P_{3-1}(x, w_1, t_2) = P_{3-1}(y, w_2, t_2)$ and $P_{3-1}(y, w_1, t_2) = P_{3-1}(x, w_2, t_2)$, and remain so thereafter; that is, the worlds w_1 and w_2 seem to have "reconverged," yet x and y would seem to have "swapped" cross-world identities at t_2. But since x and y are indiscernible and therefore have the same P_1s, furthermore $P_3(x, w_1, t_2) = P_3(y, w_2, t_2)$ and $P_3(y, w_1, t_2) = P_3(x, w_2, t_2)$. Comparing the two worlds before t_1 and after t_2, we are left with no criteria for either distinguishing between x in w_1 and y in w_2 on the one hand and y in w_1 and x in w_2 on the other (besides whatever difference *external* to x and y that went on between t_1 and t_2 that caused the divergence and reconvergence), *or* determining that they are the same![27] One is left with a kind of "ontological vertigo," to use van Inwagen's phrase: "How could a material object be essentially related to a mere trajectory through space?" (1990: 166) The best way through this dilemma, it seems to me, is to take an object's entire career, or exhaustive identity P_3

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[26] And let's say, to make it not so arbitrary, that w_1 and w_2 from t_1 also differ in whatever factors external to x and y that were necessary to cause the divergence in position for each.

[27] Actually, this sort of cross-world identity problem faces any theory that is not "haecceitist" in the modal sense; that is, that does not posit "bare substrata" that enable one to track counterfactual identities of objects.

over time, as its intraworld identity, and consider necessity of origin as the key to picking out *that* object in counterfactual worlds: an object exists in just those worlds that form a treelike branching structure through “modal space,” so to speak, off the event at which that object began to exist. At least, I cannot think of any other independently plausible way to conceive of cross-world object identity according to this theory.

(2) Properties, according to this account, have it in their causal powers to compose objects when brought into certain relations with each other. When they do so, a new set of intrinsic properties are generated in the n+1 domain. The spirit of the Shoemakerian conception of properties as causal powers, of course, is in describing the causal powers manifested *between* objects that have them. Preserving this natural notion of causal powers between objects, given the foregoing theory of object composition via causal powers of properties, the implications of interobject causal powers with respect to domains need to be drawn out. Here are a couple of plausible principles, and their joint implication for describing causation. (1) It seems most natural to think of properties according to this conception as only being “commensurable” across comparable domains: only intrinsic properties in the same domain can mutually interact. This is at least strongly suggested, it seems to me, by the multiple-domain supervenience thesis.
(2) Since the spatial relations between objects are described according to this theory as relational properties between the top-domain intrinsic properties of each object, interobject causal interactions would have to be fundamentally conceived as occurring between the top domains of each object. The upshot of (1) and (2) is that if two objects with intrinsic properties in the same domain causally interact, the total result of the causal interaction to each object, all the way “down” through the domains, would need to be

captured in terms of what happens to the top-domain intrinsic properties of each. In other words, "downward causation" is implied in any causal interaction between two objects both with intrinsic properties of domain D_{n+1}. If two objects' top-level domains differ—say, one is in D_2 and the other is in D_3—the D_2-D_2 interaction will be fundamental, and there will be both downward as well as upward causation. It seems to me that additional Kim-style work could be done drawing out plenty more implications such as these.

(3) I have shown how this theory of property closure works to generate objects, giving a general criterion for composition of objects out of their (naïve-mereology) parts. It may well be wondered if the same principle works, or should be supposed to work, for composition of organisms. A preliminary answer would seem to be *yes*, that the overall chemical structure of an organism, while extremely complex as compared to an inanimate object, does integrate such that property closure is achieved. However, as van Inwagen has explained (1990: §§17–18, *passim*), any "moderate" (*i.e.*, neither "nihilist" nor "universalist") composition answer involving organisms is bound to result in there being genuine vagueness. Take my bloodstream, for example: blood plasma is an aqueous solution, thus constituting an object according to the present theory, but blood's corpuscular components (red and white blood cells, for example), as this theory describes, are contained in the plasma without being strictly part of it. Blood plasma is also not part of, but rather runs through, the gross circulatory system (arteries and veins). In my blood capillaries, blood plasma washes up against cell membranes, where nutrients and waste products are exchanged. There is a high degree of chemical intimacy in this sort of interaction, but is there property closure, such that one object is composed in the system described? It is hard to say. In this and any number of other sort of cases, the

complexity of living systems seems to present us with really intractable vagueness in composition. Assume—for the sake of conservatism, say—that each organ system remains, in the last analysis, separate from the rest. Am I, in that case, a bag of organs and “nothing over and above” that? No; I don’t think we have to stick with criteria of composition where they don’t seem to naturally apply: (PC) describes composition of atoms, molecules, and salt crystals quite adequately, but it seems almost farcical, really, to try to apply it to whole organisms. Along with that, I would posit the notion that it seems plausible enough that criteria of composition different from that of inanimate objects should be thought to apply to organisms (see also note 18, above). After all, the principles of individuation and persistence fundamentally differ between the two: an organism’s inception and self-maintenance is essentially based on genetics, whereas an object decays spontaneously (even if slowly) and carries on no activity.

Here is an informal argument for the conclusion that organisms need a different principle of composition than that of inanimate objects. (1) (PC) works quite naturally for describing the composition of inanimate objects. (2) It is possible that there exist an organism whose whole composition unambiguously does not satisfy (PC); say, an organism most of whose parts undertake their activities in the gas phase. (3) There is a single principle of composition and identity that describes anything one would want to call an *organism,* regardless of the whole organism’s status *vis-à-vis* (PC). (4) Given (1)–(3), there must be some principle other than (PC) that describes the composition and identity of organisms. To get organisms, as well as inanimate objects, in one’s ontology, one could always just append van Inwagen’s *Life* principle (1990: 82) (substituting mere sufficiency for the biconditional therein, of course) to the (PC) principle. But there is an incongruity between the two: (PC) describes objects based on an antecedent notion of intrinsic properties, whereas *Life* simply states that there are composed, living objects. *Life* is compatible with vitalism, for example, and by itself does not tell us what it is that makes living things *tick* (although many clues can be gleaned from such as §9 of *Material Beings*). I think there is such an explanatory principle that accounts for the identity and persistence of organisms, and that it has centrally to do with DNA. Biological integration and composition may well be an instance of property closure—again, as the answer to the General Composition Question—but in terms of a principle other than (PC). As metaphysical questions about objects can be answered in terms of a principle that has instances that can be described in terms of chemistry and physics, I think metaphysical questions about organisms can be answered in terms of a principle better-suited for biological terms than (PC). But that is a topic for another occasion.

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