dialectica

Vol 76 : 3
September 2022

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doi:

Boaz Faraday Schuman. 2022. "Lewisian Worlds and Buridanian *Possibilia*." *Dialectica* 76(3): 1–0. doi:.

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Many things can be other than they are. Many other things cannot. We talk about such things all the time. But what is this talk about? One answer, presently dominant in analytical philosophy, is that we are speaking of possible worlds: if something can be other than it is, then it actually is that way in some (other) world. If something cannot be otherwise, it is not otherwise in any world whatsoever. But what are these worlds? David Lewis famously claims that every world exists, just like ours does. In contrast, the medieval thinker John Buridan understands modal logic in terms of objects and causal powers: if something can be other than it is, then there is a causal power that can make it that way. If it cannot, then no causal power—not even God—can make it otherwise. As we'll see, (i) the Lewisian plurality is not possible on Buridan's account, and accordingly (ii) a basic tenet of classical theism is untenable on Lewis's metaphysics. In short, either the Lewisian plurality is incoherent, or a core monotheistic tenet is impossible.

Modal sentences deal with things that can or must or cannot be. For example, we say that a triangle *can* be drawn, *must* be three-sided, and *cannot* be round. What makes a modal sentence modal? Short answer: its inclusion of a modal term like *can* (*possibly*), *must* (*necessarily*), and so forth. Such terms register that a claim is being qualified in such a way that the conditions of its truth are not limited to the way things actually are. But what is this modal talk about? Over the past two and a half millennia, answers have varied. Relatively recently, we have come to think of modes in terms of quantification over worlds: what is possible is true in at least one world, and what is necessary is true in all. Call this the world's reading (WR) of modal sentences. David Lewis (1941–2001) famously understands WR ontologically: these worlds really exist as spatiotemporal isolates, and are every bit as real as our own.

Contrast WR with a much older—and for a long time prominent—understanding of what modes are: terms whose operation on sentences expands (or *ampliates*) the extension of their terms, so that the terms range over possible objects, including non-existent ones. The modal properties of these objects are grounded in the causal powers of existing things: a triangle can be drawn because you or I can draw one; it is necessarily three-sided because there is no causal power (not even God) capable of making a triangle to be otherwise—at least, not without depriving it of its triangularity. Call this the objects reading (OR) of modal sentences. This is the view of John Buridan (c.1300–1361).[1] A careful examination of these views reveals that (i) they are incompatible, so that the Lewisian plurality is not a possible object or collection of objects; and accordingly that (ii) the world's reading, at least in its Lewisian form, is incompatible with a basic tenet of classical theism.

Why compare Buridan and Lewis? I have three reasons. First, Lewisian modal realism is well-known, and therefore provides a convenient off-the-shelf foil for Buridan's modal ontology. Second, Lewis has clear ontological commitments, and so he is easy to pin down. Compare the ontologically agnostic Kripkean modal semantics and syntax: you and I may have very different views on what worlds are, but nevertheless agree on a Kripkean reading of the claims of WR. So the Kripkean account does not provide a clear and illuminating contrast for Buridan's modal ontology, the way Lewis's approach does. Third, contrasting the Lewis and Buridan illuminates latent aspects of both. It gives us an insight into Lewis, hitherto unrecognised in the literature; and it reveals Buridan's own views on the limitations on divine power—limitations he does not explicitly discuss at length. After all, placing restrictions on God's power would have been a hazardous thing to do at the fourteenth-century University of Paris.[2] All the more so for an Arts Master who, as he explicitly acknowledges, is not qualified to teach theology.[3] All the same, we can tease out the consequences of the views Buridan does express. And there is more here than meets the eye.

1 For a discussion of earlier debates about causal powers in the twelfth and thirteenth centuries, see Peter King (**King2021?**).

2 In particular the infamous Condemnations of 1277 insisted on the boundlessness of divine power. For a discussion, see Grant (**Grant1979?**), and more recently Thijssen (**Thijssen2018?**).

3 That Buridan never advanced beyond the post of arts master, and so—in spite of his evident brilliance—never taught at the higher and more prestigious Faculty of Theology, is remarkable. In modern terms, this would be a bit like deciding to remain an assistant professor for life, even when promotion was available. For a discussion, see Jack Zupko (**Zupko2003?**, xi–xii).

Let's begin with WR, which is relatively familiar, and has two important shortcomings that point to two strengths of OR.

1 Possible Worlds

Nowadays, we tend to think of modality in quantificational terms: a modal is a sentence with a modal operator like "□" or "◇," for necessity and possibility, respectively. Such operators quantify across possible worlds. On these lights, $\Box\varphi$ just says that φ holds in all possible worlds, and $\Diamond\varphi$ says that φ holds in at least one. The parallel, then, is with the ordinary first-order quantifiers: (□-like) "∀," and (◇-like) "∃."[4]

There is much to be said for WR, but here I will limit myself to two points. First, it's versatile: we can use the apparatus of worlds to construct a wide variety of systems of alethic modal logic—that is, modal systems dealing with necessary truths, possible truths, and so on. We can characterise an astonishing number of systems in this way, and haggle about which one is best (or best for what). We can also characterise non-alethic systems to model knowledge and belief (epistemic logic), past, present, and future time (tense logic), and morality (deontic logic). WR, then, is extremely fruitful.[5]

Second, the WR is *precise*: can we give clear quantificational definitions of terms like *necessarily* and *possibly*, which might otherwise seem qualitative and murky. And, using Kripke's apparatus of frames, we can characterise our systems with mathematical precision. But beyond all this, we might wonder: what are these worlds, anyway?

1.1 *Lewisian Worlds*

David Lewis's answer to this question is famous and bold: all possible worlds exist, and they are just as real as ours. As he tells us (**Lewis1986?**):

4 One need not, however, be committed to a semantics of possible worlds in order to think of modal terms quantificationally: already in 1924, well before the possible-worlds innovations of Kripke, Otto Jesperson pointed out that "necessity means that *all* possibilities are comprised, just as impossibility means the exclusion of all possibilities" (**Jesperson1924?**, emphasis original, 325).

5 As Graham (**priest_g:2016?**) puts it, "the clarity of the mathematics involved, and their usefulness in an analysis of many things other than modality—such as conditionals, meaning, knowledge and belief—meant that they [i.e., possible worlds] soon became part of the intellectual landscape."

> The other worlds are of a kind with this world of ours. To be sure, there are differences of kind between things that are parts of different worlds [...] but [...] the difference between this and the other worlds is not a categorical difference. Nor does this world differ from the others in its manner of existing.

According to Lewis, there are many worlds—as many, in fact, as there are ways things can be. This ontological account of WR prompts two questions: how are these worlds externally distinct from each other, and how are they internally unified? Answers to both questions turn on spatiotemporal relations. To the former, Lewis tells us (**Lewis1986?**):

> There are no spatiotemporal relations at all between things that belong to different worlds. Nor does anything that happens at one world cause anything to happen at another. Nor do they overlap; they have no parts in common.

Lewis frequently treats causation as the paradigmatic spatiotemporal relation. Since the worlds have no spatiotemporal relations to one another, there can be no causal interactions between them. They are therefore not like planets that are too far removed to interact with each other. They are, rather, spatiotemporal isolates. Call this Lewis's *isolation doctrine*.

Importantly, Lewis does not say that different worlds *cannot* interact, as if blocked from doing so. Rather, they just *do* not: the notion of interaction between different worlds makes no sense within his theory. This requirement has a stipulative flavour—and, indeed, it is precisely that: a stipulation. This point is important, and we will return to it in section 3.

In like manner, Lewis accounts for the unity of worlds in terms of spatiotemporal relations (**Lewis1986?**):

> If two things are spatiotemporally related, they are worldmates [...] things are worldmates iff they are spatiotemporally related. A world is unified, then, by the spatiotemporal interrelation of its parts.

Again, this is presented in a stipulative way, though it is a corollary of the doctrine of isolation: worlds are spatiotemporally isolated, and therefore any spatiotemporally related things belong, *eo ipso*, to the same world. Here, whether or not causal interaction *actually* occurs is less important than immediately above: there does not need to be any obvious causal relation between

two things for them to belong to the same world. A long-dead star too distant from Earth to interact with it nevertheless has spatiotemporal relations to us: it is some distance away in time and space, and it came into being at some time relative to us. It is, therefore, our worldmate.

The foregoing considerations can be distilled into a precise account of Lewisian worlds or *possibilia*, to wit:

> POSSIBILIA$_{\text{L}}$. A world w is an isolated unity of spatiotemporally interrelated parts. If x and y have any spatiotemporal relations, they are members of the same world.

The spatiotemporal relation is, in its most general sense, Euclidean. Let R be the spatiotemporal relation, so that Rxy says that x is spatiotemporally (though not necessarily causally) related to y. Then, by POSSIBILIA$_{\text{L}}$,

$$\forall xyz(\mathrm{R}xy \wedge \mathrm{R}xz \rightarrow \mathrm{R}yz)$$

For clarity, we can also represent this diagrammatically, as follows:

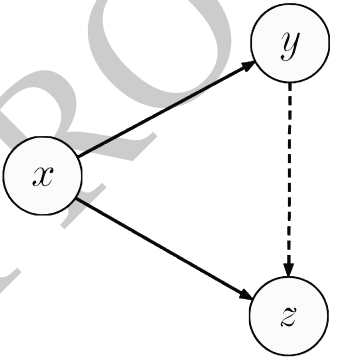

Figure 1: caption

Here, R is represented by arrows; if the relation represented by the solid arrows between x and y, x and z hold, then the relation represented by the dotted arrow between y and z also holds.

This fact makes the case that the Lewisian plurality is impossible (set out in section 3) much easier to make, so let's linger on it for a moment. Let Rxy

and Rxz. It follows that Ryz. If it didn't, then x would be worldmates with two objects that are not themselves worldmates with each other. So there would be partial but incomplete overlap among at least two worlds. And this goes against both *possibilia*$_{\text{L}}$, and against commonsense thinking about spatiotemporal relations: if, for example, x is some spatial or temporal distance from both y and z, then there must be some distance, however great, between y and z themselves. Therefore, the spatiotemporal relation R is Euclidean.

At the beginning of this section, I noted two significant advantages to the WR of ordinary modal language: WR is precise, and fruitful. Before we turn to the possible objects of Buridan, it's worth asking whether WR has any drawbacks. For present purposes, I want to highlight two: WR does not represent what is going on in ordinary modal language, and taken on its own, it is uninformative about what grounds the modal properties of things.

To begin with the latter: the extensional account furnished by WR does not capture the ordinary notion of necessity *for* or *as*. For example, triangles are necessarily three-sided; three-sidedness is necessary *for* triangle-hood. Whereas you can paint a triangular object blue without removing its triangularity, you cannot, say, rearrange its parts in such a way that it gains (or loses) a side, and yet remains a triangle. This fact is not directly expressible on WR; all it can tell us about this (or any other) necessary claim is that it is true in every world. Fair enough, but such claims do not account for the inseparability of three-sidedness and triangularity.

Probably for this reason, most ordinary modal talk is not about worlds at all, but rather about things, and the ways they can be in *this* world. Scott Soames gives some remarks that support this point in his discussion of reference to non-existent objects (**Soames2010?**):

> Although this is controversial, the idea that we can refer to, and quantify over, only things that exist is, I believe, an unfounded philosophical prejudice at variance with our ordinary thought and talk. For instance, imagine that I have all the materials to build a doghouse, plus a plan specifying every detail of the design and construction, including how each of the materials will be used. From studying the plan and materials, I know exactly which structure I intend to create. Having identified it uniquely, I can refer to it, predicate properties of it, and even name it.

Soames's dog house is a possible, non-existent object. What makes it possible is what *he* can do with materials and plans in *this* world. A lot of our day-to-

day modal talk is like this: when, for example, someone says they can paint their house green, they are talking about *themselves*, and what they can do with *their house*—not about their counterpart, in a relevantly similar world in which their counterpart's house is green.

Thus for all its versatility and precision, WR does not provide a full and accurate report of what is going on in ordinary modal language. Such language, judging by Soames's example, is about possible things, at least some of which do not exist, whose modal properties are grounded in existing causal powers. I have called this the objects reading (OR) of modal language; it is the approach taken by John Buridan. It turns out that objects like Soames's doghouse are precisely what Buridan has in mind in his analysis of *possibilia*.

2 Possible Objects

In the WR of modal language, modes operate on whole sentences, quantifying over possible worlds. In contrast, Buridan's modal logic is not propositional but *terminist*; he thinks of modes as acting on sentences' terms.[6] Hence in his treatment of modal semantics in *Tractatus de Consequentiis* (2.4), he tells us that:

> A sentence (*propositio*) [...] about possibility has a subject term that is ampliated (*ampliatum*) by the modal term that follows it, so that it stands (*ad supponendum*) not only for those things which exist, but also for those things which *can* exist even though they do not. Hence in this way it is true that air can come from water, although this is not true of any air that presently exists.[7]

6 While Buridan's *possibilia* have not received much attention, a good deal has been said already about Buridan's modal syntax and semantics. To date, the most thorough treatment of his syntax is chapter 9 of Paul Thom's (**Thom2003?**). And, following the concluding suggestions in G.E. Hughes' (**Hughes1989?**), Catarina Dutilh Novaes (**Novaes2007?**) and Spencer Johnston (**Johnston2015?**; **Johnston2017?**) have given detailed analyses of Buridan's logic in terms of possible worlds. Gyula Klima, too, has remarked in his monumental translation of Buridan's *Summulae de Dialectica* that Buridan's modal semantics contains "effectively the gist of the idea of modern possible-worlds semantics" (**Klima2001?**).

7 "Propositio [...] de possibili habet subiectum ampliatum per modum sequentem ipsum ad supponendum non solum pro his quae sunt sed etiam pro his quae possum esse quamvis non sint. Unde sic est verum quod aer potest fieri ex aqua, licet hoc non sit verum de aliquo aere qui est." Note that Buridan is here talking about *divided* (roughly, *de re*) modals; he deals with *composite* (roughly, *de dicto*) modals elsewhere. Now, immediately below this passage, Buridan tells us that a modal sentence "B is possibly A" is equivalent to "What is or can be B can be A."

Air from water is, as Paul Thom (**Thom2003?**) has observed, a simple account of boiling. The water in this pot could boil; but since it is not boiling, it is not true of any actual air that it came from this water. Hence this water is possible—but not actual—air. Elsewhere, Buridan gives the example of vinegar that could be produced from this wine, but will not, simply because I am going to drink the wine first (*de Caelo*, 1.23).[8] These are the non-existent possible objects—or *possibilia*—to which the modal terms expand—or ampliate—the terms of a sentence.[9]

What are these non-existent *possibilia*?[10] Buridan deals with *possibilia* obliquely in his logic and metaphysics, and so we will have to reconstruct his view from these discussions. Here, I present three key passages: one dealing with necessity, one with impossibility, and the last with possibility. Approaching Buridan's account of the *possibilia* from these three angles will allow us to build up a consistent and robust picture of his views on what they are.

2.1 *Necessity in the* Prior Analytics

If S is necessarily P, then (by modal duality) it is not possible for S not to be P. Yet this analysis faces a problem. As Buridan asks in his *Quaestiones super libros "Analyticorum Priorum"* (*QAPr* I, 25), what is the modal status of the following sentence?

(1) Humans are animals.

Is (1) necessarily true? In *Prior Analytics* I, 9 (310^a31), Aristotle clearly thinks so. And indeed, (1) serves as a stock example of a necessary truth in medieval

An anonymous reviewer for this journal has remarked on the connection with Williamson's (**Williamson2013?**) distinction between two readings of "possible stick:" the *predicative* reading ("x is a stick and x could have existed"), and the *attributive* reading ("x could have been a stick"). Buridan's own account looks, *prima facie*, more like the predicative reading; but perhaps the two are not equivalent. At any rate, this question could form the basis of a stand-alone paper.

8 Cf. Aristotle's cloak in *Peri Hermeneias* 9, which can be cut up, but may also simply wear out first (19^a12–16).

9 For an overview of Buridan's semantic doctrine of modal ampliation, and a case for it as one of his most significant contributions to the development of logic, see Zupko (**Zupko2003?**), & (**Zupko2018?**).

10 An anonymous reviewer for this journal has remarked that the common use of the term *possibilia* is for non-existent (possible) things, and does not extend to existing things as well. This is how I use it here, though it should be borne in mind that all *actualia* are, for Buridan, *possibilia* as well. After all, everything actual is possible.

logic.[11] Yet (1) is falsifiable, since God could annihilate all human beings. As Buridan tells us (*QAPr* I, 25, arg. 3):[12]

> If it were supposed that (1) were not necessary, it would be because God is capable of annihilating every human being. And in such a case, no human would exist, and so no human would be an animal.[13]

For Buridan, all affirmative sentences, including universals, have existential import, in contrast with negative sentences (both universal and particular), which do not. Thus Buridan would reject the reading of (1) given by classical FOL ($\forall x[\text{Human}(x) \rightarrow \text{Animal}(x)]$), which is capable of vacuous truth. Since there is no vacuous truth for affirmatives, (1) can be rendered false by the annihilation of its subject matter. Therefore, since (1) is falsifiable, it expresses a contingent truth.

Nor is this sort of contingency limited to sentences which, like (1), are taken from the natural sciences. It is also a problem for geometry:

> If this were so, then no claim of geometry would be necessary either, since God can just as well annihilate all magnitudes as all human beings. And then it would follow that geometry would not be a science, which everyone would regard as false and unsuitable. (*QAPr* I, 25, arg. 3).[14]

God can annihilate everything with magnitude, and therefore magnitude itself. If God were to do that, then all the affirmative claims of geometry would be false, since the things they deal with would not exist. This is a consequence of Buridan's anti-realism, which extends even to the objects of mathematics and geometry: if it so happened that there were no triangular arrangements of matter, then there would be no triangles (though it would still be possible to think and talk about them, like the roses of yesteryear). The same holds for all other geometric and mathematical objects.

11 Along with "God exists" and "No human is a donkey." Modern logical textbooks prefer mathematically-flavoured examples like "The set of primes is denumerable" and "$a = a$." The conventionalised role of these stock examples is clear.

12 All translations are mine.

13 "Item, si poneretur quod non esset necessaria, hoc esset pro tanto quia deus posset annihilare omnem hominem; ideo nullus homo esset, et sic nullis homo esset animal."

14 "Si hoc obstaret, nulla propositio geometrica esset necessaria, cum deus ita possit annihilare omnes magnitudines, sicut omnes homines. Et tunc ultra sequeretur quod geometria non esset scientia, quod reputatur ab omnibus falsum et inconveniens."

Worse, even if God never gets that destructive, a crisis remains: the mere fact that geometric claims *could* be falsified by an act of divine will entails that these claims are contingent. If the truth of any claim is contingent, so is its subject matter. Since the subject matter of any science (*scientia*) must be necessary, it follows that even geometry is not a science. We can expect the other sciences—with the obvious exception of theology—to fare no better, given that God could annihilate their subject matter, too. So can there be any science (apart from theology) at all?

Buridan's answer is *yes*: the claims of geometry (and of the other sciences) are necessary, but their necessity is attenuated: they are not necessarily true *simpliciter*. Rather, they are true "so long as" or "just when" (*de quando*) the things their subject and predicate terms stand for exist. Assuming no annihilation of their subject matter occurs, they will remain true—indeed, *necessarily* true:

> Necessity "just when" (*de quando*) comes about from the fact that, whenever the subject and predicate terms do stand for anything, they stand for the same thing (I am here speaking of affirmative sentences). And in this way I say that the following are necessary: "Humans are animals," or also "Horses are animals." Indeed, even "A rose is a flower" is necessary in this way, even if there are no roses now. And although there is not a lunar eclipse happening right now, still the following is necessary: "An eclipse is an obstruction of the moon by the sun." (*QAPr* I, 25, co).[15]

So a sentence like (1) is necessarily true, assuming the existence of the things it deals with, namely humans. Likewise, the claims of astronomy are true even when the events they describe are not presently occurring, since any time they *do* occur, the sentences are true. Thus, according to the account set out by Buridan in *QAPr* I, 25, a sentence like (1) can only be falsified by the *annihilation* of the things it deals with. There is no way to falsify (1) that leaves humans intact. So whenever humans exist, (1) is true.

15 "Necessitas de quando ex hoc provenit quod oportet subiectum et praedicatum quandocumque supponunt pro aliquo supponere pro eodem; et hoc dico in affirmativis. Et sic dico quod haec est necessaria 'homo est animal,' vel etiam 'equus est animal.' Immo etiam haec est necessaria 'rosa est flos,' licet modo nulla sit rosa. Et quamvis non sit eclipsis lunae, tamen haec est necessaria 'eclipsis lunae est defectus luminis a sole.' Sed isto modo haec non est necessaria 'uacuum est locus' si ponamus cum Aristotele quod impossibile est uacuum esse."

Thus the contrast between necessity and contingency in terms of modality simply construed (*simpliciter*) is the contrast between unfalsifiability and falsifiability. The contrast between necessity and contingency in terms of *de quando* modality is the contrast between falsifiability only by annihilation (*de quando* necessity) and falsifiability by alteration (*de quando* contingency). That humans are animals is *de quando* necessary, because it can only be rendered false by the removal of its subject matter. On the other hand, the fact that some humans are bearded is *de quando* contingent, since shaving them alters the fact, but leaves the subjects essentially intact.

From these observations, we can give the following Buridanian definition of necessity:

> Buridanian Necessity. S is necessarily P just in case S can only be made to be not-P by annihilating S.

This provides a good starting point for Buridanian modality; however there are crucial ambiguities that must be sorted out, if the above definition is to be consistent with the others we will look at below. Its adoption here is, therefore, tentative.

2.2 *Impossibility in the* Peri Hermeneias

In *Peri Hermeneias* 2 (16^a19), Aristotle tells us that nouns (ὀνόματα; Aristoteles Latinus: *nomina*) have signification. But Buridan asks, what about nouns like *chimaera*, which do not signify anything at all?

> We ask: does every noun (*nomen*) signify something?
>
> Objection: it does not, because the term *chimera* signifies nothing apart from a chimera. And yet a chimera is nothing. Therefore, it signifies nothing whatsoever.[16]

A chimera not only does not exist, like the roses of yesteryear; it is, in fact, impossible. Buridan makes this point several times: the chimera is made of

16 "Queritur utrum omne nomen significat aliquid. Arguitur quod non, quia iste terminus 'chimaera' nihil significat aliud a chimaera. Et tamen nihil est chimaera. Ergo nihil omnino significat" (*Peri. Herm.* 1.2, arg. 1).

incompossible parts.[17] In this respect, we may take it to be just like Schopenhauer's wooden iron or Frege's square circle.[18] Because the chimera cannot exist, it cannot be signified. And this seems to present a semantic counterexample to the *Peri Hermeneias* definition of nouns, even though syntactically, *chimera* functions like any other noun.

Buridan's solution here is to treat *chimera* as equivalent with the phrase "animal made up of parts that cannot be combined," and to note that, although this whole phrase does not signify anything, it has significative parts (namely *animal* and *part*). The details of this solution need not detain us here. What is significant for our purposes is the role of the chimera as an impossible object, whose impossibility is a function of its putative combination of incompossible parts. We can use such *impossibilia* for our next definition:

> BURIDANIAN IMPOSSIBILITY. S is not possibly P if S and P cannot be combined.

This relatively straightforward definition will figure prominently in an important exegetical problem in section 2.4.

2.3 *Potency in the* Metaphysics

Buridan's most detailed discussion of modal properties of *possibilia* is in his *Questions on the "Metaphysics" of Aristotle* (*QM*) IX, 5. There, Buridan asks whether everything that something *will* do can be said to be what it is *able* to do. If so, we get some strange results, as Buridan points out:

> A horse can come from wool. For earth comes from wool [by decomposition], and herbs come from the earth, and from those herbs which perhaps a horse will eat there can come horse semen, and, at length, another horse. And so even a horse can come from wool. And the same holds for all other modes of transmutation.[19]

17 "Chimaera est animal compositum ex membris ex quibus impossibile est aliquod animal componi." (*De Demonstrationibus* 8.2.3). For a lively discussion of the role of the chimaera in the history of philosophy, see Ebbesen (**Ebbesen1986?**).

18 Schopenhauer (1987 [1818]), vol.1, §53. Frege (1884), §74.

19 "Similiter ex eadem lana potest fieri equus, quia ex lana fiet terra, de inde herba, et ex illa herba forte quam equus comedet poterit fieri sperma equi et tandem equus. Et ita etiam ex lana potest fieri equus. Et sic de omnibus aliis modis transmutandi." (*QM* IX, 5, fol. 58rb). Among the other modes of transmutation Buridan discusses here are "Wool can become a hatchet" (wool > earth > stone > iron > hatchet), and "An infant can build a house" (infant > adult human > carpenter).

Here the problem is apparently whether or not the relation between S and P expressed by "S is possibly P" is transitive: if S can be P, and P can be Q, does it follow that S can be Q?

No, says Buridan: when we say that S can be P, we are generally speaking in terms of a *proximate* potency, rather than a remote one: S is proximately possibly P if S can become P in no more than one transmutation. In this way, wool is possibly earth, because it can become earth in one transmutation (i.e., decay); similarly, earth can become grass, and so on. Any other potencies that require multiple transmutations are remote—as is, for instance, the potency of wool to become a horse. Hence Buridan tells us that:

> Aristotle concludes the opposite. For he asks, when should something be said to be in potency, and when should it not? And he says that something should not be said to be in potency with respect to some form, except when only one transmutation is required, by which that form may be imparted on it.[20]

So although remote potencies can be discussed transitively, proximate potencies cannot. If the two are conflated, as in the wool-becoming-horse example, then, according to Buridan, the result is an equivocation.[21] Thus, although wool can decompose into earth, herbs can grow from earth, and so forth, it does not follow that wool can become herbs—much less a horse. Hence in speaking of possible horses, we are not speaking of all the things that, through multiple transmutations, could become a horse. If we were, then everything would be a possible horse, since, as Buridan observes, "anything can come from anything—albeit through several transmutations."[22]

So much for *possibilia* arising from natural causes, like possible dirt that can be generated from wool. But a problem remains: why couldn't God just rearrange the matter in a horse, say, to make it into a pile of dirt? So then a horse is possibly dirt (and vice-versa).[23] And if so, then our main problem comes roaring back: everything is possibly everything.

20 "Oppositum determinat Aristoteles. Querit enim quando aliquid debeat dici in potentia et quando non. Et dicit quod aliquid non debet dici in potentia ad aliquam formam, nisi quando sola transmutatio requiritur per quam illa forma perducatur" (*QM* IX, 5, fol. 58rb). Buridan seems to have in mind Aristotle's *Physics* I, 4 ($188^{a}32$–$^{b}3$).

21 "Modo in proposito est bene aqeuivocatio de potentia propinqua et remota" (*QM* IX, 5, fol. 58va).

22 "Quia ex quolibet potest fieri quodlibet—licet per multas transmutationes" (*QM* IX, 5, fol. 58rb).

23 I'm aware I am treading dangerously close to an old problem at which even young Socrates is reported to have balked: does dirt have an essence? (*Parmenides* 130^{c}–^{d}). I wish to remain neutral on this point: for my purposes, the only concession I have to make is that whatever makes horses

Buridan himself does not consider this problem, but there is indirect textual evidence that he would reject such a claim: after all, he frequently tells us that the following is impossible:

(2) A human is a donkey.

Granted, it is not beyond divine power to transform the matter of a human being into a donkey by imparting on it the appropriate form. But again, (2) is impossible. How?

The solution is to appeal to the notion of change entailing annihilation (or destruction—more on this in a moment), which we saw above in connection with *de quando* necessity. For example, consider the following sentence:

(3) Socrates is a human.

Any formulation of (3) is true whenever Socrates exists. And while (3) can be rendered false, this can only happen by the destruction of Socrates. Similarly if, instead of being served a hemlock cocktail, Socrates met his demise by having his matter suddenly morphed into the form of a donkey, (3) would become false. But so would the claim that Socrates himself is a donkey, since Socrates himself would no longer exist. So Socrates is not possibly a donkey.

We have limited ourselves to transmutation in talking about things-possibly-being-other-things, and to one transmutation at that. Granted, then, God can morph Socrates' matter into a donkey. But this morphing does not count as a transmutation in the natural sense, nor is it a potency belonging to Socrates. And so this fact no more entails that Socrates is a possible donkey than does the fact that Socrates can die and decay into soil, which then nourishes a plant, which a donkey eats, etc.

Here, then, we return to the original claim that *impossibilia* are incompossible combinations: donkey-Socrates, chimaeras—anything, in short, made up of parts that cannot be combined. Soon, we will see that Lewisian possible worlds, too, are Buridanian *impossibilia*. But first, we have to find a way of making the foregoing definitions consistent.

horsey is essentially different from whatever makes dirt dirty. Maybe I beg the question on this. But I invite you to beg it with me. After all, we're in good company, historically speaking.

2.4 *What are Buridanian* Possibilia*?*

In a seminal (**Hughes1989?**) paper, G.E. Hughes raises several questions about Buridan's modal logic and its underlying ontology. Concerning the latter, he tells us (**Hughes1989?**):

> For a long time I was puzzled about what Buridan could mean by talking about possible but non-actual things of a certain kind. Did he mean by a "possible A," I wondered, an actual object which is not in fact A but might have been, or might become, A? My house, e.g., is in this sense a possible green thing because, although it is not in fact green, it could become green by being painted. But this interpretation won't do; for Buridan wants to talk, e.g., about possible horses; and it seems quite clear that he does not believe that there are, or even could be, things which are not in fact horses but which might become horses.

Here Hughes makes no mention of the *Metaphysics* discussion—about horses, too!—which we just considered. This comes as no great surprise: that text is, to this day, neither edited nor translated.[24]

Here, Hughes's initial proposal is quite close to Buridan's own account: a house is a possible green thing, because there are powers in the world capable of making it so. The issue of substantial change—things becoming horses—is somewhat more thorny, since it seems odd to speak of things which are not horses, but which could become horses, as Hughes observes. And yet this is precisely what we are warranted to do, as Buridan explicitly tells us, provided we limit ourselves to at most one transmutation: horse semen is not a horse, but it is a possible horse.

Frustrated by his version of the horse puzzle, and unaware of Buridan's *QM* discussion, Hughes falls back on the familiar framework of possible worlds:

> What I want to suggest here, very briefly, is that we might understand what he says in terms of modern "possible world semantics." Possible world theorists are quite accustomed to talking about possible worlds in which there are more horses than there are in the actual world. And then, if Buridan assures us that by "Every horse can sleep" he means "Everything that is or can be a horse

24 Granted, Hughes himself did know Latin, and was experienced in palaeography. He even edited a portion of the *Logica Magna* of Paul of Venice (ca. 1369–1429). Still, one can't read everything.

> can sleep," we could understand this to mean that for everything that is a horse in any possible world, there is a (perhaps other) possible world in which it is asleep. It seems to me, in fact, that in his modal logic he is implicitly working with a kind of possible worlds semantics throughout.

Here, Hughes first claims that Buridan's modal logic can be understood using the modern apparatus of possible worlds semantics. But then he strengthens that claim: Buridan *is* in fact working with possible-worlds semantics, however implicitly.

From what we've seen of Buridan so far, we can see that at least the latter claim is mistaken. Buridan's view of modality is grounded in *causation*: if there exists no power to make S to be not P (at least without annihilating S), then S is necessarily P. Likewise, if S can be made to be P (through at most one transmutation), then S is possibly P. Thus something's modal properties are grounded in the powers that exist *in this world*, which are capable of making it to be this or that way. In other words, Buridanian *possibilia* are, in general terms, objects, some of them nonexistent, whose modality depends on the causal powers of actually existing things. Since one of these existing things is the Almighty, and since the Almighty exists by simple (which is to say strictly unalterable) necessity, the modal properties of the *possibilia* are stable. There are no other worlds in the picture.

So much for what Buridan's view is not. But the definitions we've distilled from the texts face an important exegetical problem: both necessity, on one hand, and possibility, on the other, are each in their own way inconsistent with the account of impossibility as sketched above. Impossibility, unlike necessity, does not turn on annihilation: a chimaera is made up of incompossible parts, not parts that would be literally reduced to nothing if they were combined. Moreover, there are diachronic possibilities, such as a human turning into a corpse, which are not synchronically possible: a human cannot be inanimate and rational at the same time. Just like *chimera*, *inanimate rational animal* therefore describes an impossible object. The language of transmutations is therefore not applicable to synchronic incompossibilities. These facts call for a re-examination of necessity and of possibility as set out above. We will soon see that (i) these accounts can, happily, be made consistent, and (ii) that the consistent account that emerges gives us a straightforward definition of Buridanian *possibilia*.

First, the account of necessity, which turns on annihilation (rather than destruction) of the subject is too strong: for there is more than one way to make Socrates not a human: through (divine) annihilation—literal reduction to nothing—or through (divine or natural) destruction—undergoing a change that entails removal of his (human) essence. After all, following his death, Socrates is no longer a human, but this fact does not turn on any annihilation of Socrates.

Why then does Buridan discuss necessity in terms of annihilation at all? Recall that, in the *QAPr*, Buridan is (*inter alia*) worried about the falsification of geometry: if *all* magnitudes were annihilated, then the propositions of geometry would be rendered false. But this would not follow if everything with mass were simply destroyed—that is, if everything now existing were reduced to an undifferentiated soup. Even in that soup, there would be at least some dimension, surface, and so on. Conversely, the claim that humans are animals *would* be falsified if all humans were destroyed—that is, if everyone died all at once. Hence it seems that the reliance on annihilation is stronger than it needs to be for the definition of humans as animals, though perhaps not for the propositions of geometry taken collectively. I therefore propose a weakening of this requirement, at least for our definition of *possibilia*: S is necessarily P, just in case S cannot be made other than P without *destroying* S.

The second exegetical problem is that the definition of possibility is quite weak: supposing that S is possibly P just in case S can become P through at most one transmutation, it follows that Socrates, while still alive, is possibly a corpse. Fair enough; but, as we observed, the combination of Socrates, *qua* rational animal, and corpse, *qua* inanimate object, is impossible.[25] Therefore, the most straightforward reading of impossibility, set out in section 2.2, clashes with the weak sort of possibility set out in section 2.3. What do we do?

It is true that Socrates is possibly a corpse. And it is also true that Socrates, while alive and barbate, is possibly clean-shaven. In the former case, Socrates loses his essence; in the latter he does not. We should therefore distinguish two kinds of change: one which involves loss of essence, but only through one transmutation; and another which leaves the subject intact.

Which kind of possibility is relevant to our purposes? *Impossibilia* are incompossible combinations; *possibilia* then should be possible ones. Since at least some transmutations involve change into something incompossible with

25 For a discussion of related problems in the logic and semantics of the twelfth century, see Cameron (**Cameron2015?**).

the essence of the subject, as our example of *rational animal* and *inanimate object* shows, *possibilia* cannot comprise contrary diachronic states considered synchronically. We should, therefore, take the stronger reading of possibility, suggested by the account of impossibility: S is possibly P iff S can be P in a way that does not entail the destruction of S.

From these considerations, we can give the following definition of *possibilia*, which balances out the accounts in Buridan's texts:

> POSSIBILIA$_B$. S is possibly P just in case there is a power to make S to be P without destroying the essence of S.[26]

This definition casts a pretty wide net: *possibilia* will include not just the various natural kinds and subkinds we see in the world, but also anything else which could be produced by any power—including God—without destruction of the subject. So horses larger than planets are, presumably, (divinely) possible; as are humans capable of walking on water, virgin mothers, and so on. But conspicuously absent from this jungle of *possibilia* is the Lewisian plurality of worlds with which we began.

3 Are Lewisian Possible Worlds Possible?

—Or, to put the question in Buridanian terms: can God create a Lewisian plurality of worlds? First, the argument pro: it seems that God can indeed create as many worlds as God pleases. Recall our account of the unity of Lewisian worlds, set out above (section 1.1). So long as we conceive of a world as just a cluster of spatiotemporally interrelated *possibilia*, there seems to be no barrier in principle to clustering them. Here is why: some—and probably most—possible objects are made up of interrelated possible parts. Consider, for example, a possible watch that does not now exist. Such a possible watch will

26 As an anonymous reviewer for this journal has pointed out, this definition, and the intuitions that motivate it, rest on essentialist assumptions. That is true, but the assumptions are weak ones: we need not assume that we have correctly identified the essence of S; we need only say that as a member of a natural kind, S *has* an essence—whether or not we know what it is. Still, one might worry about possibilities for houses and other artifacts, since (at least in Aristotelian metaphysics) artifacts do not have essences. A house, then, is possibly green, and also possibly a heap of rubble, and neither of these changes involves a loss of essence. Perhaps we could appeal to the house's function, which is preserved in the case of painting, but lost when it is reduced to rubble. But I leave that for another day.

not be undifferentiated all the way through, like *pâté*, but will have interrelated possible parts—possible gears, possible springs, etc.

Now it would be arbitrary and just plain wrong to place a limit on how large such a possible object could be, at least in terms of what God can create: if a watch can be made the size of a tower clock, why not a watch the size of Manhattan? Likewise, it would be arbitrary to place a limit on their complexity: if a watch the size of Manhattan is permissible, why not a huge and complex astronomical horologium—one as large and complex as our universe, even?

From these considerations, we can distill two principles, namely:

(i) *possibilia* can be internally complex, comprising interrelated possible parts; and
(ii) there is no limit in principle to the size or complexity of such *possibilia*.

From (i) and (ii)—so the argument runs—it follows that God could make worlds, roughly construed as manifolds of interrelated objects.

In fact, we can strengthen this claim: the *possibilia* just *have* to be in some possible world. Consider a possible object, say a fork: can such an object exist outside a world or manifold? Or must any such possible object exist within some kind of manifold? The existence of a fork outside some spatiotemporal manifold seems, if not impossible, then at least a little weird. A fork in the absence of other objects is one thing, but a fork in the absence of time space is quite another. And so, it seems, possible objects only ever inhabit worlds. Thus a metaphysics of possible objects must, if it is to be coherent, collapse into a metaphysics of possible worlds.[27]

So much for the argument pro; now for the argument contra. These worlds are either actual, in the sense that God has made them, or they are possible but non-existent, in the sense that God has not made them, but could. In either case, the question is: could God make an actual plurality of worlds? If so, then the Lewisian plurality is possible; if not, then it is impossible.

Following Lewisian doctrine, these worlds will have to be isolated: if they are not, they no more count as distinct possible worlds than do planets in different galaxies or cities in different epochs. They must not be at any spatiotemporal distance from each other. So can God create worlds that are not worldmates in this way?

Suppose God made these worlds. What does it mean to say such worlds are causal isolates—i.e., that they cannot interact? Distance will not do the

27 I owe the gist of this argument to Douglas Campbell.

trick: worlds are not causally isolated by any spatiotemporal distance, the way you and I are isolated from a long-dead star in Andromeda. Space is not what separates the worlds. Nor is time. Lewis has been clear.

Perhaps we can say that God stipulates that the worlds cannot interact: there is just an impermeable barrier between the worlds, analogous to the glass plates separating different tanks in a divided aquarium, or the walls splitting off different theaters in a cineplex. Perhaps it is physical, perhaps it is by divine *fiat*. Either way, we face three problems.

First, what happens when two things in different worlds interact with the dividing barrier or *fiat* that separates them? Suppose, for instance, that there is a barrier between worlds A and B; and *a* and *b*, which are possible objects in A and B respectively, are blocked from interacting by the barrier/*fiat* (imagine fish bumping into the opposite sides of a glass aquarium divider). Then a barrier that prohibits causal interaction between the two worlds, A and B, nevertheless causally interacts with both of them. Therefore, that barrier will be a member of both worlds, according to Lewis's definition: it has worldmates on both sides. But preventing such world-straddling was precisely what the barrier was supposed to do. We can try adding barriers so that the two barriers on the A and B sides are separated, a bit like parallel sheets of glass in a double-paned window. But then we get a regress: what keeps the barriers themselves apart? What would happen if one barrier collided with whatever separates it from the other? In any case, the barriers must both interact with whatever separates them.

Second, even if God could somehow separate A and B causally from each other, it would still make sense to think of them as related temporally: just as we can speak of one movie in a cineplex starting at the midpoint of another, so we can speak of a universe being half as old as another—that is, as being created midway along the life cycle of another universe. For instance, we could reasonably ask whether, from God's perspective, the timeline of B is half as long as that of A, whether B already existed when A was created, and so on.

Third, and most importantly, even if such worlds could be isolated from each other in a way that circumvents the foregoing two problems, they will still still be causally related via their causal dependence on God. Recall, from section 1, that the general spatiotemporal relation (though not necessarily causation) is Euclidean: if $x\mathrm{R}y$ and $x\mathrm{R}z$, then $z\mathrm{R}y$. Thus although two worlds may not causally interact, they are not spatiotemporally independent, since they have the same cause. They are, then, causal siblings, even if they never

interact. And if they are produced by the same cause, then they are causally related, if only in virtue of being created by the same God.

Lewis considers pseudo-plurialities like these (**Lewis1986?**), which, according to him, are not made up of truly isolated worlds. Their constituents are, rather, worldmates, even if locally they look like isolated worlds. Here is the one our cineplex and aquarium examples most closely resemble:

> The spacetime of the big world might have an extra dimension. The world-like parts might then be spread out along this extra dimension, like a stack of flatlands in three-space.

But, as Lewis is quick to point out, this is not a true plurality. Thus there is no way, on Lewis's account, to speak of temporal relations across truly isolated worlds: if there is anything like a God's eye view, then the worlds belong to the same manifold. And if they belong to the same manifold, they are not truly isolated.[28]

Here is the most common objection I have faced to this line of reasoning: it is not that Lewisian worlds *cannot* interact, in the sense that there is some mechanism keeping them apart. Instead, they just *do not*. We already noticed (in section 1.1, above) that the isolation doctrine is not a conclusion Lewis reaches by argument. It is, rather, a stipulation. And in fact, this is how Lewis presents it: right up front, on the second page of his (1986) exposition. It is thus more a starting point than a destination.

Accordingly, no criticism of this doctrine can address Lewis's arguments for it, since he does not give us any. All that can be asked is whether it makes any sense. The answer, on Buridan's metaphysics (or any metaphysics that posits one First Cause), is *no*. To anyone who espouses such a metaphysics, then, a Lewisian plurality of worlds must be something like Naive Set Theory: plausible on the face of it, but deep down self-contradictory. Lewis's worlds simply do not work on Buridan's framework. And, we might think, so much the better for Buridan.

I am not, by the way, the first to make any claims about the (in)compatibility of Lewisian worlds with classical theism, though the causal one I have been elaborating here is novel. Paul Sheehy (**Sheehy2006?**) sets out a number of

28 Something similar could be said for the synchronic contrary possibilities of Scotus' (much discussed) *Lectura* I, dist. 39, q.1–5. Since these possibilities are rooted in the causal powers of a (single) will, they are worldmates. Therefore, these synchronic contrary possibilities are not true worlds in the Lewisian sense. For a discussion of Scotus in terms of possible worlds, see Wyatt (**Wyatt2000?**).

problems for the classical theistic conception of God on Lewisian modal metaphysics. The most significant of these is his argument, suggested by Richard Davis (**Davis2008?**), that Lewisian possible worlds effectively chop God up, making each counterpart God a world-bound entity—an understanding that runs contrary to classical theism's commitment to divine unity. Ross Cameron (**Cameron2009?**) disagrees: Lewisian metaphysics can countenance *abstracta* existing outside of any world, as numbers do, so long as these *abstracta* are pure sets—that is, sets which contain only sets in their transitive closure (sets, sets of sets, sets of sets of sets, and so on, but no elements anywhere but sets, including the empty set). God, it seems, could be such a set—even if it's doubtful whether such a set is what God's believers believe in (or, anyway, believe they believe in). Subsequent debate (**Collier2021?**) has dealt with this problem of divine (unitary) existence and world-boundedness, and whether, in these ways, God can be countenanced on Lewisian worlds. Brian Leftow (**Leftow2012?**) has, moreover, criticised Lewis on the grounds that positing one God is more economical than positing several (more on this in a moment).

For my part, I agree with Cameron and Collier that a Lewisian ontology can indeed countenance an abstract, un-world-bound Necessary Being of sorts. And I agree with Sheehy and Vance that Lewisian worlds are incompatible with classical theism, albeit for reasons different from the ones they examine. After all, it is integral to classical theism that God has a creative—which is to say causal—role to play as well: God "created the heavens and the earth" (Genesis 1:1), is the One without Whom "nothing was made that was made" (John 1:2), the Originator, "Who commands only"Be!" and it is" (*Al Baqarah* "The Heifer," 117), and so on. (Countless other sources could be cited to this effect, but you get the idea). This central aspect of God's activity is incompatible with Lewis's doctrines about the plurality of worlds. Accordingly, possible worlds of the sort we have considered here will likely be deeply incompatible with (monotheistic) medieval philosophy in general—even if certain aspects of a given thinker's modal logic or ontology might remind us of this (by now quite familiar) framework.[29]

29 This will be true even when philosophical discussion centers on the notion of multiple worlds, e.g. in the claim of Al Ghazali and the Ashʿarite theologians that God could have made other worlds than this one. Here, too, the worlds that could exist are referred back to a single unified power to bring them into existence, and so there is a similar problem for Lewis's separation doctrine to the one discussed above. For a lively and interesting overview of this aspect of Al Ghazali's thought, see Taneli Kukkonen (**Kukkonen2000?**). (I am grateful to Silvia Di Vincenzo for bringing this to my attention).

What about Lewisian metaphysics considered in its own right? Even though a unified First Cause is not available on this framework, it does not follow that Lewis and his followers have to be atheists; if there is plurality in the worlds, there can also be a plurality of first causes. There is textual evidence that Lewis recognises this implication of his theory: in the (**Lewis1981?**) introduction to the first volume of his (**Lewis1983?**) *Philosophical Papers*, he remarks in passing that his view is consistent with the claim that "there are countless gods, but none of them are our worldmates" (xi). Since the worlds are, ontologically speaking, just like ours, it follows that our worldmates could include a local deity, and Lewis could merely be mistaken about the constituents of our actual world. So the Lewisian can still opt for a kind of polytheism, or mono-polytheism, to adapt a term coined by Hart (**Hart2013?**). But even basic classical monotheism is, on these lights, impossible. For Lewisian ontology is a jealous god.

4 References

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* I am grateful for the insightful comments and criticisms of Irene Binini, Jon Bornholdt, Douglas Campbell, Nate Charlow, Jack Copeland, Graziana Ciola, Silvia Di Vincenzo, Peter King, Gyula Klima, Fred Kroon, Chris Martin, Calvin Normore, Diane Proudfoot, Jeremy Seligman, Trevor Teitel, and Andrew Withy. Thanks are also due to audiences at the University of Auckland, and the University of Canterbury, Christchurch, as well as audiences at meetings of the American Philosophical Association–Eastern, and the European Symposium of Medieval Logic and Semantics. The paper has, finally, benefitted from the feedback of two anonymous reviewers for *Dialectica*. Thanks, everyone!