GRIM REAPER PARADOXES AND PATCHWORK PRINCIPLES: SEVERING THE CASE FOR FINITISM*

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Imagine there is an infinite sequence of Grim Reapers spanning an infinite past. Each Reaper has a unique natural number and a designated date to post its selfie on the official Grim Grammers Instagram page. If no selfie has been posted by Reaper n's designated date, Reaper n posts its selfie. But if an earlier Reaper posted its selfie, Reaper n does nothing. Reaper 1's designated date is January 1st, 2024; Reaper 2's designated date is January 1st, 2023; and so on *ad infinitum*.

Clearly *some* Reaper must have posted its selfie. If, for example, no Reaper had posted its selfie up until the beginning of 2024, then Reaper 1 posted its selfie. But *which* Reaper posted its selfie? Reflection reveals that *none* of them could have posted it. If Reaper n posted its selfie, then Reaper (n+1)'s designated date already transpired without any earlier Reaper having posted its selfie, in which case Reaper (n+1) posted its selfie. But then Reaper n did not post its selfie, since Reaper n posts its selfie only if no earlier Reaper posts its selfie. So, there is no n such that Reaper n posted its selfie. In other words, no Reaper posted its selfie. And yet *some* Reaper must have posted its selfie!

Paradoxes of this sort date back to José Benardete, and since their inception, many variants have blossomed.[1] These paradoxes—hereafter, *Benardete paradoxes*—have also been used to justify various finitist meta-

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1. José Benardete, *Infinity: An Essay in Metaphysics* (Oxford: Clarendon Press, 1964). For variants, see (*inter alia*) Alexander R. Pruss, *Infinity, Causation, and Paradox* (New York: Oxford University Press, 2018); Jacobus Erasmus, *The Kalām Cosmological Argument: A Reassessment* (Cham, Switzerland: Cham: Springer, 2018); Yishai Cohen, "Endless Future: A Persistent Thorn in the Kalām Cosmological Argument," *Philosophical Papers* 44, no. 2 (2015): 165–187; Robert Koons, "A New Kalam Argument: Revenge of the Grim Reaper," *Noûs* 48, no. 2 (2014): 256–267; Robert Koons, "The Universe Has a Cause," in *Contemporary Debates in Philosophy of Religion, 2nd Edition*, ed. Michael L. Peterson and Raymond J. VanArragon (Hoboken, NJ: Wiley-Blackwell, 2020), 3–12; Laureano Luna, "Yablo's Paradox and Beginningless Time," *Disputatio* 3, no. 26 (2009): 89–96; Laureano Luna, "Ungrounded Causal Chains and Beginningless Time," *Logic and Logical Philosophy* 18, nos. 3-4 (2009): 297–307; Jon Pérez Laraudogoitia, "A Variant of Benardete's Paradox," *Analysis* 63, no. 2 (2003): 124–131; John Hawthorne, "Before-Effect and Zeno Causality," *Noûs* 34, no. 4 (2000): 622–633; Graham George Priest, "On a Version of One of Zeno's Paradoxes," *Analysis* 59, no. 1 (1999): 1–2; Roy A. Sorensen, "Yablo's Paradox

physical theses such as causal finitism, temporal finitism, and discrete views of time.[2]

Our primary goal is to criticize Benardete-paradox-based arguments for finitist theses—hereafter, *B-arguments*—and thereby to advance debates in metaphysics, philosophy of time, and even philosophy of religion.[3] In particular, we challenge a central motivation for the conditional premise of B-arguments that links the possibility of various infinities to the possibility of Benardete paradoxes. This motivation derives from *patchwork principles*. We begin in section I by describing the structure of Benardete paradoxes and explaining how patchwork principles have been employed on behalf of B-argument linking premises. Then, in section II, we develop a companions in guilt argument based on a new *finite* Benardete-like paradox. Our argument challenges prominent uses of patchwork principles to support linking premises in B-arguments. Finally, in section III, we use a plausible principle about exact duplication to develop another problem for those patchwork-principle-based defenses of B-arguments.

I. BENARDETE PARADOXES AND B-ARGUMENTS

Nicholas Shackel explains that Benardete paradoxes share a formal structure involving two jointly unsatisfiable conditions.[4] Let an *unbegun set* be an infinite set, linearly ordered by the abstract relation *before* (*Bxy*), with no first member. Quantifying over the elements of an infinite set S linearly ordered by *before*, we can now state Shackel's first condition:[5]

Unbegun Condition (UC): $\forall x \exists y\,(Byx)$

According to (UC), S has no first member—for any x in S, there is some y in S before x.

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and Kindred Infinite Liars," *Mind* 107, no. 425 (1998): 137–155; Stephen Yablo, "Paradox Without Self-Reference," *Analysis* 53, no. 4 (1993): 251; and Stephen Yablo, "A Reply to New Zeno," *Analysis* 60, no. 2 (2000): 148–151.

2. Causal finitism says that necessarily, nothing has infinitely many causes. Temporal finitism says that infinite pasts are metaphysically impossible.

3. B-arguments are relevant to philosophy of religion because they have been leveraged in support of a premise in the Kalam cosmological argument—see (*inter alia*) Pruss, *Infinity, Causation, and Paradox*, ch. 9, Koons, "A New Kalam Argument: Revenge of the Grim Reaper"; Koons, "The Universe Has a Cause"; Erasmus, *The Kalām Cosmological Argument: A Reassessment*.

4. Nicholas Shackel, "The Form of the Benardete Dichotomy," *British Journal for the Philosophy of Science* 56, no. 2 (2005): 397–417. We set aside the objection that Shackel's abstract characterization of Benardete paradoxes leaves out important features thereof (for example, causal dependence), since none of our points in subsequent sections turn on Shackel's characterization capturing every important feature of Benardete paradoxes.

5. Shackel, p. 398.

Shackel's second condition says that for each x in S, x satisfies some predicate E if and only if no member before x satisfies E. Quantifying over elements of S, we state this condition as follows:[6]

At iff Nowhere Before Condition (ANBC): $\forall x\,(Ex \leftrightarrow \neg\exists y\,(Ey \wedge Byx))$

As Shackel shows, these two purely formal conditions are logically inconsistent.[7] We might think this logical inconsistency is key to solving Benardete paradoxes: while (UC) and (ANBC) may be *individually* possible, their conjunction is simply inconsistent and hence impossible, *end of story*. However, finitists of various stripes have urged us to resist this deflationary solution by developing B-arguments for finitist theses. Here is the general form of B-arguments:

1. If there could be unbegun sets ordered by R, then there could be sets satisfying both (UC) and (ANBC). (*Linking premise*)
2. There cannot be sets satisfying both (UC) and (ANBC).
3. So, there cannot be unbegun sets ordered by R. (From 1, 2)

B-arguments for causal finitism fit this schema by replacing R with *causes*. B-arguments for temporal finitism replace R with *earlier than* and consider unbegun sets of equal temporal intervals. Other B-arguments roughly follow suit.[8]

Prominent tools for motivating B-argument linking premises are *patchwork* or *recombination principles*.[9] Consider the principle that Robert Koons adduces:

> First, we assume that some particular, localized situation, S, is metaphysically possible (and so contained in some possible world w_1). Second, we assume that there is a second possible world w_2 with a spatiotemporal or

6. Shackel, p. 398.
7. Shackel, pp. 400-401.
8. For B-arguments for causal finitism, see (*inter alia*) Pruss, *Infinity, Causation, and Paradox*, pp. 47–48, Koons, "The Universe Has a Cause"; Erasmus, *The Kalām Cosmological Argument: A Reassessment*; and Luna, "Ungrounded Causal Chains and Beginningless Time." For B-arguments for temporal finitism, see (*inter alia*) Koons, "A New Kalam Argument: Revenge of the Grim Reaper"; Koons, "The Universe Has a Cause"; and Laureano Luna and Jacobus Erasmus, "A Philosophical Argument for the Beginning of Time," *Prolegomena* 19, no. 2 (2020): 161–176.
9. These are employed in Koons, "A New Kalam Argument: Revenge of the Grim Reaper"; Koons, "The Universe Has a Cause"; Pruss, *Infinity, Causation, and Paradox*, *inter alia*. For criticisms of the use of patchwork principles on behalf of B-arguments, see Joseph C. Schmid, "Benardete Paradoxes, Patchwork Principles, and the Infinite Past," *Synthese* 203 (2024): 51; Joseph C. Schmid, "The End is Near: Grim Reapers and Endless Futures," *Mind*, forthcoming, Joseph C. Schmid and Alex Malpass, "Branching Actualism and Cosmological Arguments," *Philosophical Studies* 180, no. 7 (2023): 1951–1973; and Luna and Erasmus, "A Philosophical Argument for the Beginning of Time."

> causal structure that provides enough 'room' for S to be repeated κ [times] (where κ is a cardinal number, either finite or infinite). On these two assumptions, the patchwork principle licenses us to conclude that there is a third possible world, w_3, in which a situation intrinsically identical to S has been repeated κ times (in the arrangement corresponding to the structure of w_2). The picture is that w_2 provides the frame, w_1 the sample patch, and w_3 the completed quilt.[10]

To justify B-argument linking premises with this principle, we simply need to show how a quilted or patched-together world (W_3) instantiating a Benardete paradox results from applying the principle to a framework world (W_2) and a sample-patch world (W_1) containing an individual sample patch. Now, if the past could be infinite, then there is a possible world W_2 with (say) infinitely many past days and so enough 'room' to accommodate a unique Grim Reaper (GR), together with a particle and plane, on each day of the infinite past. Moreover, an *individual* GR with the intrinsic power and disposition to create and place a particle some distance from a plane iff no earlier GR creates and places a particle some distance from the plane is surely contained in some possible sample-patch world W_1. Assuming the past could be infinite, we can then use the patchwork principle to infer the possibility of a world at which an unbegun set of GRs satisfies both (UC) and (ANBC). Since that is *not* possible, it follows that the past cannot be infinite. While the aforementioned recombinations and duplications used an infinite past as a framework, other frameworks have been used—for example, continuous or dense temporal intervals, infinitely many connected causal nodes, and so on.

In what follows, we focus on a distinct but related version of the patchwork principle articulated and defended by Koons.[11] There are three reasons for this focus. First, it is very similar to the above patchwork principle, and what we say about the former applies *mutatis mutandis* to the latter. Second, the principle has an admirably high degree of rigor and precision, which makes it a more fitting target for evaluation. Third, what we say about *Koons'* application of the patchwork principle in the context of B-arguments applies *mutatis mutandis* to other prominent applications thereof.[12]

10. Koons, "The Universe Has a Cause," pp. 5–6.
11. Koons, "A New Kalam Argument: Revenge of the Grim Reaper."
12. For example, Pruss, *Infinity, Causation, and Paradox*. We acknowledge that one might develop variants of the patchwork principle that refer to possible *causal* structures rather than possible *spacetime* structures, and it's not immediately obvious that our companions in guilt argument will challenge B-arguments for *causal* finitism that appeal to those variants. But note that such B-arguments *will* succumb to our problem in section III.

II. COMPANIONS IN GUILT

Our concern will be one B-argument in particular—Koons' Grim Reaper Argument (GRA)—although, as noted above, our case will generalize to other prominent patchwork-principle-based defenses of B-arguments. In the GRA, there are four premises (P1–P4) that are argued to be jointly inconsistent with the assumption for reductio that a bounded and non-well-founded time sequence is possible (H1).[13] Leaving out the premise (P4) about spacetime's arbitrary compressibility (since it is irrelevant to our ensuing discussion), we can state the other premises as follows:[14]

P1. *Possible Grim Reaper.* There is a possible world W and a region R such that R has a finite temporal duration d seconds, there is a Grim Reaper wholly contained within R, and throughout R the Grim Reaper has the power and disposition to create a particle and place it at a designated position d meters from the plane P if there is no Fred particle closer to the plane than d meters, and otherwise to maintain any Fred particle that is within d meters of the plane in its initial position.

P2. *Infinitary Patchwork.* If S is a countable series of possible worlds, and T a countable series of regions within those worlds such that T_i is part of W_i (for each i), and f is a metric and topology structure-preserving function from T into the set of spatiotemporal regions of world W such that no two values of f overlap, then there is a possible world W' and an isomorphism f' from the spatiotemporal regions of W to the spatiotemporal regions of W' such that the part of each world W_i within the region R_i exactly resembles the part of W' within region $f'(f(R_i))$.

P3. *Intrinsicality of the Grim Reapers' Powers and Dispositions.* The powers/dispositions ascribed to each Grim Reaper are properties intrinsic to that Reaper in its corresponding region and world.

Koons resolves the inconsistency by affirming P1∧P2∧P3∧P4 and rejecting H1. However, this is not the most plausible way to resolve the contradiction. Our companions in guilt argument for this conclusion runs as follows:

13. At least one other assumption is needed to generate the inconsistency. This will be discussed in section III.

14. These are taken directly from Koons, "A New Kalam Argument: Revenge of the Grim Reaper," pp. 256–260.

4. If P1∧P2∧P3 is true, then P1*∧P2*∧P3* is true.
5. P1*∧P2*∧P3* is not true.
6. P1∧P2∧P3 is not true. (From 4, 5)

The conclusion implies that Koons' preferred resolution of the inconsistency among P1∧P2∧P3∧P4∧H1 is mistaken. The details of each premise, as well as the content of P1*–P3*, will be elaborated in this section. Here is the roadmap. We begin by introducing a new *finite* Benardete-like paradox in section II.1. We then use this paradox to motivate (4) and (5) in turn. Then, in sections II.2-II.6, we address five worries for our companions in guilt argument.

II.1. A finite Benardete-like paradox. Our paradox involves light bulbs of a special sort, which we will call 'Bulbs' to distinguish them from ordinary light bulbs. Each Bulb can be in one of two mutually exclusive states, ON or OFF. A Bulb is able and disposed to be ON iff there is no Bulb to its left which is ON (and otherwise to be OFF). We define the *to the left of* relation as follows:

> *Definition.* A Bulb b_n is *to the left of* a Bulb b_m iff there is a sequence S of Bulbs $b_n, b_{n+1}, \ldots, b_m$ such that for each b_i in S, if b_{i+1} is in S, then b_i is to the immediate left of b_{i+1}. A Bulb b_n is to the *immediate* left of a Bulb b_m iff the glass of b_n is touching the electrical contact of b_m.

Given the above specifications, a Bulb with no Bulbs to its left will be ON. For instance, a linear sequence of four Bulbs would appear as follows:

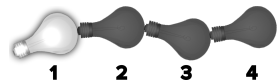

Figure 1: Four Bulb case (b_1–b_4)

Notice that b_1 is ON because no Bulb to its left is ON, whereas each of b_2, b_3, and b_4 is OFF because some Bulb to its left is ON.

We can now provide P1* as an analogue to P1:

> P1*. *Possible Bulb.* There is a possible world W and a region R such that there is a Bulb wholly contained within R, and throughout R, the Bulb has the power and disposition to be ON iff there is no Bulb to its left that is ON, and OFF otherwise.[15]

15. One might worry that a Bulb's disposition makes it potentially sensitive to the conditions in an infinite region (if, for example, there are infinitely many Bulbs to its left). But

We will let P2* be the same as P2, that is, the Infinitary Patchwork principle. Finally, we provide P3* as an analogue to P3:

P3*. *Intrinsicality of the Bulbs' Powers and Dispositions.* The powers/dispositions ascribed to each Bulb are properties intrinsic to that Bulb in its corresponding region and world.[16]

We will now argue that if P1∧P2∧P3 is true, then so too is P1*∧P2*∧P3*. To do this, we will argue that if each individual Pi is true, then so too is the corresponding Pi*.

First, why is P1* true if P1 is true? Well, like an individual GR, an individual Bulb *seems* possible; it is both conceivable and imaginable, and these are widely taken to be evidence possibility;[17] a Bulb is relevantly similar to lots of *actual* mechanical systems whose states are sensitive to things in their environment; its constitution is similar to *actual* light bulbs, which we know are possible; and so on. The modal epistemological supports wielded on behalf of a *GR's* individual possibility, in short, seem equally applicable to a *Bulb's* individual possibility. Metaphysically speaking, moreover, a Bulb—along with its specified power/disposition—is quite mundane. To bring this point out, imagine a world containing two such Bulbs. Suppose both Bulbs are ON. Now suppose that someone connects them such that one is to the immediate left of the other. In this case, the leftward Bulb would remain ON while the rightward Bulb would turn OFF. This is surely perfectly innocent. If anything, the Bulbs are *less* strange than their GR counterparts, which are capable of performing arbitrarily precise actions in arbitrarily small intervals of time. Bulbs seems quite tame in comparison. Thus, if we are granting the possibility of individual GRs, it seems we should grant the possibility of individual Bulbs. Consequently, if P1 is true, then so too is P1*.

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this potential sensitivity only follows if we *add* to P1* that infinite regions are possible; it does not follow from P1* itself. And in any case, we could simply specify that a Bulb is disposed to be ON iff none of finitely many leftward Bulbs is ON, and OFF iff at least one of finitely many leftward Bulbs is ON. Since our paradox arises with finitely many Bulbs, this change affects neither our paradox nor the argument based on it. For simplicity, we will use the simpler statement of a Bulb's disposition in P1*.

16. As Koons, "A New Kalam Argument: Revenge of the Grim Reaper," p. 263 notes, the inference to the possibility of a paradoxical patched-together world actually requires not only that a GR's *power/disposition* be intrinsic to it in its region and world but also that the *realization* thereof be intrinsic in this manner. Just as Koons makes this additional assumption in the context of P3, we can equally make it in the context of P3*. Of course, we will challenge Koons' assumption here in section III, but our point is simply that *if* it is appropriate in the case of GRs, it is also appropriate in the case of Bulbs. Hereafter, we will treat this assumption as implicit in P3*, making it explicit when necessary.

17. Cf. Stephen Yablo, "Is Conceivability a Guide to Possibility?," *Philosophy and Phenomenological Research* 53, no. 1 (1993): 1–42.

Second, P2* true if P2 is true because P2* is the same as P2.

Third, P3* true if P3 is true because the support provided for P3 applies equally well to P3*. Each Bulb has the power to be ON or OFF under certain circumstances, and its having that power does not depend on anything else being arranged in a certain way. In the GR case, it was argued that "[e]ach GR has a power to produce a particle of a certain kind under certain circumstances. Its having that power does not depend on anything else being arranged in a certain way",[18] and it seems fair to say the same here. The state of a Bulb simply varies with the circumstances according to the powers/dispositions we suppose it to have intrinsically. This is exactly parallel to what is assumed in the GR case: the state of a GR—say, creating a particle—varies with the environment according to the powers/dispositions we suppose it to have intrinsically. Consequently, if P3 is true, then so is P3*.[19]

Having justified (4), we will now justify (5). We first introduce an assumption about possible spacetimes:

H1*. *Possibility of a Circular Spatial Arrangement.* There is a possible world W containing a spacetime region R consisting of sixteen spatially circularly-arranged non-overlapping Bulb-sized regions $R_1, \ldots, R_{16}$, such that for any $i \in \{1, \ldots, 16\}$, if R_i contains a Bulb b_i and R_{i+1} contains a Bulb b_{i+1}, then b_i is to the immediate left of b_{i+1}.[20]

We next show that P1*∧P2*∧P3*∧H1* is inconsistent. Since the Bulbs are possible individually (P1*), clearly there are 16 worlds $W_1, \ldots, W_{16}$, each of which contains a region (R_1 at W_1, …, R_{16} at W_{16}) containing only one Bulb. Given H1*, there is a possible region of spacetime (in some 'framework' world) that can accommodate the regions $R_1, \ldots, R_{16}$ in a spatially circular arrangement. The patchwork principle (P2*) then

18. Koons, "A New Kalam Argument: Revenge of the Grim Reaper," p. 263.

19. One might object that in the Bulb case, the relevant environment is *outside* a given Bulb's region, whereas in the GR case, the environment is *within* a given GR's region. This, in turn, makes a difference to whether the relevant power/disposition—or the *realization* thereof—is intrinsic to its bearer in the bearer's region. We have two replies. First, the Bulb power/disposition can be specified further to parallel the powers/dispositions in Koons' Signaler paradox. Just suppose that each Bulb has the intrinsic power/disposition to instantaneously transmit a signal rightward in the way described by (IC) in section II.2, such that the Bulb-regions adjoin in the same way that Signaler-regions adjoin (as described in Koons, p. 264). Given this specification, a Bulb need only act on a signal *in its own region*. Second, the GRA requires that whether a GR realizes its power/disposition *also* depends on what happens in regions *outside* its own region, as we explain at the end of section III.

20. Here, $i + 1$ is understood as $i + 1$ (mod 16), which ensures that $i + 1 = 1$ when $i = 16$.

licenses us to conclude that there is a possible world W' containing a region R' that consists of non-overlapping regions $R'_1, \ldots, R'_{16}$, the contents of which exactly resemble the contents of the corresponding regions $R_1, \ldots, R_{16}$, such that the regions $R'_1, \ldots, R'_{16}$ contain Bulbs that form a loop as depicted in Figure 2:

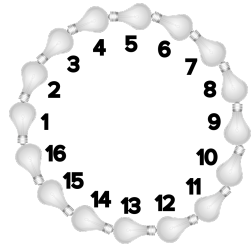

Figure 2: Loop of Bulbs at W'

Because the Bulbs' powers/dispositions (and realizations thereof) are intrinsic to them (P3*) at their respective sample-patch regions $R_1, \ldots, R_{16}$, and because the patchwork principle (P2*) preserves intrinsic features, each Bulb will realize its power and disposition in the corresponding regions $R'_1, \ldots, R'_{16}$ at W'. But, alas, there is no way for this to be satisfied. Consider any Bulb b_i at W'. Since there is a sequence of Bulbs $b_i, b_{i+1}, \ldots, b_i$ such that for each Bulb b_i in that sequence, b_i is to the immediate left of b_{i+1}, b_i is to the left of b_i. So, every Bulb is to the left of itself. Suppose, then, that b_i is ON. Given that each Bulb realizes its power/disposition at W', any Bulb is ON only if each Bulb to its left is OFF. However, since b_i is to the left of itself, it follows that b_i is ON only if it is OFF. Hence, by assuming that b_i is ON, we conclude that it is both ON and OFF, which is absurd. So b_i is not ON. This reasoning is perfectly general, applying to *each* Bulb in R' at W'. Hence, no Bulb in R' at W' is ON.

But if no Bulb in R' at W' is ON, then no Bulb to the left of b_i in R' at W' is ON. Given that each Bulb realizes its power/disposition at W', any Bulb is ON if no Bulb to its left is ON. So, b_i is ON in R' at W'. Consequently, *some* Bulb in R' at W' is ON.

Thus, we have shown both that no Bulb is ON in R' at W', but also that some Bulb is ON in R' at W'—a contradiction. Accordingly, P1*∧P2*∧P3*∧H1* is inconsistent. Since H1* is clearly true—*our world*, after all, contains such a region—(5) follows: P1*∧P2*∧P3* is false.

Although it differs from Benardete paradoxes normally presented, our Bulb paradox has an abstract structure relevantly similar thereto (which is why we call it *Benardete-like*). The *to the left of* relation—while not a linear ordering relation—is analogous to the *before* relation, and

any Bulb is ON iff no Bulb to its left is ON, giving us an analogue of (ANBC). Moreover, finitely many Bulbs connected in a circle ordered by the *to the left of* relation satisfy an analogue of (UC), as each Bulb is such that there is a Bulb to its left.

Here is the upshot. Having justified (4) and (5), we conclude that P1∧P2∧P3 is not true. Hence, the GRA—which proceeds from the truth of P1∧P2∧P3∧P4 to the falsity of H1—fails. In what follows, we address five worries for our companions in guilt argument.

II.2. Worry One. Because the state of a Bulb instantaneously influences the states of any rightward Bulbs, P1* requires the possibility of instantaneous action at arbitrary distances. But then P1 and P1* are not companions in guilt—or, at least, it is not true that if we accept P1, then we should accept P1*. That's because P1 requires no such dubious commitment. Moreover, since instantaneous action at a distance requires causal influence to transmit at infinite speed, P1* requires the possibility of infinite speeds. But this is a controversial commitment. Michael Huemer, for instance, argues from a range of infinitary paradoxes to the theory that infinite natural intensive magnitudes are impossible.[21] But speed of causal influence is plausibly a natural intensive magnitude. Once again, P1 requires no such controversial commitment and faces no conflict with Huemer's theory.

Reply. From the fact that P1 and P1* require different commitments, the falsity of <if we accept P1, then we should accept P1*> does not follow. What matters is whether their different commitments are *relevant* to their relative plausibility. So long as P1*'s commitments do not make P1* less plausible than P1, the epistemic parity between the premises remains: if P1 is accepted, then P1* should also be accepted.[22] The rest of our reply will unpack this general response.

21. Michael Huemer, *Approaching Infinity* (New York: Palgrave Macmillan, 2016).

22. Of course, this *epistemic* parity is different from our conditional claim that if P1 is true, then P1* is true. Worry One only targets the epistemic parity, but the worry can be modified to target the conditional claim by saying that P1* is (likely) false for reasons that do not afflict P1 and that would not be assuaged by P1's truth. These reasons pertain to the (alleged) impossibility of instantaneous action at a distance and infinite intensive natural magnitudes. We have three replies to this modified worry. First, the epistemic parity is *itself* grounds for accepting the conditional claim, since if P1* is at least as plausible as P1, then we have reason to think that P1∧¬P1* is *false* and hence that if P1 is true, then P1* is true. Second, many of our ensuing responses address this modified worry because they directly address the claim that P1* is (likely) false for those reasons. Third, we could easily formulate our companions in guilt argument in purely *epistemic* terms, thereby doing away with the conditional claim. In particular, we could simply argue that if someone accepts each of P1–P3, then they should also accept each of P1*–P3*. And that is true if P1*–P3* are at least as plausible as P1–P3. Also: strictly speaking we only need the weaker claim that *either* (i) P1* is not rendered less plausible than P1, *or* (ii) P1* *is* rendered less plausible than P1 but to a sufficiently small degree that acceptance of the latter should still lead to acceptance of the former.

We first note four ways of understanding the connection between Bulbs. Since these also correspond to different ways of understanding a Bulb's power/disposition to be ON iff no leftward Bulb is ON, we note those too.

Indirect Causation (IC). A Bulb may indirectly affect the state of any rightward Bulb by propagating some information-carrying signal to it. Understood thusly, a Bulb is able and disposed to send such signals to any rightward Bulb and to be ON precisely when no signal from a leftward Bulb carries the information that a leftward Bulb is ON.

Direct Causation (DC). A Bulb may directly affect the state of any rightward Bulb without sending any intermediary information-carrier. Understood thusly, a Bulb b is able and disposed to directly cause any rightward Bulb to be OFF precisely when b is ON and to be ON precisely when no leftward Bulb directly causes b to be OFF.[23]

Metaphysical Determination (MD). A Bulb may metaphysically determine the state of any rightward Bulb (when the enabling condition of there being rightward Bulbs is met).[24] Understood thusly, a Bulb b is able and disposed to metaphysically determine any rightward Bulb to be OFF precisely when b is ON and to be ON precisely when no leftward Bulb metaphysically determines b to be OFF.

Bare Correlation (BC). A Bulb may simply correlate with other Bulbs in such a way that a Bulb is able and disposed to be ON iff no leftward Bulb is ON. The states of rightward Bulbs do not causally or metaphysically depend on (the states of) leftward Bulbs.

For each option, we will examine whether P1* is less plausible than P1 when Bulbs are understood accordingly. After proceeding through the options individually, we will also consider their *collective* impact on the parity between P1* and P1.

23. We could modify (IC) and (DC) to fit your favorite theory of causal relata. For example, we could let the causes and effects be the events of Bulbs having certain states at certain times.

24. As we use it, x metaphysically determines y when y depends on x *ontologically* (as opposed to *causally*). A paradigm metaphysical determination relation is *grounding*. Note that we can also modify (MD) to fit your favorite theory of the relata of metaphysical determination relations.

Let P1*$_{(IC)}$ be P1* when the Bulbs are understood according to (IC). In our view, P1*$_{(IC)}$ and P1 are approximately equally plausible. For starters, many of the central motivations for P1 seem to carry over to P1*$_{(IC)}$. To us, GRs with the relevant power and disposition seem intuitively possible, and the same is true of Bulbs with (IC)'s power and disposition. GRs with the relevant power and disposition are perfectly consistent, and the same is true of Bulbs with (IC)'s power and disposition. GRs with the relevant power and disposition seem conceivable and imaginable, and the same is true of Bulbs with (IC)'s power and disposition. We can also motivate the possibility of infinite speeds by appealing to the principle that if x is possible and y differs from x merely in quantity or degree, then there is (defeasible) reason to think y is also possible.[25] If this principle is correct, then since finitely fast information-carrying signals like those in P1*$_{(IC)}$ are surely possible, there is (defeasible) reason to think infinitely fast information-carrying signals like those in P1*$_{(IC)}$ are possible too.

Of course, since speed of signal transmission is plausibly a natural intensive magnitude, P1*$_{(IC)}$ *does* run afoul of Huemer's theory. But in our estimation, this does not threaten the approximate parity between P1*$_{(IC)}$ and P1. There are three reasons for this. First, Huemer's theory is meant to "account for which sorts of infinities are possible and which are impossible."[26] But as several authors have noted, there are many infinitary paradoxes—including variants of paradoxes that Huemer's theory is meant to solve—that do not involve infinite natural intensive magnitudes.[27] Moreover, because P1*$_{(IC)}$ entails the falsity of Huemer's theory, the abovementioned motivations for P1*$_{(IC)}$ are *themselves* grounds for rejecting Huemer's theory. These considerations make Huemer's theory quite unattractive to us.[28] Second, while P1*$_{(IC)}$'s denial of Huemer's theory is a controversial commitment that P1 does not share, P1 has various controversial commitments that P1*$_{(IC)}$ does

25. See Joshua L. Rasmussen, "Continuity as a Guide to Possibility," *Australasian Journal of Philosophy* 92, no. 3 (2014): 525–538 and Alexander R. Pruss and Joshua L. Rasmussen, *Necessary Existence* (New York: Oxford University Press, 2018), ch. 6 for defenses of relevantly similar principles, and see Joshua L. Rasmussen, "Plantinga," in *Ontological Arguments*, ed. Graham Oppy (Cambridge University Press, 2018), 176–194 for an application to infinite quantities and degrees. The guiding idea is that mere differences in degree don't typically make for a categorical difference in modal status. So, if x differs from y merely in degree and y is possible, then we have (defeasible) reason to think x is also possible.

26. Huemer, *Approaching Infinity*, p. xiii.

27. See, for example, Pruss, *Infinity, Causation, and Paradox*, pp. 153–159 and Joseph C. Schmid, "A Step-by-Step Argument for Causal Finitism," *Erkenntnis* 88, no. 5 (2023): 2097–2122.

28. Pruss, *Infinity, Causation, and Paradox*, pp. 153–159 also argues (quite forcefully, in our view) that the theory suffers from a range of other problems.

not share. For instance, given the set-up of Koons' paradox, the GRs in P1 must be able to place particles at arbitrarily precise locations during arbitrarily short intervals of time, and it is controversial whether mechanisms could act arbitrarily precisely while moving at arbitrarily high speeds. If one sheds the commitment to arbitrarily high speeds by making the GRs ever-smaller by a geometric proportion, then P1 is saddled with a *different* controversial commitment—namely, the possibility of arbitrarily small material out of which GRs are made. These unique, controversial commitments of P1 do not seem more plausible to us than P1*$_{(IC)}$'s unique, controversial commitments. Third, B-arguments are often wielded on behalf of first-cause arguments for traditional theism. But as Huemer notes, his theory plausibly rules out traditional theism.[29] At least in the current context, then, P1*$_{(IC)}$'s denial of Huemer's theory should not lead many defenders of P1 to deny the approximate parity between P1 and P1*$_{(IC)}$.

Thus, we think P1*$_{(IC)}$ and P1 are approximately equally plausible. For similar reasons, we think the same holds for P1*$_{(DC)}$, which is P1* when the Bulbs are understood according to (DC). As before, the central motivations for P1 seem to carry over to P1*$_{(DC)}$: modal intuition, conceivability and imaginability, coherence, and so on. Moreover, Newtonian universes are often (and plausibly) taken to be at least *metaphysically* possible. Yet Newtonian gravity plausibly involves direct, instantaneous action at spatial distances.[30] Additionally, direct causation between *non-spatial* and spatial things is very plausibly possible—for example, surely *some* possible world contains embodied organisms for whom non-epiphenomenalist dualism is true.[31] But there does not seem to be a relevant difference between this sort of direct causation and direct causation between spatially distant things that could account for why the former, but not the latter, is metaphysically possible. And while P1*$_{(DC)}$ uniquely and (somewhat) controversially commits to the possibility of direct causation across spatial distances, this commitment does not seem to us less plausible than P1's unique and controversial commitments covered above.

Does P1*$_{(DC)}$ run afoul of Huemer's theory? It seems not. Given that P1*$_{(DC)}$ involves Bulbs directly inducing the states of other Bulbs, there

29. Huemer, *Approaching Infinity*, pp. 217–218.

30. A similar point applies to P1* more generally. Specifically, the Bohmian interpretation of quantum mechanics, as well as *any* of the handful of non-local interpretations, posits instantaneous action at arbitrary distances. At least *one* of these interpretations is plausibly metaphysically *possible*, and able philosophers have argued that non-locality is actually true, such as Tim Maudlin, *Quantum Non-Locality and Relativity* (Malden, MA: Wiley-Blackwell, 2011), p. 111.

31. Theistic proponents of B-arguments should grant this point, since God (traditionally conceived) is a non-spatial thing directly causally related to spatial things.

is nothing that actually travels instantaneously between spatially distant Bulbs, and hence there is nothing that has infinite speed. And even if P1*$_{(DC)}$ *did* run afoul of Huemer's theory, this would not threaten the approximate parity between P1*$_{(DC)}$ and P1 for the reasons covered above.

Lastly, let P1*$_{(MD)}$ and P1*$_{(BC)}$ be P1* when the Bulbs are understood according to (MD) and (BC), respectively. Reactions may diverge concerning whether P1*$_{(MD)}$ and P1*$_{(BC)}$ inherit the motivations for P1—for example, whether P1*$_{(MD)}$ and P1*$_{(BC)}$ *seem* possible and whether they are conceivable. We can at least report positive answers from our end, but we recognize that others might report negative answers.[32] Finally, both P1*$_{(MD)}$ and P1*$_{(BC)}$ seem clearly consistent with Huemer's theory.

So far, we have only examined the four alternatives *individually* and concluded that at least two (and maybe all) of them do not make P1* less plausible than P1 on account of the commitments mentioned in Worry One. When we examine the alternatives *collectively*, the conclusion that P1* is not less plausible than P1 is only strengthened. After all, to justify the parity between P1* and P1, we only need the more modest claim that the *disjunction* of P1*$_{(IC)}$, P1*$_{(DC)}$, P1*$_{(MD)}$, and P1*$_{(BC)}$ is not less plausible than P1. And given our reasoning about the *individual* alternatives, we find this more modest claim very plausible.

Considering all the preceding, we think Worry One can be resisted. But before concluding, two final dialectical points are in order. First, suppose you find our replies to Worry One unconvincing. We then invite you to understand our case for the companionship between P1 and P1* as *conditional* on the possibility of instantaneous action at a distance. It is significant and philosophically interesting that our companions in guilt argument succeeds *if* instantaneous action at a distance is possible.

Second, even if instantaneous action at a distance is impossible, we can still develop a new finite Benardete-like paradox if closed timelike curves (CTCs) are metaphysically possible. For we can modify our Benardete-like paradox so that each Bulb has the intrinsic power/disposition to be ON iff no *earlier* Bulb is ON and OFF otherwise. We can then use a CTC as our spatiotemporal 'framework' into which we 'patch' (using P2*) finitely many individually possible Bulbs with the newly modified power/disposition, such that the Bulbs are circularly ar-

32. Notably, it seems independently plausible that metaphysical determination relations can span spatial distances. To modify an example from Gideon Rosen, "Ground by Law," *Philosophical Issues* 27, no. 1 (2017): p. 280, semantic content in one region is plausibly partly metaphysically determined by spatially distant dispositions and patterns of usage.

ranged in time. Since each Bulb in the resulting patched-together world counts as earlier than itself, each Bulb is ON iff it is OFF.

Of course, one can avert this newly modified Benardete-like paradox by denying the possibility of CTCs. If this is how proponents of the GRA wish to resist our newly modified paradox, then we have at least uncovered a heretofore unnoticed commitment of the GRA—namely, the impossibility of CTCs. This is significant, since there is at least *some* independent reason to think CTCs are possible. They appear conceivable, at least to us; they might simply *strike* one as intuitively possible; and there are well-known, consistent solutions to Einstein's Field Equations which allow for them. To the extent that these considerations support the possibility of CTCs, they correspondingly count against the GRA.

II.3. Worry Two. The fact that P1*∧P2*∧P3* is *unsatisfiable* given the obviously true H1* while P1∧P2∧P3 presumably *is* satisfiable given H1* is *itself* a relevant difference between P1∧P2∧P3 and P1*∧P2*∧P3*. So we can reasonably reject P1*∧P2*∧P3* without rejecting P1∧P2∧P3.

Reply. This type of worry reflects a fundamental issue that arises in the context of companions in guilt arguments. The issue is the looming threat that *the very implausibility of one thesis* undermines its claimed companionship with the *other* thesis. The general way to proceed in light of this threat is to ask which is *more plausible* in light of the evidence: that (i) P1∧P2∧P3 is true *despite* its apparent connection to the false P1*∧P2*∧P3*, or that (ii) P1∧P2∧P3, *like* its seeming companion P1*∧P2*∧P3*, is false? Our arguments earlier in this section—offered in support of the conditional statements P1→P1*, P2→P2*, and P3→P3*—are precisely arguments that *directly support* (ii). In terms of comparing the relative plausibility of (i) and (ii), we side with (ii) being more plausible. But our case here is *defeasible*—in principle, it can be overturned by countervailing considerations. Such considerations could take two forms. First, one could undermine or rebut the arguments we gave that directly support (ii). Second, one could offer support for (i) that is *more* plausible than the support we offered for (ii). *Absent* such considerations, the conclusion we draw holds.

II.4. Worry Three. There is an additional assumption required by the circularly arranged Bulb case, namely, that infinite chains of dependence are metaphysically possible. For Bulb 1's state depends on Bulb 2's state, which depends on Bulb 3's state, which... depends on Bulb 1's state, which depends... *ad infinitum.* But if we deny that assumption and affirm dependence finitism—according to which such chains are metaphysically *impossible*—we can block the inference to the paradoxical Bulb scenario.

Reply. In the Bulb case, any Bulb's state depends only on *finitely* many things—namely, the states of the Bulbs in the scenario. In our view, then, dependence finitism is not violated.

But suppose the Bulb scenario *does* involve an infinite dependence chain (or any other allegedly absurd form of dependence). This is not a problem for our case, since such a chain is simply a *consequence* of P1*∧P2*∧P3*∧H1*, not an *additional* assumption that we might dismiss in order to preserve P1*∧P2*∧P3*∧H1*. Compare: in the GRA, H1 is an assumption concerning possible spacetimes, an assumption that is later dismissed in order to preserve P1∧P2∧P3. If it turned out that H1 was a *consequence* of P1∧P2∧P3, this move would not be available. Yet this is precisely what happens in the Bulb case. *Assuming* the Bulb scenario involves an infinite dependence chain, the possibility of such simply *follows* from P1*∧P2*∧P3*∧H1*. Thus, to *deny* that infinite dependence chains are possible requires denying P1*∧P2*∧P3*∧H1*. Since H1* is true and P1*∧P2*∧P3* is not less plausible than P1∧P2∧P3, this would similarly undermine P1∧P2∧P3—and with it, the GRA itself.

II.5. Worry Four. If Bulbs are possible, someone could attempt to arrange them into a circle (for example, as depicted in Figure 2), but since such an arrangement is not possible, there would have to be some mysterious force that prevents this construction. Such a mysterious force is absurd, and so P1* is false. However, this problem does not equally attend P1.

Reply. It is simply untrue that P1* implies that there would have to be an absurd mysterious force preventing a seemingly mundane circular arrangement of Bulbs. Call a world containing Bulbs a 'Bulb world', and suppose that there are Bulb worlds at which someone or something attempts to arrange Bulbs into a circle as in Figure 2. One of three things might transpire in such a world:

7. Upon being arranged into a circle (or perhaps sometime before), at least one Bulb would fail to realize the relevant power or disposition or else lose the relevant power or disposition.
8. The attempt(s) to arrange the Bulbs into a circle would fail for some reason or other (for example, the arranger slips on a banana peel, or gets distracted, etc.).
9. Upon being arranged into a circle (or perhaps sometime before), at least one Bulb would cease to exist, with either (a) something qualitatively similar (for example, an ordinary light bulb) continuing in its place, (b) something qualitatively different continuing in its place, or (c) nothing continuing in its place.

So long as at least one of these options is metaphysically possible, no metaphysical impossibility follows from the possibility of Bulbs (at least

as far as Worry Four is concerned). If this is right, then if there is *any* mysterious force here—which we deny—it is not *so* mysterious as to be impossible.

We will consider the three options in turn. To us, the first alternative in (7) does not appear absurd at all. That some things reliably fail to realize their powers/dispositions in certain circumstances (even if they have those powers/dispositions intrinsically) is a perfectly ordinary phenomenon. A match, for instance, has the intrinsic power and disposition to light when struck, but the match may nevertheless reliably fail to light in sufficiently damp or wet environments. Similarly, for the second alternative in (7), it is a perfectly ordinary phenomenon that some things reliably lose powers/dispositions, even ones they intrinsically possess, in response to certain environmental conditions. In response to an acidic environment, for instance, blue litmus paper will reliably turn red and thus lose previously-possessed intrinsic powers/dispositions to reflect certain wavelengths of light.

Regarding (8), there is once more no absurdity here. To us, at least, there is nothing untoward in supposing that no one would succeed in circularly arranging Bulbs in a Bulb world. Further, no intolerably brute facts need be implicated in such a failure; in any Bulb world in which a circular arrangement is attempted, there is going to be an explanation for why the arranger fails to do so. It could be because they drop a Bulb, or do not line them up correctly, or slip on a banana peel, or any of countless possible reasons. This reply is similar to moves made in the context of time-travel paradoxes.[33] Tim the time-traveler will invariably fail to kill his grandfather, either because his gun jams, his grandfather survives the shot, or any number of things occur such that his grandfather survives. Again, while this might be *strange*, its strangeness provides no good reason to think time-travel is metaphysically impossible.[34] Similarly, although it may be that some of the worlds at which people attempt to combine Bulbs into loops involve strange sequences of events, that strangeness provides no good reason to suppose that

33. See, for example, David Lewis, "The Paradoxes of Time Travel," *American Philosophical Quarterly* 13, no. 2 (1976): 145–152 and Kadri Vihvelin, "Killing Time Again," *The Monist* 103, no. 3 (2020): 312–327.

34. In fact, as Sam Baron and Mark Colyvan, "The End of Mystery," *American Philosophical Quarterly* 56, no. 3 (2019): 247–264 have forcefully argued, we can offer a plausible and illuminating *non-causal* explanation for why Tim is doomed to fail by appeal to the *contradictoriness* of him succeeding. This explanation could be adapted to the present context *mutatis mutandis* for Bulb worlds in which the Bulbs realize their powers/dispositions. For an opposing view on grandfather paradoxes, see Yael Loewenstein, "Against the Standard Solution to the Grandfather Paradox," *Synthese* 200, no. 172 (2022). We do not find Loewenstein's case convincing, but that's a topic for another day.

Bulbs are metaphysically impossible. Option (8), in other words, is not so strange as to debar Bulbs from the realm of metaphysical possibility.

Regarding (9a), consider the property of *being a planet*, where, necessarily, if something is a planet, then it orbits a star. If you destroy the star around which a planet orbits, there is no longer any planet present but merely some non-planet celestial body. There is nothing metaphysically suspicious about this. Our proposal for (9a) is similar: whether some light bulb counts as a Bulb depends in part on its surroundings. Specifically, a light bulb ceases to be a Bulb if it finds itself in a circular arrangement of light bulbs, analogous to how a celestial body ceases to be a planet in the absence of stars. If Bulbs are like planets in this regard—and there seems to be nothing absurd in that assumption—then there is nothing absurd about (9). Because this scenario may result in the Bulbs' characteristic power/disposition being *extrinsic*, it may represent a case in which P1* is true while P3* is false. The point, though, is that it does not seem to involve any intolerable absurdity.

One might object that our point in the previous paragraph undermines our claimed companionship between P3* and P3, since the point seems to provide grounds for thinking P3* is false *without* providing grounds for thinking P3 is false. We have two responses. First, even if this objection is correct, our points about (7), (8), and (9bc) remain unaffected and suffice to address Worry Four. Second, our point in the paragraph can be recast to remove any conflict with P3*. Specifically, we can render a Bulb's characteristic power/disposition *intrinsic* by characterizing it as *essential* to Bulbs, where *P* is essential to *x* only if necessarily, if *x* exists, then *x* has *P*. Consider the definition of intrinsicality operative in the GRA:

> A property P is *intrinsic* to a thing x within region R in world W if and only if x is P throughout R in W, and every counterpart of x in any region R' of world W' whose contents exactly duplicate the contents of R in W also has P throughout R'.[35]

Given this definition, *any* essential property of *x* is intrinsic to *x* because there cannot be a region which contains a counterpart to *x* that lacks this property (assuming the counterpart relation preserves essential properties).[36]

35. Koons, "A New Kalam Argument: Revenge of the Grim Reaper," p. 258.

36. One might now question whether Bulbs that have their power/disposition essentially ('e-Bulbs' for short) are possible. After all, we cannot assume that objects with any arbitrary essence are possible. In response, we can at least report that <e-Bulbs are possible> does not seem much less plausible to us than <GRs are possible>, and

Regarding (9bc), while these kinds of occurrences might be strange, they are not for that reason *absurd*. Moreover, thinking (9bc) involves some intolerable absurdity seems unavailable to the proponent of the GRA, for it is *precisely* scenarios like this that should be possible given the patchwork principle. Consider two sample patches, one containing only a regular light bulb and another containing only a rock. By the patchwork principle, we can infer the possibility of a patched-together world at which these regions exist adjacently in time such that an outside observer would see what looks like a light bulb turning into a rock. If the patchwork principle is true, then occurrences like this are abundant in modal space. Why, then, would we rule out the possibility of Bulbs merely because (per options (9bc)) they would be implicated in scenarios of this sort? While more can be said on this point, it seems to us that the remaining options here are either to affirm the patchwork principle and affirm the possibility of these kinds of scenarios, or to deny the patchwork principle. The former does nothing to undermine our companions in guilt argument, while the latter directly undermines the GRA.

II.6. Worry Five. Bulbs are impossible because any Bulb must have a disposition, when to the left of itself, to be ON iff it is not ON. But there cannot be such a disposition. Since this reason for rejecting P1* does not apply to P1, there is no companionship between P1* and P1.

Reply. We have three replies. First, we think there is a subtle but important mistake here. A Bulb b is disposed to be ON iff no Bulb to its left is ON. We can state b's disposition like so, where 'L' signifies the transitive binary relation *to the left of*, 'Ox' signifies that x is ON, and x ranges over Bulbs:

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much of the modal epistemological support for the latter can be wielded on behalf of the former. Moreover, many ordinary objects seem to enjoy environment-sensitive essential powers or dispositions—objects like islands and plateaus come to mind—and it is unclear what could account for why *these* are possible while e-Bulbs are not. It is also worth noting that there are respectable plenitudinous views on which any material object is co-located with multitudes of other material objects that differ in modal profile (see, *inter alia*, Karen Bennett, "Spatio-Temporal Coincidence and the Grounding Problem," *Philosophical Studies* 118, no. 3 (2004): 339–371; Maegan Fairchild, "The Barest Flutter of the Smallest Leaf: Understanding Material Plenitude," *Philosophical Review* 128, no. 2 (2019): 143–178; and Maegan Fairchild, "Varieties of Plenitude," *Philosophy Compass* 15, no. 3 (2020): 1–11). Here, a *modal profile* is a specification of the modal properties of an object, where *modal properties* specify what an object is like essentially or accidentally. For any material object O, plenitudinous views of this sort will posit some object co-located with O enjoying all of O's non-modal properties, including O's dispositions, essentially. So long as such views are at least *possible* (and compossible with the existence of Bulbs), the worry at hand is assuaged. Nevertheless, if you still find <e-Bulbs are possible> considerably less plausible than <GRs are possible>, just attend to our first reply in the main text.

10. $Ob \leftrightarrow \forall x\,(Lxb \rightarrow \neg Ox)$

Now suppose:

11. Lbb

Importantly, it does not follow from (10) and (11) that:

12. $Ob \leftrightarrow \neg Ob$

For there is a (classical) countermodel to the argument from (10) and (11) to (12)—namely, a model with domain D: $\{b, b_1, b_2\}$ such that O: $\{b_2\}$ and L: $D \times D$.[37] But if (12) does not follow from (10) and (11), then merely from the fact that b satisfies (11) and has a disposition corresponding to (10), it does not follow that b has a disposition corresponding to (12). Thus, *contra* Worry Five, it is not true that a Bulb must have a disposition, when to the left of itself, to be ON iff it is not ON.

Second, we think a parallel argument can be run against P1: GRs are impossible because any GR must have a disposition, when preceded by a beginningless sequence of GRs, to act iff it does not act.[38] But given Worry Five, there cannot be such a disposition.

One might object that there is a relevant difference between the arguments. GRs do not actually require the absurd disposition in the parallel argument, since a GR *cannot* be preceded by a beginningless sequence of GRs. And if scenario S cannot obtain, then it is *not* true that x is disposed, when S obtains, to ϕ.[39] But the same cannot be said of the original argument.

This objection grants that if Bulbs *cannot* be circularly arranged (so that a Bulb *cannot* be to the left of itself), then it is *not* true that a Bulb must be disposed, when to the left of itself, to be ON iff it is not ON.

37. Of course, this model does not satisfy the biconditional that b_2 is ON iff no Bulb to b_2's left is ON, since b_2 is ON despite some Bulb to b_2's left (namely, b_2 itself) being ON. Hence, according to the model, b_2 either lost its disposition or failed to realize it. But we already saw in Worry Four that this is exactly how possible worlds containing circularly arranged Bulbs must be.

38. To get a Benardete paradox, an individual GR must be disposed to act iff no earlier GR acts; if GR is preceded by a beginningless sequence of similarly disposed GRs, <GR acts iff no earlier GR acts> entails <GR acts iff it does not act>. Hence, GRs having a disposition specified by the former biconditional requires that GRs have a disposition, when preceded by a beginningless sequence of GRs, specified by the latter biconditional (which is a principle that Worry Five itself relies on).

39. Notably, C. S. Jenkins and Daniel Nolan, "Disposition Impossible," *Noûs* 46, no. 4 (2012): 732–753 challenge this principle by arguing that things can be disposed to ϕ in circumstances C even when ϕ and C are impossible. Their case might also undermine Worry Five's insistence on the absurdity of the characteristic Bulb disposition, but we will not explore that here.

But notice that <Bulbs are possible> is perfectly compatible with <a Bulb cannot be to the left of itself>, and hence the possibility of Bulbs does *not* entail that a Bulb is disposed, when to the left of itself, to be ON iff it is not ON, *contra* Worry Five.[40] If one objects that if Bulbs *were* possible, then they *could* be circularly arranged, then we are back at (a variant of) Worry Four, which we have already addressed.[41]

Third, 'Bulb *b* has the disposition, when to the left of itself, to be ON iff it is not ON' is ambiguous between (i) *if b* is to the left of itself, *then b* has the disposition to be ON iff it is not ON, and (ii) *b* has a conditional disposition of the form: if it is to the left of itself, then it is ON iff it is not ON.[42]

Under disambiguation (i), the impossibility of *b* having a disposition to be ON iff it is not ON does not license us to infer that *b* is impossible; it only licenses us to infer that it is impossible that *b* is to the left of itself. It could be that *b* is possible even though it is not possible that *b* is to the left of itself.

Similarly, under disambiguation (ii), we cannot infer that *b* is impossible. Suppose it is not even possible that *b* is to the left of itself. Then the disposition in disambiguation (ii) is *not* a disposition to be in a contradictory state *simpliciter*; it is only a *conditional* disposition to be in a contradictory state *if* some impossible situation obtains. But depending on one's view about counterpossible conditional dispositions (CCDs), either there is nothing absurd about that disposition, or else *b* would not even *have* that disposition.

Consider an analogous case. God (if God exists) is disposed to know *p* iff *p* is true (for any *p*). So, if we countenance CCDs, then we can attribute to God a CCD of the following form without absurdity: *if* some contradiction is true, then God knows that contradiction. By contrast, if we do *not* countenance CCDs, then we will simply deny that God *has* that CCD on the grounds that its antecedent is impossible. But that does not mean that God is not disposed to know *p* iff *p* is true; God lacks the aforementioned CCD simply because its antecedent, though specifying that some *p* is true, isn't even possible in the first place.

40. If P entails Q and R is compatible with P, then R does not entail $\neg Q$. After all, if R entails $\neg Q$ and P entails Q, then R and P are incompatible. Thus, if P and R *are* compatible and P entails Q, then R does *not* entail $\neg Q$. Now let P be <a Bulb cannot be to the left of itself>, Q be <it is not the case that a Bulb is disposed, when to the left of itself, to be ON iff it is not ON>, and R be <Bulbs are possible>.

41. Note that granting the impossibility of circularly-arranged Bulbs would require abandoning option (7) concerning what might happen at Bulb worlds. But that does not seem particularly damaging to our companions in guilt argument. And in any case, our first reply to Worry Five allows for the possibility of circularly arranged Bulbs.

42. Though, given our first reply, *b* need not have *either* of these dispositions.

The same can be said about Bulbs: for any world W at which b (with its characteristic disposition) exists, b at W is disposed to be ON iff every Bulb to its left is not ON. So, if we countenance CCDs, then we can attribute to b at W a CCD of the following form without absurdity: *if* it is to the left of itself, then it is ON iff it is not ON.[43] By contrast, if we do *not* countenance CCDs, then we will simply deny that b at W *has* that CCD on the grounds that its antecedent is impossible. But that does not mean that b at W isn't disposed to be ON iff every Bulb to its left is not ON; b at W lacks the aforementioned CCD simply because its antecedent, though specifying that b is to its left, is not even possible in the first place given our earlier supposition. Either way, b at W does not have an absurd disposition—either because the disposition is not absurd, or because b at W does not have it.

So, on the assumption that b cannot be to the left of itself, b does not have an absurd disposition in any world in which b exists (with its characteristic disposition). But b's possible existence (with its characteristic disposition) is compatible with that assumption, and hence countenancing b's possible existence (with its characteristic disposition) does not mean countenancing the possibility that b has an absurd disposition, *contra* Worry Five.

III. EXACT DUPLICATION AND INTRINSICALITY

We will close by developing another problem for the GRA. We can state a GR's realized power/disposition (RPD) in general terms as follows:

> x has RPD $=_{def}$ x has the realized power/disposition to create and place a particle d meters away from a plane if and only if no particle has already been placed closer to the plane.[44]

As we have seen, the GRA requires that RPD is *intrinsic* to the GRs which have it. But this assumption is problematic. Consider an ostensibly uncontroversial patchwork inference with just two sample-patch regions R_1 and R_2 from sample-patch worlds W_1 and W_2 (respectively). Suppose each region contains a GR, each of which has RPD intrinsically, and both of which are creating and placing a particle because they are initial in GR sequences at their respective sample-patch worlds. Given the obvious fact that there is a framework world W with enough spatiotemporal 'room' to fit two such GRs in sequence, we can use P2 to infer that there is a possible world W' containing two regions in se-

43. Again, this does not actually follow, but Worry Five *needs* it to follow.

44. The specifics of what value d takes, as stated in Koons, "A New Kalam Argument: Revenge of the Grim Reaper," pp. 256–257, are inessential here.

quence, R'_1 before R'_2, the contents of which *exactly resemble or duplicate* the contents of R_1 and R_2 (respectively). All of this should be perfectly acceptable to proponents of the GRA.[45]

The problem, however, is that inconsistent conclusions can be drawn about the activities of the GRs at W'. First, the activity of the GR in R'_2 at W' should be *exactly the same* as the activity of the GR in R_2 at W_2, since P2 ensures that the contents of R'_2 *exactly duplicate* the contents of R_2 (and similarly for R'_1 and R_1). Since both GRs are creating and placing a particle in R_1 and R_2, their counterparts in R'_1 and R'_2 will be doing exactly the same.

Second, the activity of the GR in R'_2 at W' should be *different* from the activity of the GR in R_2 at W_2. For the GR in R_2 has RPD intrinsically, and hence its duplicate GR counterpart in R'_2 at W' will likewise have RPD. But since the GR in R'_2 is *non-initial* in the sequence of GRs at W', a previous GR *will* have created and placed a particle closer than d meters to the plane at W'. Since the GR in R'_2 has RPD, this GR will then *refrain* from creating and placing a particle d meters from the plane. But then the GR in R'_2 at W' will be doing something *different* from the GR in R_2 at W_2.

This is plainly inconsistent: the GR in R'_2 at W' cannot both create and place a particle and *not* do so. We can summarize the assumptions which generate this inconsistency as follows:

13. Initial GRs are possible individually (from P1).
14. Infinitary Patchwork (P2).
15. Intrinsicality of a GR's (realized) power/disposition (P3).
16. Some possible spatiotemporal framework can fit two GRs in sequence.
17. If (i) the contents of a region R'_i exactly duplicate the contents of a region R_i, (ii) R_i contains a GR_i, and (iii) GR_i is creating and placing a particle in R_i, then some x is creating and placing a particle in R'_i.[46]
18. If R_i contains a GR that has RPD intrinsically, and the contents of R'_i exactly duplicate the contents of R_i, then R'_i contains an x that has RPD.[47]

45. This setup (and our ensuing problem) can easily be adapted to other versions of the GR scenario, be they ones with Fred, signals, or whatever.

46. Here, (17) does not require the stronger assumption x is a counterpart to GR_i, although that is a natural assumption. The weaker (17) suffices to generate the contradiction, and we followed Koons in (implicitly) making the stronger assumption in our earlier reasoning.

47. Once again, (18) does not require that x is a counterpart to the GR in R_i.

The GRA clearly requires (13)-(15), and (16) is obviously true. Consequently, denying one of these to avert our problem is not an option for the proponent of the GRA. The GRA also requires (18), since if (18) is false, then it could be the case that each sample-patch region contains a GR that has RPD intrinsically even though *nothing* in the corresponding subregions at the patched-together world has RPD. In such a case, no Benardete paradox arises in the patched-together world.

Since (13)-(15) and (18) are needed for the GRA while (16) is clearly true, the GRA proponent must reject (17). To us at least, this response strikes us as plainly *incorrect*—(17) is true, at least for any ordinary understanding of 'exact duplication'. If you were to examine two regions and notice that different things are happening inside those regions—for example, a GR in one region is creating and placing a particle whereas *nothing* in the other region is creating and placing a particle—you would clearly be correct to conclude that the contents of those regions do not exactly duplicate each other.

Of course, one could also add an exact analogue of (17) to the assumptions about Bulbs in our companions in guilt argument to generate an exactly analogous contradiction (even without a circular arrangement of Bulbs).[48] Since (17) is incredibly plausible, this simply tells us that both the GRA and our companions in guilt argument share an underlying problem. This, of course, was the upshot of our companions in guilt argument, but we now have another path to the same conclusion.

We also think our problem in this section makes particularly salient which assumption is mistaken—namely, the assumption that the *realized powers/dispositions* of Bulbs and Reapers are intrinsic to them (P3/P3*). Even if their characteristic *powers/dispositions* are intrinsic to Bulbs and GRs, whether those powers/dispositions are *realized* depends on the contents of other regions. Whether a Bulb b realizes its power/disposition to be ON iff no leftward Bulb is ON partly depends on the states of leftward Bulbs in other regions—if b is ON, then whether b realizes that power/disposition depends on whether some leftward Bulb (in a disjoint region) is ON. If a leftward Bulb is ON, then b has failed to realize that power/disposition (since b is ON despite some leftward Bulb being ON). For the same reason, whether a GR realizes its power/disposition to create and place a particle d meters from the plane iff no particle has been placed closer to the plane depends on the actions of previous GRs—if GR_i is creating and placing a particle d meters from

48. For the same reason that the GRA needs (18), our companions in guilt argument likewise needs an exact analogue to (18). So, since our companions in guilt argument needs exact analogues of (13)-(15) and (18), and since an exact analogue of (16) is clearly true, adding an exact analogue of (17) will generate an exactly analogous contradiction.

the plane, then whether GR_i realizes that power/disposition depends on whether some previous GR (in a disjoint region) has placed a particle closer than d meters to the plane. If a previous GR *has* done so, then GR_i has failed to realize that power/disposition (since GR_i creates and places the particle despite a particle having been placed closer to the plane). Supposing otherwise enabled us to infer, absurdly, that an *initial* GR in a patched-together world could still *realize* its power/disposition despite failing to create and place a particle (even though no particle had been placed already).

One might object that the correct description of GR_i's power/disposition actually renders its realization *intrinsic*. The correct description is *not* that GR_i is able and disposed to place a particle d meters from the plane iff no particle has been placed closer to the plane by any previous GR. The realization of *that* power/disposition *is* extrinsic to GR_i in its region. The *correct* description is that GR_i is able and disposed to place a particle d meters from the plane iff it does not find any particle closer to the plane (within its spacetime region). Whether *this* power/disposition is realized is a function purely of what happens inside GR_i's region; it does not depend on what happens in disjoint regions, and hence whether GR_i realizes its power/disposition is intrinsic to GR_i in its region.

But this objection fails. The GRA requires that whether GR_i finds a particle closer than d meters to the plane (within its region) *depends on* whether a previous GR created and placed a particle closer than d meters to the plane. This is precisely how Koons avoids the 'amazing vanishing particle' objection: the GRA requires that *some* sort of signal successfully transmits between GR-containing regions.[49] In the case of GRs, this requires that the presence or absence of a particle in GR_i's region depends on whether there is another, earlier Reaper which created and placed the particle. Without this dependence assumption, it could be that *each* GR in the patched-together world creates and places a particle simply because none of the particles persist across the temporal boundaries of GR-containing regions—in which case, no Benardete paradox arises, as no set satisfies (UC) and (ANBC). So, the GRA requires that whether a particle is present in GR_i's spacetime region depends on what happens in disjoint regions. But whether GR_i realizes its power/disposition to place a particle d meters from the plane iff it does not find any particle closer to the plane (within its region) plainly depends on whether a particle is present in GR_i's spacetime region. So, given the transitivity of dependence, the GRA requires that whether

49. Koons, "A New Kalam Argument: Revenge of the Grim Reaper," pp. 263–264.

GR_i realizes its power/disposition depends on what happens in disjoint regions, *contra* the objection at hand. Consequently, P3 is false, and the GRA is unsound.

Finally, one might try to avert our problem in this section by modifying the patchwork principle. The modified principle would license us to infer only that the *realized intrinsic powers/dispositions* of the objects in sample-patch worlds, rather than *all* their intrinsic properties, are preserved in patched-together worlds.[50]

We have three brief replies. First, note that the modified principle must be strikingly fine-tuned. Specifically, it must license us to infer that *whether* a Reaper's intrinsic powers/dispositions are realized in a sample patch is preserved in the patched-together world, but it *cannot* license us to infer that the *way* in which they are realized (by, say, creating a placing a particle) is so preserved. (Otherwise, our problem simply re-arises.) But consider a correlative and almost-identical principle that *does* license the latter inference. We cannot see a principled, nonarbitrary way to accept the fine-tuned principle without accepting this correlative principle, and the motivations for the former seem to equally motivate the latter. Consequently, we think that anyone who accepts the former should accept the latter. And since the latter leads to our problem for the GRA, we do not think the suggestion at hand circumvents our problem.

Second, if the *way* that a GR realizes its intrinsic power/disposition to create and place a particle iff no particle has been placed is by creating and placing a particle, then that GR *also* surely realizes its intrinsic power/disposition to create and place a particle (full stop). If this is right, then this modified patchwork principle would preserve *that* realized power/disposition as well, and so our problem remains: we can still patch together regions such that a GR creates and places a particle *despite being non-initial* in a GR-sequence.

Third, this objection does not avoid our challenge to P3, since the modified principle does not challenge our case for the conclusion that the *realization* of a GR's power/disposition is extrinsic (and hence not preserved by patchwork principles). Yet the patchwork inference in the GRA *needs* to preserve the realization of GRs' powers/dispositions, since otherwise we cannot infer that the patched-together world instantiates a Benardete paradox.

For these reasons, we do not think the objection succeeds. Of course, further dialectical moves could be made. We encourage future work to explore them in more detail.

50. If *all* powers/dispositions are preserved, including extrinsic ones, then familiar counterexamples to the patchwork principle will arise.

IV. CONCLUSION

We began by explaining Benardete paradoxes and B-arguments, which are arguments for finitist metaphysical theses based on those paradoxes. We also explained how patchwork principles are used to support the crucial linking premise in B-arguments. We then developed a new *finite* Benardete-like paradox involving Bulbs. In addition to being independently philosophically interesting, this paradox can be used to defend a novel companions in guilt argument that challenges the GRA, an influential B-argument that relies on the patchwork principle. Finally, we developed another problem relating to *exact duplication* for the GRA. This problem, in turn, allowed us to pinpoint which assumption in the GRA is mistaken. While we think our arguments seriously undermine the GRA, our primary hope is that we have served and advanced debates surrounding Benardete paradoxes, finitism, B-arguments, and patchwork principles.

TROY DANA

University of Ottawa

JOSEPH C. SCHMID

Princeton University