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CONTINUITY AS A GUIDE TO POSSIBILITY

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I propose a new guide for assessing claims about what is possible. I offer examples of modal claims that are, in a certain intuitive respect, "continuous" with one another. I then put forward a general, defeasible principle of *modal continuity* that can account for our intuitions about those examples. According to this principle, statements that differ by a mere quantitative term don't normally differ with respect to being possibly true. I offer a precise statement of the principle, and then I consider exceptions in an effort to find a more nuanced continuity principle that is more reliable and still sufficiently general. Next, I offer a possible explanation of why modal continuity tends to hold and why exceptions occur where they do. Although my primary purpose is to introduce a new technique for modal reasoning, I showcase the power of the principle by applying it to a philosophical dispute concerning parts and wholes: the principle, if true, reveals a new cost of the thesis that composition is restricted. Furthermore, I point out examples of other philosophical inquiries (in philosophy of mind, metaphysics, and philosophical cosmology) that may benefit from a principle of modal continuity. The principle gives us a new tool for assessing a wide variety of modal claims.

Possibility, Conceivability, Modal Skepticism, Modal Continuity

1. Introduction

> [If] there were two bodies in the same place, it would also be true that any number of bodies could be together; for it is impossible to draw a line of division beyond which the statement would become untrue.
>
> [Aristotle, *Physics*: 4.6]

Many philosophical arguments depend on premises about what *could* or *could not* have been. Here are well-worn examples: an argument for the conclusion that I am not identical to my body from the premise that I could exist in a numerically distinct body; an argument for a necessary being from the premise that such a being is possible; an argument for skepticism from the premise that I could be a brain in a vat. It has proven difficult, however, to assess the reliability of our modal intuitions, especially on philosophical matters. For example, it may seem to some of us that zombies are metaphysically possible when we think up a scenario in which physical duplicates of ourselves are not conscious. Yet, if all consciousness is ultimately a physical phenomenon, as many philosophers and neuroscientists believe, then zombies that duplicate our physical makeup are *not* possible. Our intuitions would mislead. Or consider that it may seem broadly logically *possible* for there to be a necessarily existing entity, and it may seem *equally possible* for their *not* to be such a thing. But given a sufficiently rich semantics of modality (e.g., **S5**), it can be shown that only *one* among the above pair of intuitions can be correct.[1] Such examples can inspire doubts concerning the reliability of our modal intuitions about philosophical matters.

A common response to considerations in favor of modal skepticism is to defend the claim that *conceivability* is a guide—a defeasible guide, to be sure—to possibility (see [Chalmers 2002]). The utility of conceivability is limited, however, in part because it is

[1] Here is the argument: (i) suppose it is possible that there is something *N*, such that it is necessary that it exists; then (ii) it is necessary that *N* exists (by **S5**); (iii) if it is necessary that *N* exists, then it is not possible that *N* does not exist; therefore (iv) if it is possible that *N* exists, then it is not possible that *N* does not exist.

difficult to say exactly what conceivability *is* and in what contexts it is reliable. (One might join van Inwagen [2001], for example, in being skeptical of modal judgments in philosophical contexts.) Rather than join the discussion over the helpfulness of conceivability, I shall offer an alternative guide—one which is restricted to modal claims of a very specific sort, but which may prove to be a useful tool in the epistemologist's toolbox.

The paper will unfold as so. I will begin with some examples of modal claims that are, in a certain intuitive respect, *continuous* with one another. Then I will articulate a general, defeasible modal principle of continuity that can account for our intuitions about those examples. I will then consider some exceptions to the general continuity principle, and I'll offer a restricted version of the continuity principle that does not appear to be susceptible to clear counterexamples. I will conclude by drawing attention to one philosophically interesting application of the restricted continuity principle by employing it in an argument against restricted composition.

2. A Principle of Modal Continuity

Suppose there is an infinite array of evenly spaced vases. As it happens, each vase is superseded by another that is precisely 2 units taller than the previous one: their heights in arbitrary units are 2u, 4u, 6u, 8u, etc. Call this scenario 'SIZE'.

Here is a question: if SIZE is possible, is it *also* (broadly logically) possible for there to be a vase that is 3u tall? It would seem so. After all, if SIZE is possible, then there can be 2u and 4u tall vases. So, it seems there could also be a vase whose size is between those values. Although we have never seen such a vase, it seems such a vase *could* exist. The alternative idea that there could be vases of an infinite variety of heights but none that is three units tall is very *odd*—counterintuitive, epistemically undesirable, repugnant to the mind.

Let us consider a second scenario (inspired by Aristotle), which I call ‘COLOCATED’. Suppose that there can be *two* exactly co-located objects. If that were possible, would it also be possible for there to be *three* exactly co-located objects? It would seem so: it is implausible for two co-located things to be possible but not three. The difference in mere *number* of co-located objects doesn’t seem to make a difference with respect to the possibility of their co-location. Even if you don’t think co-location is possible, you may appreciate the intuition that if co-location *were* possible, then any number of things could be co-located.

I would like to identify a general principle that accounts for our judgments concerning SIZE and COLOCATED. To start, notice that in both cases we assume that a difference in *number* doesn’t make a difference with respect to possibility. With respect to SIZE, we assume that a vase of any arbitrary number of units tall is possible. Regarding COLOCATED, we assume that any number of things can be co-located if two things can be. Here is a principle that can account for these results:

> (M) Normally, if a proposition M_1 differs from a proposition M_2 by a mere quantity, then M_1 is possibly true *iff* M_2 is possibly true.[2]

According to (M), a difference in *mere quantity* doesn’t normally make a difference with respect to possibility. The ‘normally’ operator expresses a defeasibility constraint: upon considering particular instances of (M), one has a *prima facie* reason to think that modal continuity applies. Let us say that propositions differ by a mere quantity *iff* they are expressible by sentences that only differ with respect to at least one quantitative term. So, for example, <there are two co-located objects> differs in mere quantity from <there are three co-located objects> because they are expressible by sentences that only differ with

[2] Alternatively: if propositions M_1 and M_2 are of the form *possibly, A*, and if they differ by a mere quantity, then M_1 is true *iff* M_2 is true. I offer this formulation for those philosophers, especially existentialists, who deny the inference from <possibly, A> to <*the proposition that A* is possibly true>.

respect to the quantitative terms ‘two’ and ‘three’. The proposal, then, is that *quantitative* differences don’t generally suffice for *modal* differences. We expect *modal continuity*, other things being equal.

Principle (M) accounts for our intuitions about many apparent cases of modal continuity. So, for example, a difference with respect to vase size doesn’t seem to make a difference with respect to the possibility of there being a vase of the given size. And a difference in the number of co-located objects doesn’t seem to make a difference with respect to the possibility of there being the given number of co-located objects. Consider some other cases: first, if extended simples are possible, then an extended simple of *any size* would seem to be (broadly logically) possible; second, there is no upper-bound on *how many* concrete objects could jointly exist; third, there is no lower-bound on how big a spherical object could be (assuming the possibility of a different cosmos, perhaps one having different laws, with more or less materials); fourth, if qualitatively colorful objects are possible, then there could be a colorful object of *any complexity*; and so on. Each of these cases exhibits modal continuity.

But here are a couple disclaimers. First, I do not claim that (M) is a *basic* principle of reasoning. I leave it open whether (M) may fall out of more basic epistemological principles. For example, one might think that (M) is implied by a general principle of induction: we infer that this *A* is possible because these other *A*s are possible. Or one might think that (M) is falls out of a principle of indifference: we infer that *X* is possible because it doesn’t differ from *Y* in any evidently relevant respects, and *Y* is possible. Or one might think there is some other, more basic epistemic principle that implies (M). I leave the matter open. My basis for proposing (M) is simply that it accounts for many apparent cases of modal continuity. But there may be other ways to motivate the principle. (In section 3, I will speculate as to what may be true about *necessity* and *possibility* that allows modal continuity to normally hold.)

Second disclaimer: I do not claim that there are no exceptions to (M). In fact, I think there are many exceptions, and I will discuss a few in the next section. What I claim, rather, is that (M) is a good rule of thumb: it provides *prima facie* evidence for modal continuity in arbitrarily given cases. I believe that (M) can give one a *pro tanto* reason to think that certain situations are possible. For instance, suppose you have no reason whatsoever to affirm or deny that a certain claim *X* is possibly true. You then notice that *X* differs from a certain claim *Y* by a mere degree. Furthermore, you happen to be reasonably sure that *Y* is possibly true. I suggest that in this case, you now have a *pro tanto* reason to think that *X* is also possibly true. The reason may not be an "all things considered" reason. So, caution is called for. Even still, you have made an epistemic gain: you have found a way to *extend* your modal intuitions via a principle of modal continuity.

3. A Restricted Principle of Modal Continuity

In this section, I would like to identify a more specific, restricted version of a principle of modal continuity that is more reliable than the general principle of modal continuity. My goal here is to find a principle that is less likely to suffer from counterexamples and that is still general enough to be useful. I will close this section by discussing methodological issues concerning how the restricted and unrestricted continuity principles might relate to the nature of necessity.

To start, it will help to have a more precise statement of the general continuity principle. We may define 'modal continuity' in terms of a *modally unified* class of degreed properties. Take, for example, the class of properties of the form *being n meters tall*. Suppose every member of that class can be exemplified (individually) *except* for one: *being 4,512 meters tall*. Then the class of *height* properties has what we may call 'a modal gap'.

The class has a modal gap because *being 4,512 meters tall* cannot be instantiated, whereas every other *tallness* property can be. A unified class has no modal gaps.

Let me try to be more precise about the meaning of 'unified class of degreed properties'. We may characterize such a class as an ordered class of properties that are related to one another by certain asymmetric and transitive relations. For example, *being k-sided* seems to stand in an asymmetric and transitive relation *R*—e.g., more-sidedness—to *being (k+1)-sided*, for any *k* (where *k* is a positive integer). Here, then, is a more precise definition:

> '*C* is a unified class of degreed properties' $=_{df}$ 'There exists a transitive and asymmetric relation *R*, such that for all *x* and all *y*, (i) if *x* is in *C* and *y* is in *C*, then either *x* bears *R* to *y* or *y* bears *R* to *x*, and (ii) *x* is a finite distance from *y*'.[3]

We may now define 'modal gap' as follows:

> '*G* is a modal gap in *C*' $=_{df}$ '*C* is a unified class of degreed properties, such that (i) at least one member of *C* is exemplifiable, and (ii) *G* is a finite proper subclass of *C*, such that no member of *G* is exemplifiable.

With the notion of a modal gap in hand, we may express a general modal continuity hypothesis in terms of the denial of modal gaps:

> (M_2) Normally, if *C* is a unified class of degreed properties, then *C* has no modal gaps.

Principle (M_2) accounts for our intuitions about SIZE and COLOCATED. Regarding SIZE, we said that vases can come in any size. Suppose that isn't true. Then the class of vase-size properties has a modal gap: some vase-size properties are exemplifiable (possibly instantiated) but not all. But (M_2) suggests otherwise. So, (M_2) undergirds our intuition that a difference in size doesn't seem to make a difference with respect to the possibility of

[3] *Distance* is determined by a distance function *d* on *C*, where *d* is a function, $C \times C \rightarrow R$, which satisfies the set theoertic conditions of being a distance function. Since the mapping is to the real number system, I am limiting my investigation of unified classes (sets) of degreed properties to those whose cardinality does not exceed the cardinality of the set of real numbers. I am not concerned with whether or not there might be modal gaps in a class that has infinitely distant members.

there being a vase of the given size. Similarly, (M_2) suggests that there is no modal gap in the class of *co-location* properties: so, if *being 2 co-located objects* can be exemplified, then so can *being 3 co-located objects*. These are the right results.[4]

Still, there are exceptions to the general principle. Consider, first, that there are predicates, normally conjunctive ones, which pick out impossible properties in a unified class of degreed properties. Consequently, there are unified classes of degreed properties that have modal gaps. Here is an example to illustrate: the class *A* whose sole members include *being 13-sided and less than 14-sided* and *being 14-sided and less than 14-sided*. Since *being 13-sided and less than 14-sided* can be instantiated, whereas *being 14-sided and less than 14-sided* cannot be, there is a modal gap in *A*. One might think that *A* is an ordered class. That is, one might think that *being 14-sided and less than 14-sided* bears an asymmetric and transitive relation (analogous to the *more-sidedness* relation) to *being 13-sided and less than 14-sided*. If that is so, then *A* is a unified class of degreed properties that contains a modal gap.

There are other gappy classes. Consider, for example, a class of *n*-sided regular polygons (equilateral triangles, squares, and so on). This class has a modal gap that includes *being 1-sided polygon* and *being 2-sided polygon* because polygons must have at least three sides. Certain classes of *three*-dimensional polygons are even gappier. For example, consider regular polyhedrons: the tetrahedron (four faces, each an equilateral

[4] Interestingly, we may deduce (M_2) from the seemingly more modest principle, (M_M) that a unified class of degreed properties has *multi*-member modal gaps *if* it has any modal gaps at all. To see this, let *G* be a modal gap of any size in a large class *C*. Then, by definition, *C* has at least one member *c* that can be instantiated. Now *G* either has exactly one member or has more than one. Suppose it has one, which I'll call *g*. Since *C* is a unified class of degreed properties, any class *C** that contains *g* and *c* is also a unified class of degreed properties. But *G* is a one-member class that is a modal gap in *C**, which contradicts (M_M). Suppose, then, that *G* has more than one member, and let *g** be one such member. Then there is a unified class of degreed properties *C#* that contains only *g** and *c*. But the class containing *g** alone is a one-member class that is the only modal gap in *C#*. And *that* contradicts (M_M). Therefore, if (M_M) is true, then no class of degreed properties has a modal gap of any size.

triangle of the same size), the cube (six faces, each a square of the same size), etc. Consider the class of *n*-faced regular polyhedrons. This class also causes trouble for modal continuity: no polyhedron, regular or not, can have fewer than four faces. Worse still, only five values of *n* determine a possible property: 4, 6, 8, 12, and 20. The only regular polyhedrons have surfaces that consist of four equilateral triangles, six squares, eight equilateral triangles, twelve regular pentagons, or twenty equilateral triangles. This is a modally gappy set indeed![5]

Although (M) may provide *prima facie* evidence regarding arbitrary cases, it would be nice if we could find a restricted version of the principle that has no obvious exceptions. Let me try to do that.

Notice, first, that each of the impossible properties mentioned above are *strictly logically* impossible. So, for example, there is a logical contradiction in the claim that something exemplifies *being 14-sided and less than 14-sided*. And we can show that definitional geometric axioms strictly preclude the possibilities of a two-sided polygon and a fifteen-sided regular polyhedron. In SIZE and COLOCATED, by contrast, the relevant properties aren't strictly logically impossible. Let us consider, then, a principle that is restricted to properties that are logically coherent:

> (M_3) There is no *coherent* unified class of degreed properties that has a modal gap, where
>
> '*C* is coherent' $=_{df}$ 'No member of *C* is strictly logically impossible'.[6]

(M_3) yields the right results for SIZE and COLOCATED because no vase size or number

[5] I owe the polygon examples to Peter van Inwagen.

[6] I am assuming that it is strictly logically impossible for there to be a *fractional* number of things: for instance, it is strictly impossible for there to be exactly 4.5 things—given the meaning of 'thing'. But if we drop that assumption, then we may instead explicitly add to (M_3) the condition that no member of *C* is such that it is strictly necessary that if it is exemplified, then there is a fractional number of things.

of co-located objects is strictly logically impossible.

Are there exceptions to (M_3)? It seems there are. Consider that some concrete particulars have limited *capacities*. To illustrate, let class *B* be a class whose members are *being Keith Lehrer and capable of eating n-kilograms of cat food* (for all *n*). I do not think it is far-fetched to suppose that there are masses of cat food that are too great for Professor Lehrer to possibly eat. If that is so, then there are modal gaps in *B*. And if *B* meets the conditions of being a unified, coherent class of degreed properties (as it appears to), then *B* is a counterexample to (M_3).[7]

Nevertheless, the above exception, like the previous ones, is importantly different from SIDED and COLOCATED. Consider that the term 'being Keith Lehrer' can only be understood (by those of us who are not identical to Keith Lehrer, at least) by understanding 'being identical to the thing that satisfies *F*', where *F* is a definite description. Consider next that whatever thing satisfies *F* may have "hidden" properties and powers that can only be discovered *a posteriori*: the thing, *Keith Lehrer*, plausibly has certain essential limitations, and eating capacity is evidently one of them. By contrast, 'being 3 units tall' and 'being 3 collocated things' (say) are not picked out using such terms as 'being the thing that'. Notice also that 'being *n*-units tall' and 'being *n* collocated things' are not picked out using a term like 'being identical to one of the (concrete) *things* that'. Perhaps, then, we may avoid exceptions while still accounting for SIDED and COLOCATED with the following restricted principle:

> (M_4) There is no coherent, non-haecceitous unified class of degreed properties that has a modal gap,

where

[7] But as Nathan Ballantyne suggested to me, the identity conditions of Lehrer might be rather flexible, such that he could be any size. Then why not think Keith Lehrer *can* eat any amount of cat food?

> ‘C is non-haecceitous’ $=_{df}$ ‘No member of *C* is such that it is expressible by a term equivalent to a term of the form ‘being identical to the (concrete) thing that ...’ or ‘being identical to one of the (concrete) things that ...’.

After some consideration, I have come to think (M_4) is a good candidate for a continuity principle that has no clear cut exceptions. If there are exceptions, they aren’t easy to identify, or they aren’t clear cut.

Yet, there are a couple potential counterexample I will consider. One has to do with limitations on instances of certain *kinds* of things. Take the class *C* whose members are *being human and capable of eating n-kilograms of cat food* (for any *n*). Suppose ‘being human’ is defined in terms of genetic make-up. Then there is plausibly a mass so great that no human would be capable of eating cat food having that mass—such as a mass greater than that of the entire universe. So, it seems *C* has modal gaps.

I don’t believe *C* poses a counterexample to (M_4), however, because I don’t believe that *C* is both non-haecceitous and coherent. Let me explain. Suppose we manage to explicitly define the terms ‘being human’ and ‘capable of eating’. Then given a certain very high value for *n*, the sentence,

1. There exists an *x*, such that *x* is human and capable of eating n-kilograms of cat food,

will have a translation syntactically identical to one (or more) of the following:

2. There exists an *x*, such that *x* is *F*, and it is not the case that x is *F*.
3. There exists an *x*, such that *x* is *F*, where ‘*x* is *F*’ is defined using a term equivalent to a term of the form ‘being identical to one of the things that …’.
4. There exists an *x*, such that *x* is *F*, and ‘*x* is *F*’ is *not* defined using a term equivalent to a term of the form ‘being identical to one of the things that…’.

I say that *C* is haecceitous or incoherent because it seems to me that either (i) there is no intelligible translation from (1) to (4), or (ii) there is *also* an intelligible translation from (1) to (2). Consider (i). It is doubtful that there is an intelligible translation from

(1) to (4) if ‘being human’ expresses the property of *being a bipedal primate*. The reason is that ‘being a primate’ is defined in terms of ‘having an ancestor of sort *F*’, and there is no plausible way to define ‘having an ancestor of sort *F*’ except in terms of the *haecceitous* predicate ‘being identical to one of the things that is causally related to something that satisfies (or satisfied) *F*’. If, on the other hand, ‘being human’ is definable in such a way that there is an intelligible translation from (1) to (4), then it is far from clear that there should be a limit to the eating capacity of a human. It seems we’d only suspect that ‘capable of eating *n* kilograms of cat food and being human’ expresses an impossible property for some value of *n* if we also suspected that for some value of *n*, the predicate is contradictory and *ipso facto* strictly incoherent. I confess, therefore, that I see no clear way to define the above predicates, such that a modal gap evidently occurs in a coherent, non-haecceitous class. So, I don’t think *C* poses a clear counterexample to (M_4).

Let us consider one more candidate counterexample. Let class *C* be a class whose members are of the form *being glass and being transparent to degree r* (where $1 \geq r \geq 0$, and $r \in R$). One may wonder whether, given (M_4), it should be possible that there is an invisible (perfectly transparent) piece of glass.[8] The answer depends on how ‘being glass’ and ‘being transparent’ are defined. Suppose ‘being perfectly transparent’ means ‘reflecting no light’. Then if glass is (by definition) made up of things that reflect light, it follows that *C* is strictly incoherent—and so (M_4) does not apply. Alternatively, if ‘glass’ is defined in terms of ‘being made of something identical to the *F* things’, then *C* is not non-haecceitous, and again, (M_4) does not apply. If, however, ‘being glass’ and ‘being transparent’ are defined in such a way that *C* is neither incoherent nor non-haecceitous, then invisible glass may indeed be possible. Either way, there is no problem here for (M_4).

[8] I owe this example to van Inwagen, who offered it to me in correspondence.

I can't say for sure that there are no exceptions to (M_4). Nevertheless, (M_4) seems to account for many cases of modal continuity, and if there are exceptions, they aren't readily apparent.[9] I suggest, therefore, that (M_4) may provide an accurate guide to modality. (M_4) is certainly more reliable than the general statement that no unified class of degreed properties whatsoever has a gap. And I take it that even the general statement is reliable, to an extent, because it provides defeasible evidence for arbitrary cases. So, I offer (M_4) as an additional, more secure principle of modal continuity.

The notable advantage of (M_4) over (M) is that, even if there are exceptions to (M_4), they are (apparently) fewer and further between. The restricted principle is, I suggest, a *more reliable* guide. (I'll speculate as to what may make it more reliable in a moment.) Even still, (M) is more widely applicable—it even *generally* holds for many non-coherent and haecceitous unified classes of degreed properties. Furthermore, the principle is simpler and more intuitive. I suggest, therefore, that (M) may be especially useful for providing an initial assessment for any arbitrary case of modal continuity, even while certain restricted principles can provide more secure assessments for certain domains of modal continuity. The principles are complementary and each has its time and place.

At this point, one might wonder how the restricted and unrestricted principles are related to the nature of modality. What is it about *necessity*, for example, that gives rise to any defeasible principles of modal continuity? And what explains the breaks in modal continuity?[10] Principle (M_4) includes what may appear to be *ad hoc* restrictions to (M)—restrictions that ostensibly having nothing at all to do with modality. So, if the restricted

[9] When considering candidate counterexamples, we should bear in mind that broad logical possibility is broader than nomological possibility: so, for example, even if electron orbits are discontinuous given our laws, there may be other laws that allow for orbits that occupy the gaps.

[10] I am grateful to an anonymous referee for bringing these sorts of questions to my attention.

principle is indeed more reliable, what accounts for that? What makes the restricted principles any "closer" to tracking the modal facts than the unrestricted principles? Answers to these questions would bring a deeper understanding of the source of the reliability of modal continuity principles—and may thus inspire greater confidence in the principles themselves.

These important questions aren't easy to answer, but I have a few proposals to offer for further consideration. First, perhaps modal continuity holds because (i) *possibility* differs from *impossibility* in a basic, categorical way, and (ii) basic categorical differences don't easily turn on mere differences in degree. Plausibly, differences in degree tend to be too slight to account for the deep difference in a basic category. And plausibly, the difference between possibility and impossibility is deep and categorical: there are no intermediates, like *less impossible* or *more possible*. (Of course, people sometimes use expressions like "that's barely possible," but they're plausibly talking about degree of *difficulty*, not degree of *modality*.) So, perhaps modal continuity tends to hold because a difference in degree would normally be too slight to account for a difference with respect to the basic categories of *possibility* and *necessity*. In short, perhaps category inspires continuity, other things being equal.

This answer is compatible with at least two options for understanding why exceptions to continuity occur where they do. The first is relatively pessimistic: it could be that there is, unfortunately, no general principle that explains where all or most of the exceptions are. Reality may not be so neat and tidy. In that case, perhaps the best we can do is to consider particular cases (or domains of cases) to assess whether modal continuity intuitively appears to hold in those cases (or domains of cases). We could still specify restricted principles of continuity to track those cases where continuity seems to hold most reliably. (Compare: contingent facts *typically* enjoy an explanation, but there may be no general principle that explains where all exceptions to this principle of explanation arise.)

On this option, we may still have a way to discern what's a reliable modal continuity principle and what's not. Consider that we have modal intuitions about some particular cases. After all, it is our judgments about particular cases that allow us to identify counterexamples to the continuity principles. So, if we assume that our intuitions about the counterexamples are reliable, then we may thereby assume that these intuitions give us a grasp of relevant modal facts. And if we can fine-tune our modal continuity principles by appealing to various modal facts, then our fine-tuned principle will be more sensitive to more facts than the general principle. The idea here is that our intuitions about certain cases supply evidence concerning certain modal facts, and we can appeal to those facts when refining the principles. (The methodology here is *particularist*: from the particulars we get the methods.[11]) So, perhaps we can expect that certain restricted principles will track the modal facts more closely than the unrestricted one. When a principle "respects" or "captures" more of the facts, this means it is more reliable.[12]

A second option is to explain modal breaks in terms of conflicts between different *degrees of specificity* contained within a modal statement. To illustrate, take the statement, <there is a 14-sided and less than 14-sided thing>. It features two *degreed* properties: *being n-sided* and *being less than m-sided*. These properties are of course incompatible with each other when $m = n$. And they therefore mark a "modal intersection" between two axes of specifications, which are defined by n and m. That is to say, where n is less than m, co-exemplification is *possible*; otherwise, it's *impossible*. In this example, the modal claim,

[11] For an elaboration and defense of particularism, see [Chisholm 1973].

[12] I am grateful to Ballantyne for suggesting this way of developing the proposal.

<there is a 14-sided and less than 14-sided thing>, contains “multiple axis” of specification. Similarly, statements about the drinking capacity of a specific individual contain multiple specifications. Keith Lehrer, for example, has specific essential capacities. So, statements about amounts of milk Lehrer can drink while jumping on a trampoline (say) have multiple specifications: *amount* of milk and the *specific* person. Distinct specifications are sometimes incompatible with each other, resulting in a modal break (and a two-dimensional modal intersection). The idea, then, is that although a mere difference in a degree or specification does not by itself normally have the power to produce a basic modal difference, differences in *multiple* specifications create ample opportunities for internal conflict among the different specifications. And multiple specifications increase the risk of modal breaks. On this proposal, (M_4) is a more secure principle in part because it restricts, albeit somewhat artificially, the scope to statements that have (or are more likely to have) only one axis of specification.[13]

Of course, I have not explained why *each* and *every* modal break occurs where it does. There appear to be many different causes of modal breaks. What I am suggesting, instead, is that modal continuity may fall out of the general principle that differences in degree don’t normally create differences in category: category inspires continuity. This proposal implies *modal inertia*, which may be blocked by various factors in various contexts. This is but one possible proposal, and no doubt there are alternatives that are also possible. The epistemology of modal continuity stands ready for further investigation.

[13] Why work with (M_4), then, rather than with a principle that is restricted to one axis of specification? I have two reasons. First, I worry that there are breaks even in one-dimensional modal statements: for example, there can be *one* concrete object but not ½ concrete objects. Second, there are multi-dimensional statements that don’t seem to have breaks, and (M_4) accounts for many of them. That said, a “one-axis” continuity principle might serve our purposes in certain contexts. I don’t have a master principle to offer that is maximally ideal for all contexts.

4. Modal Continuity and Unrestricted Composition

A principle of modal continuity is useful for investigating a variety of interesting philosophical theories. I will present one application here.

I will make use of a modal continuity principle to provide a novel reason to think that composition is *unrestricted*—*i.e.*, no objects fail to jointly compose something. My strategy will be to give an argument based upon modal continuity for the conclusion that there exists something that is composed of a tower and a distant nose—a *tower-nose*. If the argument goes through for tower-noses, then the same reasoning should go through *mutatis mutandis* for any collection of (material) objects.[14]

Here is the basic argument, which I call 'the Modal Composition Argument':

P1. Possibly, there is a composite object *O* having proper parts p_1 and p_2.

P2. The proposition that p_1 and p_2 jointly compose something is different by a mere degree from the proposition that a tower and a nose jointly compose something.

P3. Therefore, possibly, there is a tower-nose. (P1, P2, M_4)

P4. There is a tower and there is a nose.

P5. If (i) there is a tower, (ii) there is a nose, and (iii) possibly, there is a tower-nose, then there is a tower-nose.

P6. Therefore, there is a tower-nose.

Let me discuss each premises. Premise P1 asserts that composition is possible. Most philosophers would accept this premise, and I will assume it to be true for the sake of argument. Those who don't accept P1 may still find value in the Modal Composition Argument, for they may treat the argument as a *reductio* of the thesis that mereological nihilism is possibly false.

Next consider P2: <p_1 and p_2 jointly compose something> is different by a mere

[14] I shall limit the argument's scope to material (spatially situated) objects.

degree from <a tower and a nose jointly compose something>. Why think this? The reason is that the difference between a tower or a nose, on the one hand, and any other material object on the other, is plausibly specifiable in terms of a quantitative (degreed) difference in geometry, various spatial relations and dispositional properties. So, for example, suppose p_1 is a frog's leg. Now consider the following representation of a (sorites) series that goes from the frog's leg to a particular tower:

The geometries are radically over-simplified, but the point of the illustration isn't affected by the lack of specificity. The point is that the differences between a frog's leg and a tower are ultimately determined by differences in various degreed properties, such as degreed differences in geometry, spatial orientation, and dispositional, relational or functional properties. These difference-making properties form a unified class of degreed properties, where each member differs from another by a certain specifiable degree. Suppose that is right. Then <there is something composed of a tower and a nose> differs by degree from <there is something composed of p_1 and p_2>.[15]

The next step is P3: possibly, there is a tower-nose. This step follows from the previous premises together with a principle of modal continuity. It is worth emphasizing that the relevant class of difference-making properties is both coherent and non-

[15] I am not suggesting that P2 premise is undeniable or completely uncontroversial. See, for example, [Merricks 2005] for dissent. Nevertheless, advocates of restricted composition commonly assume a premise like this, and so it is useful to see how it may be used in an argument against restricted composition. Note also that the premise is especially plausible on the standard "bottom-up" materialist picture according to which all properties of material objects are ultimately determined by the lower-level properties and relations instantiated by basic units of matter.

haecceitous. Hence, the inference in question is supported not only by a general, defeasible continuity principle, but also by the more robust, restricted principle (M_4). It appears, then, that we have a "modal continuity" reason to accept the inference.

The next premise, P4, says that there is a tower and there is a nose. For example, there is my nose, and there is the Eiffel tower. I will assume this premise is true for the sake of argument. If you doubt the premise (perhaps because you don't believe in artifacts or arbitrary undetached parts), then run the argument in terms of a pair of objects you think do exist. Nothing in the argument turns on the details of *which* material objects exist.

P5 is the final premise: *if* (i) there is a tower, (ii) there is a nose, and (iii) possibly, there is a tower-nose, *then* there is a tower-nose. You might think this is the premise to deny. But I believe there is a good reason to think P5 is true. The reason is based upon the possibility of a world *indiscernible* to ours in which there is a tower-nose. To see what I have in mind, suppose (i) there is a tower *T*, (ii) there is a nose *N*, and (iii) possibly, there is a tower-nose. The first thing to notice is that a principle of modal continuity implies the possibility of a tower-nose of *any* size and shape. Differences in size and shape are differences in degree, and so by M_4, these differences (plausibly) don't make a modal difference. I suggest, then, if M_4 is true, then it is possible for there to be a tower-nose that is qualitatively indistinguishable from what would be the fusion of *T* and *N*. Moreover, by the same reasoning, there is a possible world with a tower-nose that is qualitatively indiscernible from ours: for again, no difference in arrangement of matter amounts to more than a mere difference in degree. Modal continuity implies, therefore, that there is a possible world that is qualitatively *just like ours* in which perfect duplicates of *T* and *N* compose something. But if *duplicates* of *T* and *N* compose something in a duplicate world, then it seems that *T* and *N* should themselves compose something in *our* world.

The above reasoning implicitly makes use of the following principle:

(C) Worlds that are intrinsic duplicates are compositional duplicates.

The thought here is that if you fix the facts about the existence and arrangement of the basic ingredients of a world, then you thereby fix the world's compositional facts. Put differently, if two worlds *differ* with respect to what objects compose what, then they differ in some other, non-compositional respect.

The principle enjoys a ring of plausibly. Consider that without the principle, there cannot be any deeper *explanation* of why composition occurs when it does. Compositional facts would be inexplicable. Moreover, if (C) is false, then it seems it would be possible, in principle, for objects to "flicker in and out" of existence without *anything* changing position. So, Peter van Inwagen may be presently correct: there are no tables or chairs. But a second later, Hud Hudson may become right: there are tables, chairs and tower-noses—regardless of whether anything changed position or orientation! Such a "flicker" scenario doesn't seem like it should be genuinely metaphysical possible. It is more plausible, I think, that non-compositional facts fix compositional ones. I suspect that many advocates of restricted composition will agree.[16]

The conclusion follows from the premises: there is a tower-nose. And if there is a tower-nose, then by the same reasoning, there is a fusion of any arbitrary collection of objects. Therefore, we have here a new, "modal continuity" argument for unrestricted composition.

I don't claim that the argument is decisive. Like any argument in philosophy, there is room for rational disagreement. Speaking for myself, I find the premises of the Modal Constitution Argument quite plausible. And since the *validity* of the argument crucially

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[16] Ned Markosian, a defender of restricted composition, will agree. He accepts that the spatial profile of a world suffices for its compositional profile. See [Markosian forthcoming: 6–7].

hinges on a principle of modal continuity, it seems the notion of modal continuity can play a valuable role in contemporary mereological debates.

5. Conclusion

I have offered a new technique for modal reasoning. The technique can be quite useful for extending our modal insights. I gave an example of one philosophy application, and others are not hard to find. Here are just three candidate applications deserving further investigation: first, modal continuity provides fresh support for the *subtraction argument* for Metaphysical Nihilism by supporting the premise that each (contingent) thing could be removed until there is nothing (contingent);[17] second, if there were a necessarily existent, first cause of contingent things, as some theorists have supposed (among naturalists and non-naturalists alike), then the causal potential of the first-cause would have no upper bound (by modal continuity);[18] third, for any set of geometric states, there can be a thought about that set (by modal continuity), and thus, there are more possible thoughts than possible geometric states (by Cantor's theorem). The reader may have thought of other applications. My hope, therefore, is that future work on the reliability of modal intuitions will benefit from discussion of modal continuity principles like the ones I have offered here.[19]

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[17] Efird and Stoneham [2009] discuss and defend the subtraction argument.

[18] Cf. [Koons 1997].

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