

INFINITE CAUSAL CHAINS AND EXPLANATION

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Introduction

Many cosmological arguments for the existence of a first cause or a necessary being rely on a premise which denies the possibility of an infinite regress of some particular sort. Adequate and satisfying support for this sort of premise, however, is not always provided. In this paper I try to provide support for such a premise, and thereby make some progress towards formulating a rigorous and convincing cosmological argument.

After discussing the notion of a causal explanation (section I), I formulate three principles which govern any successful causal explanation (section II). I then introduce the notions of a caused being, a causal network, and a causal chain, and argue that (roughly) an infinite causal chain of caused beings cannot be explained merely by reference to the causal activities of the members of that chain (section III).¹ In a sequel to the present paper, I employ this result to construct two closely related arguments for the existence of a necessary being.

The majority of the content of this paper is directed to the goal of taking a rather straightforward intuition and making it precise. Let me sketch that intuition briefly before commencing the technical work.

Consider the following analogy: The phoenix is a mythical bird that, after living a long life, dies in a torrent of flames. From the ashes of the dead phoenix a new phoenix arises, and the process repeats. Now imagine that we live in a world where this myth is true. What is more,

¹ My thinking on the issues dealt with in this paper owes much to Peter van Inwagen, *Metaphysics*, 2nd ed. (Boulder, CO: Westview Press, 2002), chs. 6-7, and Patrick Lee “A Version of the Contingency Argument for the Existence of the Creator,” unpublished manuscript. I’ve also been helped by Scott MacDonald, “Aquinas’s Parasitic Cosmological Argument,” *Medieval Philosophy and Theology*, 1:119-55; and Robert Koons, “A New Look at the Cosmological Argument,” *American Philosophical Quarterly* 34 (1997): 193-212.

imagine that there is no beginning of time. So there are phoenixes and there have always been phoenixes. More precisely, at any one time there is exactly one phoenix, and there have been an infinite number of phoenixes in the (infinite) past. It is a fact, then, that there is a series of phoenixes. Now, given that this is not a metaphysically necessary fact, given that there might not have been phoenixes at all, we might wonder why there are phoenixes. Suppose we are told that the current phoenix exists because the previous phoenix caused it, and the previous phoenix existed because the phoenix previous to *it* caused it, and so on *ad infinitum*. This proposed explanation does not in fact explain the fact we wanted explained. It might, perhaps, explain the fact that there is currently a phoenix. But if we were wondering why there are any phoenixes at all, why we are in a world with a whole series of phoenixes rather than a world in which there are none, then the proposed explanation would fail. The proposed explanation would fail because it presupposes that there *are* phoenixes around to do the causing. We want to know why there are any phoenixes at all, but the explanation we are given presupposes that there are some phoenixes. It presupposes the very thing that it is trying to explain. Any adequate explanation of the fact that there is a series of phoenixes will need to invoke something other than a phoenix.

The situation is just the same with caused, contingent beings. If we ask the question, “Why are there any contingent beings at all?”, it won’t help to be told that “There are contingent beings because other contingent beings caused them.” For that answer presupposes that there *are* contingent beings (around to do the causing). But that is exactly what we wanted an explanation of (we wanted an explanation of why there are contingent beings). Any adequate explanation of why there are some contingent beings will have to invoke a different sort of being—an uncaused, necessary being. I now proceed to make this line of reasoning more precise.

I. Explanation and causation

A) *Explanations and ontological categories*

The notion of an explanation is a wide-ranging one. Any explanation is an explanation *of* something, but items from a large number of different ontological categories can count as the object of an explanation. We speak very naturally of an explanation of a *fact*, as in, “Do you have any explanation of the fact that your paper is late?” But we also might give an explanation of an event or class of events, an explanation of a rule, or an explanation of the meaning of a word or sentence. In this paper I shall be concerned only with explanations of facts.

As I shall use the term, then, explanations are explanations *of* facts. But what are explanations themselves? That is, what sort of a thing is an explanation? Two answers suggest themselves: either an explanation of a fact is itself a fact, or it is a proposition. Consider the following pair of fact and explanation:

F1 John is going to the post office.
E1 John wants to buy stamps.

That John wants to buy stamps is an explanation of the fact that John is going to the post office (F1). But is it the *fact* that John wants to buy stamps that is the explanation here, or is it the *proposition* that John wants to buy stamps that is the explanation (or, perhaps, the *truth* of the proposition)? For ease of exposition, I’ll make the assumption that explanations are themselves facts, but nothing in my argument hangs on this assumption, so far as I can tell.

B) *Atomic facts and complex facts*

Imagine that we (you and I) are sitting across from each other at a table, and we each have a glass of water. Though a general account of the individuation of facts is not easy to formulate, it nonetheless seems clear that

F2 There is water in my glass

is one fact, and

F3 There is water in your glass

is another (supposing we each have our own glass). But it also seems that

F4 There is water in both our glasses

is itself a fact. We can think of F4 as a complex fact composed of two sub-facts, F2 and F3.

Speaking generally, a fact F is complex if it is composed of two or more other facts, which are called “sub-facts” in relation to F. And a fact is composed of sub-facts (say Fa and Fb) if and only if, necessarily, what it is for F to be the case just is what it is for Fa to be the case and Fb to be the case. For example, what it is for there to be water in both our glasses *just is* what it is for there to be water in my glass and there to be water in your glass. And so F4 is a fact composed of F3 and F2 and is therefore a complex fact. A fact is an atomic fact if it is not composed of any sub-facts.

C) *Explanations and causes*

Most explanations make reference to one or more causes of the facts they explain. That is, most explanations *provide* (as I shall say) causes of the facts they explain. While it may be that some explanations do not provide causes of the facts they explain, I will be concerned only with those explanations that do. That is, in this paper I will concern myself with *causal explanations*, where a causal explanation is an explanation that provides one or more causes of the fact it explains.

Depending on the fact to be explained, any of the four Aristotelian causes can furnish an explanation. But here I will be interested only in efficient causes.

Causal explanations provide causes. Speaking generally, we could express this statement by saying that any causal explanation of a fact is intimately related to one or more causes of that fact. Formulating this point more precisely will require us to adopt the language of some particular theory of causation (e.g. event causation) as opposed to the language of one of its rivals (e.g. agent causation). That is, the statement that

(C) Causal explanations provide causes

will be expressed differently depending on which view of causation is being assumed. Suppose efficient causes are agents. Then, given that explanations are facts (rather than propositions), (C) should be expressed as follows: (efficient causal) explanations are facts which *involve* agent causes and their activities.

And what if efficient causes are events? To see how (C) should be expressed on this hypothesis, we must take note of the close correspondence between facts and events. To the fact that I poured water in that glass corresponds the event of my pouring water in that glass (or, perhaps, the event of my having poured water in that glass). In general, to the fact that O is P corresponds the event of O's being P, and to the fact that O does A corresponds the event of O's doing A. Corresponding to the complex fact that there is water in both our glasses is the (complex) event of there being water in both our glasses. With this provisional sketch of the correspondence between facts and events in place, we could express (C) like this: A causal explanation of a fact F is a fact which corresponds to an event which is a cause of F.

One could formulate and defend my main theses (below) on either the supposition that agents are efficient causes or the supposition that events are efficient causes. But I shall do neither. Rather than speak in terms of agent causation or event causation, I shall speak in terms of fact causation. If it is legitimate to think of one event as the cause of another event, it seems no less legitimate to think of one fact as the cause of another fact. If the event of my pouring water in the glass a minute ago can be thought of as a cause of the event of there being water in the glass, then it also seems that the fact that I poured water in the glass a minute ago can be thought of as a cause of the fact that there is water in the glass.²

² As I use the terms 'fact' and 'event', both facts and events are concrete entities. Cf. Koons, "A New Look at the Cosmological Argument."

Given the close correspondence between facts and events, it seems legitimate to speak in terms of fact causation.³ Doing so will allow me to formulate my argument with greater ease. If we adopt the language of fact causation, for example, (C) can be expressed quite simply: An explanation of a fact F is a fact which is a cause of F. Henceforth, then, I will speak of some facts as being causes of other facts.

II. Explanations and putative explanations

Imagine again that we are at table together, each with a glass of water. But now imagine that there is also a third glass, also full of water. Consider the fact that

F5 There is water in that glass.

Now consider two putative explanations of F5:

E5a I poured water in that glass just a minute ago.

E5b Necessarily, for every proposition p, if someone knows p, then p is true. And I know that there is water in that glass. Therefore, there is water in that glass.

While E5a seems to be a fairly good explanation, given the context, of F5, we are not at all inclined to call E5b a good explanation. I shall call it a *merely putative explanation*, i.e. a fact which purports to be an explanation of some other fact, but which is not really an explanation of that other fact. In this section I want to consider some of the ways in which a putative explanation of some fact can fail to be an explanation. That is, I want to consider some of the features that distinguish merely putative explanations from explanations that really *explain*.

There are no doubt many ways in which a proposed or putative explanation can miss the mark, but for our purposes one in particular will be of interest. An explanation cannot *presuppose* the fact it explains; a putative explanation that does presuppose the fact to be explained must be a merely putative explanation. In what follows I will specify three ways in which a putative explanation can presuppose the fact it is meant to explain.

³ Even were it not legitimate, my argument could be re-cast in the terms of event causation.

A) *Principle of Explanation One*

First, consider the fact that

F6 All of God's beliefs are true.

We would rightly object if someone were to offer the following as an explanation of F6:

E6 None of God's beliefs are false.

We would object because the sentence expressing E6 is (or at least seems to be) a mere restatement of the sentence expressing F6, given the assumptions that God has beliefs and that each such belief is either true or false. The problem here seems to be that the *explanans* is identical with the *explanandum*. And if it is indeed the case that F6 is identical with E6, then E6 is not an explanation of F6, for a fact cannot be its own explanation. For a clearer example, consider:

F7 I exist.

E7 I exist.

The fact that I exist cannot explain the fact that I exist. Reflection on such particular examples should convince us of the following general rule, which I shall call principle of explanation one:

PE1 Necessarily, if E is an efficient causal explanation of F, then E is not identical to F.

B) *Circular causation and Principle of Explanation Two*

Next, consider the pair

F8 The grandfather of the dog Spot existed.

E8 Spot exists.

E8 cannot provide an efficient causal explanation of F8 for this simple reason: the fact that Spot exists is causally posterior to (or causally *downstream* from) the fact that Spot's grandfather existed (in the order of efficient causality). Because the fact that Spot exists is causally posterior (in the order of efficient causation) to the fact that his grandfather existed, the fact that Spot exists can't be an efficient cause of the fact that his grandfather existed (for every cause is causally *prior* to its effect). And so E8 cannot be a cause of F8, and therefore E8 cannot be an explanation of F8. We can generalize from this example and accept

PE2 Necessarily, if E is an efficient causal explanation of F, then E is not causally posterior to F in the order of efficient causality.⁴

C) *Principle of Explanation Three*

Furthermore, if PE2 is true, then so is

PE3 Necessarily, if E is an efficient causal explanation of F, then E is not causally posterior to a sub-fact of F in the order of efficient causality.

In regard to PE3, I have in mind a pair like this:

F9 My mother exists and my aunt exists.
E9 I exist.

E9 could never explain F9 because the fact that I exist is causally posterior to the fact that my mother exists. Argument: Let F9a be the fact that my mother exists, and let F9b be the fact that my aunt exists. The fact that I exist (E9) is causally posterior to the fact that my mother exists (F9a). By PE2, E9 cannot be an efficient causal explanation of F9a. But if E9 cannot explain F9a, then it also cannot explain a larger fact of which F9a is just a part. So E9 cannot explain F9. Generalizing from this example, we arrive at PE3.

With these three principles in mind, I'll say that a putative explanation E, offered to explain a fact F, *presupposes* F if it violates PE1, PE2, or PE3.

III. An infinite causal chain of caused beings

I turn now to my main topic, infinite causal chains. Some terminology will be of help.

A) *Caused and uncaused beings*

Let us say that, roughly, a being is a caused being if and only if its existence is efficiently caused by something, and a being is an uncaused being if and only if its existence is not efficiently caused by anything. More precisely:

⁴ The reasoning in the above paragraph seems sound. It is perhaps worthwhile to point out, however, that it relies on a rejection of the possibility of circular efficient causation. Because length constraints prohibit me from delving into this issue in any depth, and because few thinkers would in fact quarrel with the rejection of circular efficient causation, I will forego a defense of the claim that circular efficient causation is impossible.

X is a *caused being* if and only if (i) X exists and (ii) there either is or once was a being Y such that either (a) Y itself is an efficient cause of the fact that X exists or (b) some fact or event about Y and its causal activity is an efficient cause of the fact that X exists.⁵

X is an *uncaused being* if and only if X is not a caused being.

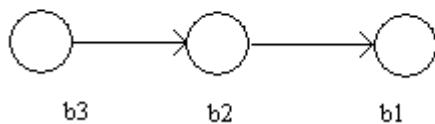
We can say a bit more about any caused being by invoking the impossibility of circular efficient causation. Given that circular efficient causation is impossible, a thing cannot be its own efficient cause. We can therefore dispense with the possibility of self-causation and say:

X is a *caused being* if and only if (i) X exists and (ii) there either is or once was a being Y *distinct from X* such that either Y itself or some fact or event about Y and its causal activity is an efficient cause of the fact that X exists.

B) *Causal chains and causal networks*

Next, I introduce the notion of a certain sort of causal chain. Imagine a trio of caused beings, b1, b2 and b3, such that some fact about the causal activity of b3 is an efficient cause of the fact that b2 exists, and some fact about the causal activity of b2 is an efficient cause of the fact that b1 exists. Let us say that b3, b2 and b1 form an efficient causal chain, and let us call the collection of b3, b2 and b1 an efficient causal chain. This causal chain is represented in figure one, in which the arrows represent the causal relations described above.

Figure 1



Nothing I have said about b1, b2 and b3 forming a causal chain implies that b2 is the *only* being involved in efficiently causing the fact that b1 exists. The fact that b1 exists may have other efficient causes besides the fact about the causal activity of b2. Speaking generally, we can say that a causal chain need not be closed – it is not the case that every causal chain we might consider

⁵ This definition accommodates theories of agent and event causation as well as a theory of fact causation.

includes all the causes of each member of the chain. Having said this, we can make the above example more concrete: let b3 be Spot's grandfather Rex, b2 be Spot's father Fido, and b1 be Spot himself. The fact that Rex generated Fido is an efficient cause of the fact that Fido exists, and the fact that Fido generated Spot is an efficient cause of the fact that Spot exists. Rex, Spot, and Fido form a causal chain.

That b1, b2, and b3 form a causal chain does not imply that b2 is the only being involved in the efficient causation of the fact that b1 exists. However, I do wish to define the term 'causal chain' in such a way that the claim that b1, b2, and b3 form a causal chain *does* imply that, of all those beings included in the causal chain, only one is involved in the efficient causation of the fact that b1 exists. By using the word 'chain' in 'causal chain', I want to capture the notion that a causal chain is a linear, non-branched series. Compare figure one to figure two.

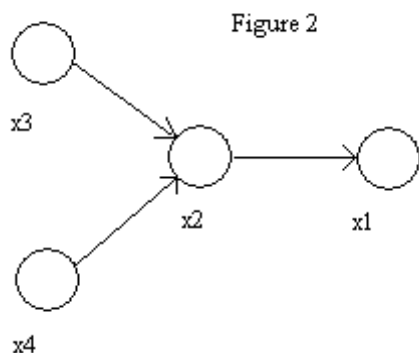


Figure two depicts a collection of four beings, x1, x2, x3 and x4. X2 is related to x1 in just the same way as b2 is related to b1. But x2 has two efficient causes. One efficient cause of the fact that x2 exists is a fact about the causal activity of x3; another efficient cause of the fact that x2 exists is a fact about the causal activity of x4. Speaking in agent causation terms, we could say that x2 has two immediate efficient causes, x3 and x4. Accordingly, there is a 'branch' in the figure depicting the collection of x1, x2, x3 and x4. Because I want to reserve the term 'causal chain' for a collection of beings which form a non-branched series, I shall call the collection consisting of x1, x2, x3 and x4 a *causal network*. Very roughly: a causal network is a collection of beings such that

for any being B in the network, there is either a cause of B in the network, or an effect of B in the network. And a causal chain is a linear causal network.

Somewhat less roughly, a *causal network* is defined as a collection of beings such that for any being b_i in the collection, there is a distinct being b_k in the collection such that either (i) some fact about the causal activity of b_k is an efficient cause of the fact that b_i exists, or (ii) some fact about the causal activity of b_i is an efficient cause of the fact that b_k exists. Speaking in terms of agent causation, any being in a causal network is either the effect of another being in the network or the cause of another being in the network.

The definition of a causal chain will be more complex, since we must incorporate the stipulation that a causal chain is a linear, non-branched series. If we were operating on an agent causation theory, the definition would be relatively straightforward: a *causal chain* is a causal network such that for any being b_i in the network, (i) it is not the case that there is more than one being in the network that is an immediate efficient cause of the fact that b_i exists and (ii) it is not the case that there is more than one being in the network that is an immediate effect of b_i in the order of efficient causality. Clauses (i) and (ii) serve to eliminate branching within the network.

But since I am operating on a theory of fact causation, the wording of the definition is more cumbersome. As a first approximation, we can put things this way: Provisionally, a *causal chain* is a causal network such that for any being b_i in the network, (i) it is not the case that more than one being in the network is immediately involved in the efficient causation of the fact that b_i exists and (ii) it is not the case that more than one being b_k in the network is such that some fact about the causal activity of b_i is an immediate efficient cause of the fact that b_k exists.⁶

⁶ I have taken the trouble to distinguish between causal chains and causal networks for the following reason. My two arguments for the existence of a necessary being (in another paper) must mention causal networks, but it is easier to see the point I wish to make about infinite causal networks by first considering infinite causal chains.

We must complicate matters further by taking into account the fact that the beings involved in the efficient causation of some existential fact might have ceased to exist. So one more wrinkle needs to be introduced into the definitions of a causal chain and a causal network before proceeding.

If some being once existed but now does not, call it a past being.⁷ If some being now exists, call it a present being. Suppose Spot's grandfather Rex has died, but Spot's father Fido is alive; then Rex is a past being, while Fido and Spot are present beings. The causal chain formed by Rex, Fido and Spot is a collection of two present beings and one past being. It might seem strange that Rex is a member of a collection even though Rex does not exist. But when we understand what it means to say that Rex is a member of the causal chain formed by Rex, Fido and Spot, the apparent strangeness fades away. To say that Rex is a member of a causal chain formed by Rex, Fido and Spot is just to say that there either is or was a being Rex, and that there either is or was a being Fido, and that there either is or was a being Spot, and that all these beings stand or stood in the appropriate causal relations to each other. To say that a past being B is in a causal network is just to say that there was a being B that was causally related in the appropriate way to some other member of the network.

With the terminology of 'past' and 'present' beings in place, we can now replace our provisional definitions of a causal network and a causal chain with their finalized counterparts.

A causal network is defined as a collection of beings (whether past or present) such that for any being b_i in the collection, a distinct being b_k is in the collection and is such that either (i) some fact about the causal activity of b_k is an efficient cause of the fact that b_i exists (or the fact that b_i existed, as the case may be), or (ii) some fact about the causal activity of b_i is an efficient cause of the fact that b_k exists (or the fact that b_k existed, as the case may be).

A causal chain is defined as a causal network such that for any being b_i in the network, (i) it is not the case that more than one being in the network is or was immediately involved in the efficient causation of the fact that b_i exists (or the fact that b_i existed, as the case may

⁷ Suppose the horse Secretariat is dead. If I were to say, 'Secretariat is a past being', I would not be implying that there exists a being which no longer exists. 'Secretariat is a past being' merely implies that there used to be a being which, now, no longer exists. To say 'Secretariat is a past being' is just to say that there once was (but no longer is) a being that was Secretariat.

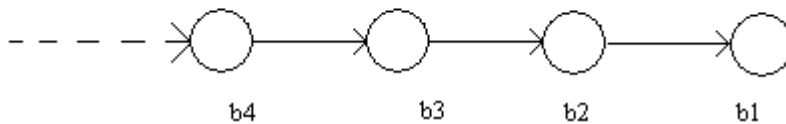
be) and (ii) it is not the case that more than one being b_k in the network is such that some fact about the causal activity of b_i is an immediate efficient cause of the fact that b_k exists (or the fact that b_k existed, as the case may be).

I now proceed to a substantive point about causal chains and explanations.

C) *The Infinity Lemma*

Suppose we have an infinite causal chain which includes an infinite number of caused beings b_1, b_2, b_3, b_4 , and so on *ad infinitum*. Suppose b_1 and b_2 are present beings, and all the rest are past beings. Some fact about the causal activity of b_2 is an efficient cause of the fact that b_1 exists. Some fact about the causal activity of b_3 is an efficient cause of the fact that b_2 exists. And so on. (See figure three.)

Figure 3



Now, consider the infinite complex fact⁸ that

F10 b_1 exists and b_2 exists and b_3 existed and b_4 existed and....

Suppose we were looking for an efficient causal explanation of F10. Some philosophers might offer a putative explanation of F10 that invokes the causal activities of b_2, b_3 , and the rest of the members of the chain. For example, a putative explanation framed in the terms of agent causation might go like this: It is a fact that F10 because

E10a (b2 caused b_1 to exist) and (b3 caused b_2 to exist) and (b4 caused b_3 to exist) and....

A putative explanation in the terms of fact causation would take the form:

E10b (Some fact about the causal activity of b_2 on b_1) and (some fact about the causal activity of b_3 on b_2) and (some fact about the causal activity of b_4 on b_3) and....

⁸ A complex fact is an infinite complex fact if it is composed of an infinite number of atomic facts.

Appearances notwithstanding, neither E10a nor E10b can be an explanation of F10, because each presupposes F10. More specifically, both E10a and E10b violate principle of explanation three.

To see this, consider E10a. E10a is composed of an infinite number of components, namely,

E10a¹ b2 caused b1 to exist
E10a² b3 caused b2 to exist
and so on.

Take the first of these components: b2 caused b1 to exist. While it is true that b2 caused b1 to exist, it must be noted that b2 could not do any causing if b2 did not first exist.⁹ That is, any causing that b2 does is causally posterior to the fact that b2 exists.¹⁰ So E10a¹ is causally posterior

⁹ ‘First’ here means first in the order of causality or explanation, not in the order of time. Perhaps it is possible that something (X) could be causing something else (Y) from the first moment of its (X’s) existence.

¹⁰ I’m claiming that the fact that b2 caused b1 is causally posterior to the fact that b2 exists. Someone might object to this claim, asserting that while the existence of b2 is a necessary condition for the obtaining of the fact that b2 causes b1, the existence of b2 is not itself a cause of the fact that b2 causes b1 to exist. Upon reflection, I’m sympathetic to this objection. Still, I think I can avoid it (the objection) by reformulating my argument, as follows: It is clear that b2 must exist if b2 is to exercise any causal activity. Granting to the objector that b2’s existence is not itself an efficient cause of the fact that b2 causes b1, we could still say that b2’s existence is a causal precondition, or a *causa sine qua non* of the fact that b2 causes b1. Say that a fact F (like the fact that b2 exists) is a *causa sine qua non* of a fact of the form “thing S causes ____” if the obtaining of F is required for S to engage in causing _____. Similarly, say that a fact F (like the complex fact that b2 exists and b3 exists) is a *causa sine qua non* of a fact of the form “thing S1 causes ____ and thing S2 causes ____” if the obtaining of F is required for it to be the case that both S1 and S2 can engage in causing their effects. And similarly for any complex fact about the causal activity of some things, the Ss. Then we can introduce the following principle of explanation:

PE2* Necessarily, if E is an efficient causal explanation of F, then F is not a *causa sine qua non* of E.

Next, from PE2* we can derive

PE3* Necessarily, if E is an efficient causal explanation of F, then no sub-fact of F is a *causa sine qua non* of E.

Argument: Suppose Fa is a *causa sine qua non* of some fact E (having the form “S causes ____” or “S1 causes ____ and S2 causes ____” or...etc.). Then E cannot be an efficient causal explanation of Fa (by PE2*). But then E could not be an efficient causal explanation of a complex fact consisting of Fa *and* some other sub-fact Fb (for if E can’t explain Fa, E also can’t explain a larger fact of which Fa is a sub-fact). Thus, if E *does* explain a fact F, then it must be the case that no sub-fact of F is a *causa sine qua non* of E.

Finally, to avoid the objection mentioned at the beginning of this footnote, PE3* could be used in place of PE3, in the argument I give below, in the main text. To anticipate, the argument would be: A sub-

to the fact that b2 exists. Likewise, E10a² is causally posterior to the fact that b3 existed, and so on.

Now realize that F10 is composed of an infinite number of atomic facts:

F10¹ b1 exists
F10² b2 exists
F10³ b3 existed

and so on. Having given these names to the sub-facts of F10, we can say: E10a¹ is causally posterior to F10², and E10a² is causally posterior to F10³, and so on. Therefore the entire putative explanation E10a is causally posterior to the complex fact composed of F10², F10³, and so on.¹¹

That is, E10a is causally posterior to

F11 b2 exists and b3 existed and b4 existed and...

But F11 is a sub-fact of F10. Therefore E10a is causally posterior to a sub-fact of F10, and thus, by

PE3, cannot be an explanation of F10. A parallel account could be given for E10b. And if

fact of F10 (viz., F11) is a *causa sine qua non* of E10a. So, by PE3*, E10a cannot be an efficient causal explanation of F10.

¹¹ In moving from the previous sentence to this sentence, I have employed the following principle: If a complex fact F is composed of sub-facts A, B, etc., and A is causally posterior to A* and B is causally posterior to B*, and so on, then F is causally posterior to the complex fact composed of A*, B*, etc. Alexander Pruss has raised an objection to this principle (call the principle “P”, for ease of reference). Pruss’s objection runs as follows: Assume P for the sake of a *reductio*. Now consider an infinite series of events { ..., E₋₂, E₋₁, E₀, E₁, E₂, E₃, ... }, extending infinitely into the past, and infinitely into the future. Let F be the complex fact corresponding to the occurrence of this infinite series of events. Suppose further that each member in this series is caused by the preceding member and is in turn a cause of the subsequent member. Then any given member (say, E₂) is causally posterior to the preceding member (E₁). But then P will imply that the whole infinite complex fact F is causally posterior to itself. This is because any given member of F – say, E₃ – is causally posterior to the preceding member, E₂. And so each of the members of F is causally posterior to a sub-fact in the whole complex fact consisting of...all the sub-facts of F. So by P, F will be causally posterior to itself, which is absurd. So P must be false.

This may well be a decisive objection to the cogency of my argument for (IL). Time and length constraints prevent from addressing this objection adequately, but for the time being I’ll briefly gesture at two replies that might be worth pursuing. First, it could be noted that the fact used to furnish a counter-example to P is not really a fact at all, since “half of it” lies in the future. Second, whatever the case may be with the general principle, P, it seems clear that F11 is a *causa sine qua non* of E10a (on this terminology, see the previous footnote). That is to say, roughly, that in order for all of the bs mentioned in E10a (b2, b3, and so on) to have been able to engage in causing their effects, it is required that F11 obtain. But then, utilizing the modified form of PE3 developed in the previous footnote, viz.,

PE3* Necessarily, if E is an efficient causal explanation of F, then no sub-fact of F is a *causa sine qua non* of E,

we can show that E10a is not an efficient causal explanation of F10. (For it’s false that no sub-fact of F10 is a *causa sine qua non* of E.) And from there, the rest of the argument for (IL) should hold.

explanations like E10a and E10b cannot explain F10, then neither can any other explanation which involves only the causal activities of the members of the infinite causal chain in question.

We can generalize from this example to reach a conclusion I will call the infinity lemma for causal chains:

- (IL) Necessarily, for any infinite causal chain of caused beings, the complex fact that each of the members of that chain exists/existed¹² is not explained by any complex fact which is only about the causal activities of the members of the chain.¹³

While the infinity lemma is framed in relatively technical terms, its basic point can be grasped intuitively. Consider again the phoenix analogy: imagine that at any one time there is exactly one phoenix, and that there have been an infinite number of phoenixes in the (infinite) past. It is a fact, then, that there is a series of phoenixes. That is, letting p1 stand for the present phoenix, p2 for p1's immediate predecessor, and so on, it is a fact that

F^P p1 exists and p2 existed and p3 existed and...

Now, we might wonder why there is a series of phoenixes given that it is not a necessary truth that phoenixes exist. That is, we might want an explanation of why it is a fact that F^P. And if we want to know why F^P is a fact, it won't help to be told that p2 gave rise to p1, and p3 gave rise to p2, and p4 gave rise to p3, and so on. We could put things this way: the following is a merely putative explanation of F^P:

E^P p2 gave rise to p1 and p3 gave rise to p2 and p4 gave rise to p3 and...

I think it is quite clear, intuitively, that E^P fails as an explanation of F^P. We want to know why there are any phoenixes at all. If we are told that there are phoenixes because other phoenixes

¹² I use the phrase 'exists/existed' to accommodate the fact that some of the beings in a causal chain may be past beings, while others may be present beings. By 'the complex fact that each of the members of that chain exists/existed' I mean the complex fact which is composed of (i) the atomic fact expressed by a phrase of the form 'the fact that _____ _____', where the first blank is filled by a name of the first member of the chain and the second blank by the appropriate form of the verb exist, and (ii) the atomic fact expressed by a phrase of the same form, where the first blank is filled by a name of the second member and the second blank by the appropriate verb, and so on.

¹³ This result can be extended relatively easily to causal networks (from causal chains). Length constraints prohibit me from reproducing the argument here.

caused them, we have not been given a satisfying answer, because the answer we have been given presupposes that there *are* phoenixes (to do the causing), which is exactly what we wanted an explanation of.

Again, the situation is just the same with an infinite causal chain of caused beings. Take the infinite set of beings consisting of the members of the causal chain depicted in figure three. Call those beings the Bs. If we want to know why there are and have been Bs, it won't help to be told that there are and have been Bs because some of the Bs caused others of the Bs. That answer presupposes that there *are* Bs, which is just what we want an explanation of.

To sum up: the infinity lemma for causal chains makes a claim about a certain type of fact, namely, the complex fact that each of the members of some infinite causal chain of caused beings exists (or existed, as the case may be). The infinity lemma states that this type of complex fact cannot be explained by any complex fact involving only the causal activities of the members of the chain in question. (For any fact of the latter type would presuppose the fact to be explained.) In a sequel to this paper, I proceed to employ this lemma to construct two closely related arguments for the existence of a necessary being.¹⁴

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