Determination Relations and Metaphysical Explanations

Maşuk Şimşek

masuk.simsek@bilkent.edu.tr

Bilkent University, Ankara

https://orcid.org/0009-0001-0938-0623

Abstract

Ross Cameron (2022) argues that metaphysical infinitists should reject the generally accepted idea that metaphysical determination relations back metaphysical explanations. Otherwise it won't be possible for them to come up with successful explanations for the existence of dependent entities in non-wellfounded chains of dependence. I argue that his argument suffers from what he calls the finitist dogma, although indirectly so. However, there is a better way of motivating Cameron's conclusion. Assuming Cameron's principle of Essence, explanations for the existence of dependent entities turn out to be circular if determination relations back explanations. This latter argument provides a stronger case as it puts the foundationalist under significant pressure, besides putting the infinitist under some pressure, to deny the idea that determination relations back explanations.

Reality is vast and variegated. There are concrete objects, events, mathematical objects, persons, economies etc. This variety, nevertheless, doesn't preclude unity in what exists. Things are connected to each other via different kinds of relations making it possible for us to comprehend them in unison. A decrease in the interest rate causes an increase in inflation, a cell is composed of organelles, the fact that my pen is cylindrical grounds the fact that it has a shape, the set of natural numbers ontologically depends on the existence of natural numbers etc. Some of these relations are causal and are relied on in causal explanations. Others are non-causal. *Metaphysical determination relations* has lately been used in the literature as an umbrella term for the other, non-causal kinds of relations.

It seems obvious that causal relations are explanatory. Scientists, for instance, appeal to causal relations in their explanations and we think that those explanations are supported by relevant causal relations. It is said that one explains a phenomenon by determining its cause (Ratner, 2003).[1]

Can we say the same thing about non-causal determination relations as well? Is it obviously true that metaphysical determination relations support explanations? Some think that it is difficult to see what use metaphysical determination relations are for unless they are explanatory (Bliss, 2018). Based on this motivation, metaphysical determination relations are usually taken to support explanations of a distinct kind, i.e. *metaphysical explanations*. Just like causal relations back causal explanations, metaphysical determination relations back metaphysical explanations. One way to understand metaphysical explanations is to take them as *what it is* claims (Cameron, 2022, p. 135). Consider the relation of set-membership. What it is for the singleton $\{x\}$, for instance, to exists is to have x as an only member. Now, the idea is that this explanation is backed by a relation between the singleton $\{x\}$ and its member x.

Ross Cameron (2022) attacks this widespread assumption. Unless you are a metaphysical foundationalist – that is, you think a chain of metaphysical determination should be wellfounded,

---

[1] Thanks to an anonymous referee for suggesting this analogy.

i.e. tethered to an ultimate foundation – you need to accept that there are certain cases where metaphysical determination relations don't back metaphysical explanations. This argument, if successful, forces metaphysical infinitists and metaphysical holists – those who think, respectively, that infinite or circular chains of metaphysical determination untethered to a foundation are possible – to deny that metaphysical determination relations necessarily back metaphysical explanations.

The layout of the essay is as follows. After summarizing Cameron's argument in Section 1, I criticize it in Section 2 by appealing to a distinction between *Objectivist* and *Subjectivist* senses of explanation, and to *the Hume-Edwards Principle*. In Section 3, I offer an alternative to Cameron's argument by using Cameron's premises. Throughout 3.1-3.3, I evaluate ways of reacting to the argument I offer. I conclude in Section 4 by signifying the advantages of my alternative over Cameron's argument.

1.   Cameron's Argument

Cameron's argument is based on two principles:

> **Essence**: When x ontologically depends on y, the fact that x ontologically depends on y is part of x's nature.
>
> **Dependence**: When x ontologically depends on y, this dependence holds at least partly in virtue of the existence or nature of y.

Applied to our earlier example, Essence says that fact $<\{x\}$ depends on $x>$[2] is part of $\{x\}$'s nature. $\{x\}$ is the singleton of x, and hence a complete explanation of its nature has to include an appeal to the fact that $\{x\}$ depends on x; $\{x\}$ could not exist and be the set it is without depending on x. And Dependence says that x is at least partly responsible for the fact that $\{x\}$ depends on x. Either x and

---

[2] Throughout the paper, I will use '$<f>$' to mean 'the fact that f' following common practice.

{x} are responsible for the dependence relation together or it holds solely because of x. In either case, x is at least partly responsible for the relation.

Now, these two principles make the success of any explanation for the existence and nature of {x} hostage to any explanation for the existence and nature of x. The mechanics of this argument are as follows. Because <{x} depends on x> is part of {x}'s nature, by Essence, we need to appeal to this dependence relation in order to give a complete explanation for {x}. Because x is at least partly responsible for the dependence relation, by Dependence, our appeal to the dependence relation takes us to x. Thus, in order to give a complete explanation for {x}, we are compelled to account for x. In other words, the success of our explanation for the existence and nature of {x} is hostage to the explanation for the existence and nature of x.

Now, if x is not ontologically dependent on another entity, it will be possible to provide a successful explanation for its existence and nature. This successful explanation will form the bedrock for the success of the explanation for {x}. But if x is a dependent entity, we will be faced with the same problem once again. For instance, if x is a singleton, whose sole member is y, the success of the explanation for x will be hostage to the explanation for y. For, again, Essence will take us from the explanation for the existence and nature of x to the fact that x depends on y, and Dependence will take us from there to y. The success of the explanation will be deferred once more. Moreover, unless this ontological dependence chain bottoms out at the level of a foundational entity, this deferral will go on and on. If the chain is infinite or circular, the success of the first explanation, along with any other explanation in the chain, will be deferred infinitely.

This means that in order for us to have a complete explanation for the existence and nature of an entity on a chain of ontological dependence, that chain needs to be tethered to a foundation. Even if there is no problem about the possibility of infinite or circular non-wellfounded chains of dependence *per se*, metaphysical foundationalism will seem to have an explanatory advantage over its rivals. Therefore, Cameron concludes, it's better for the metaphysical infinitist and holist to deny

the claim that metaphysical explanations are backed by metaphysical determination relations, thereby defusing the supposed explanatory disadvantage.

2. Completing an Infinite Chain of Explanation

It isn't clear whether Cameron's argument, by itself, can motivate this conclusion. For, it depends on a questionable further assumption: that an infinite chain of explanation cannot be successfully completed. The reason for this is not merely that the explanatory chain is infinite. For, that would be begging the question against infinitism. The reason why an infinite chain of explanation cannot be successfully completed, he says, is that one cannot even make a single successful explanation in such a chain. The success of a single explanation in the chain is hostage to the successes of every subsequent explanation in the infinite chain; since the chain is infinite, the success of the original explanation is "never established" (p. 101).

2. 1. Subjectivist vs Objectivist Explanations

Yet, unless we are misled by spatiotemporal connotations of the chain metaphor, there is no reason to think this. When we talk about explanation in this context, we are not using what Bird (2005) calls the *subjectivist* sense of the word but the *objectivist* sense of it. In the first sense, an explanation is an act of explaining. As all other doings of a subject, an explanatory act takes time. As Lewis (1986) points out, alluding to Bromberger (1965), questions like "Who gave the explanation?", "When was the explanation given?", or "Where was it?" Apply to this sense of the word.

In some contexts, however, explanation seems independent of subjects. For instance, when the physicalist says that there is a physical explanation for every physical phenomenon, the claim is not that each physical phenomenon is explained by some person or that a complete physical explanation of every phenomenon could be given by many people working in tandem. Rather, what

is claimed is that each physical phenomenon stands in an explanatory relation to another. Therefore, the questions cited above do not apply to this second sense. Instead, questions like "Is it very complicated?", "Who thought of it first?", or "Does anyone know it?" apply.

Explanations in this objectivist sense are not doings of subjects but propositions in which explanatory relations are featured. These are the relations which allow us to make sense of the world. Any act of explanation is supposed to allude to these explanatory relations. Nevertheless, it is possible for the objectivist explanation not to be conveyed at all in such an explanatory act. Lewis (1986) states that an explanation in this second sense "might even be information that never could be conveyed, for it might have no finite expression in any language we ever use" (p. 218).

Now, it would be sensible to deny the possibility of a complete infinite chain of subjectivist explanation, since such a claim would require infinitely many acts of explanation. When, however, infinitists claim that an infinite chain of explanation can be complete, they aren't positing infinite chains of explanatory acts. Rather, they are using the objectivist sense of explanation. And in this sense, as Lewis endorsed above, the explanatory story can in fact be infinite, even though it might be impossible to express it in an explanatory act.

2. 2. *Completing an Infinite Chain of Explanations*

How, then, should we conceive an infinite chain of explanation as successfully completed? The notion of completeness we need to employ here, I claim, needs to address completeness requirements in holist and infinitist cases as much as foundationalist cases, thereby staying impartial in the debate among these camps. The following criterion, namely *the Hume-Edwards Principle*, meets this condition: An explanatory chain is complete if and only if each and every explanandum in the chain gets an explanation (Rowe, 1970)[3]. That is to say, if nothing in the chain is left out, we can say that it is a complete chain of explanation. Applied to the case of infinite

---

[3] I need to thank an anonymous referee for their helpful suggestion in contextualizing this principle.

chains, this means that an infinite chain of explanation is complete provided that every entity in the chain gets an explanation in the objectivist sense.

What reason can one have to deny that every entity in an infinite chain can get an explanation? If the success of each explanation were hostage to the existence of a further explanation in the subjectivist sense, this would require us to try to complete a never-ending journey. However, when we formulate the explanation in the objectivist sense, we don't have such a problem. The success of an explanation, in this case, won't be hostage to the existence of an explanatory act but to the existence of the next explanation in the objectivist sense, which doesn't require time.

Pruss (1998) provides three counterexamples to the Hume-Edwards Principle. I will now go over Pruss' examples and show that they fail.

In the first case, there is a cannonball which is shot out at 11:58 and lands at noon. Let C be the set of time-slices of the cannonball's movement beginning from but not including 11:59 to and including 12:00. That is, C is the collection of the cannonball's states in the last minute of its movement. Pruss argues that C fits the Hume-Edwards Principle. It consists of infinitely many states at infinitely many time-slices in the last minute. Moreover, given the relevant Newtonian laws of physics, each state within C can be completely explained by a state preceding that state in C. Now, if the principle is true, then C must be completely explained by itself, since each and every state in it is allegedly explained by a previous state. This would mean that the movement of the cannonball in the last minute could be explained without appealing to the cannon at all, which is absurd. Therefore, the thought goes, the principle is false.

This case, on the face of it, seems to fit the Hume-Edwards Principle. Because the time-slice at 11:59 is not included in C, there is no time-slice in C which can be deemed the first in the series. So, whichever time-slice you pick, there will be infinitely many time-slices preceding it in C. So, we are expected to accept that each explanandum in C is explained by its predecessor in C.

Nevertheless, I claim, this counterexample doesn't work. For, either the state of the cannonball at 11:58, call it *T**, doesn't explain anything in *C* or *C* is not complete and hence doesn't fit the Hume-Edwards Principle. But surely, *T** explains infinitely many states succeeding it in *C*. For, according to Pruss' account, any state of the cannonball is explained by states preceding it and there are states in *C* which are preceded by *T**. The fact that we aren't able to pick a single state in *C* which could be deemed *the immediate successor of T** doesn't prevent us from stating that there are states in *C* succeeding *T**. There are, in fact, infinitely many successors of *T** in *C*. Therefore, there are infinitely many explananda in *C* which are left without an explanation when *T** is not included in the explanation. It's true that *C* is not self-explanatory but it's not true that every member in *C* is explained. Therefore, Pruss' cannonball example doesn't meet the Hume-Edwards Principle, and hence, doesn't falsify it.

This is a paradigmatic example of using a mistaken analogy against non-wellfounded infinite chains. Non-wellfounded infinite chains are, as Oberle (2022) points out, categorically different from wellfounded infinite chains whose foundation is cut out. An infinite series of causation whose primary cause is cut out is not a non-wellfounded series. For, a non-wellfounded series wouldn't need a primary cause in the beginning. *C* in Pruss' example is like a wellfounded series whose link to its foundation is severed. The fact that we can slice *C* into infinitely many states doesn't automatically make it a non-wellfounded series. That's why we can coherently claim that without *T**, there are states in *C* which aren't explained. If *C* was a non-wellfounded infinite series, we wouldn't be able to claim that there are states outside *C* , like *T*,* without which we cannot explain certain states in *C*. So, even though Pruss' target wasn't non-wellfounded infinite chains but the Hume-Edwards Principle, his argument requires finding such a non-wellfounded infinite chain and demonstrating that explaining all the explananda in it doesn't suffice to explain the whole of the chain.

Pruss' remaining two counterexamples target circular explanations and they reiterate the same mistake of confounding non-wellfounded chains with wellfounded chains without a foundation. In one of them, there is a classical time travel scenario in which a woman has travelled back in time to give birth to herself. In the other, we are expected to think that the collection of all the chickens and the collection of all the eggs in the world form an explanatory cycle. Both examples fail to address the issue of completeness.

In the time travel example, either the time travel circle exists independently of anything else or it depends on an external cause. If it is independent, then it can be claimed that explaining the parts is sufficient to explain the whole of the circle. This doesn't even count as biting the bullet since the bullet was bit when you accepted that such an independent circle of time travel is possible. The explanatory story simply would follow the ontological story. If, however, you think that the time travel scenario wouldn't be metaphysically possible without an external ground, then the parts of the circle are not completely grounded on each other, since they also depend on the external cause as well. So, without an appeal to the external cause, there will be explananda in the chain which aren't explained. In either case, the Hume-Edwards Principle is not falsified.

The last example is analogous to the second horn of the time travel example. The circle formed by the set of all the chickens and the set of all the eggs does depend on external causes. Given the evolutionary history of chickens, the set of chickens and the set of eggs don't form a closed circle. Therefore, an explanation of those two sets would not leave any unexplained explananda in the circle. Thus, the principle will again not be falsified.

To sum up, the Hume-Edwards Principle provides a criterion of completeness favorable to the infinitist.[4] It allows her to say that every link in an infinite chain gets an objective explanation.

---

[4] See Billon (2023) for a different conception of how non-wellfounded infinite chains of explanations can be complete. Billon doesn't take the Hume-Edwards Principle to be providing a successful account of completeness for non-wellfounded infinite chains since he thinks this principle fails to give a separate explanation for the existence of the whole chain. However, he proposes another account according to which there are complete non-wellfounded infinite chains of explanation.

Although Cameron's argument doesn't directly depend on finitist dogma since it doesn't depend simply on the impossibility of infinite chains of explanations, it still reiterates a similar mistake at the level of success of explanations. It depends on the idea that an infinite chain of explanations in which the success of each is hostage to the success of next cannot be complete, and that it cannot be complete because it is infinite. Therefore, as it stands, Cameron's argument is unsuccessful in forcing the finitist or holist to deny that metaphysical explanations are backed by metaphysical dependence relations.

3.   The Circularity Argument

There is, however, a better way of arguing that explanations should be pulled apart from determination relations. Cameron's argument was supposed to compel the infinitist to separate metaphysical explanations from metaphysical determination relations. As we will see, my argument *could* be used to motivate the infinitist to separate explanations from determination relations: she can only dodge this pressure on pain of losing an epistemic advantage over metaphysical holism. Metaphysical foundationalists, however, will be under more significant pressure to separate explanations from determination.

Assuming the principle of Essence, the idea that explanations follow from determination relations faces a circularity problem. For, the dependence relation is both part of what is supposed to give rise to the explanation for the existence of the dependent entity and part of what is to be explained.

Part of the essence of a set is the fact that it depends on its members for its existence and identity. The fact that $\{x\}$ depends on x for its existence and identity, for instance, is part of the essence of $\{x\}$. So, any explanation for the existence and nature of $\{x\}$ also needs to account for the fact that $\{x\}$ depends on x. Yet, given that explanations are backed by determination relations, the fact that $\{x\}$ depends on x is among the things which make the explanation possible. Hence, the fact

that {x} depends on x is part of both *explananda* and *explanantia*. Therefore, the explanation is circular.

The circularity argument can be formalized as follows.[5]

(1) If x depends on y, then <x depends on y> is part of x's nature.   (**Essence**)

(2) {x} depends on x.   (Premise)

(3) ∴ <{x} depends on x> is part of {x}'s nature.   (By 1 & 2)

(4) If a fact f is part of x's nature, then f must be among the *explananda*

     of any explanation of x's existence and nature.   (Premise)

(5) ∴ <{x} depends on x> must be among the *explananda* of any

    explanation of {x}'s existence and nature.   (By 3 & 4)

(6) If x depends on y, then <x depends on y> must be among the *explanans*

    of any explanation of x's existence and nature.   (**Backing**)

(7) ∴ <{x} depends on x> must be among the *explanans* of any

    explanation of {x}'s existence and nature.   (By 2 & 6)

(8) ∴ <{x} depends on x> must be among both the *explananda* and

    the *explanans* of any explanation of {x}'s existence and nature.   (By 5 & 7)

Assuming Backing and Essence, we have arrived at the conclusion that explanations regarding the existence of certain dependent entities are circular. How should we react to this conclusion? There are three main options. Rejecting Essence, embracing circularity, or rejecting Backing. I will now go over these options one by one.

---

[5] I am indebted to Jonathan Payton for the fruitful discussion we had and the constructive criticism he offered regarding this formalization.

3. 1. Rejecting Essence

One way to oppose the circularity argument is to reject Essence. Essence, after all, is a strong condition requiring dependent entities to have their dependence relations essentially. This might not obtain in all cases of metaphysical determination. In the case of a ship and the parts composing it, for instance, the ship ontologically depends on its parts but this dependence isn't part of the nature of that ship. That ship can be that very ship even if it has different parts. Then, the circularity in the explanations for dependent entities can be avoided in cases involving certain metaphysical determination relations like composition.

It's true that there are cases where Essence doesn't apply. But, still, there are also cases where it applies. And, provided that we don't embrace circularity, that there are some cases to which Essence applies is sufficient for the project of pulling apart explanations from determination relations. For, as Cameron (p. 99) states, that project requires showing not that explanations can always be separated from determination relations but that they can be separated at least in some cases of determination.

What remains, then, is demonstrating cases where Essence applies. And, incidentally, we have just the case for that: part of the essence of a set is the fact that it depends on its members. It would be impossible to know what a set is and to be able to identify which set one is thinking and talking about without grasping the idea that sets depend essentially on their members (Lowe, 2018).

Let's try to make sense of the scenario in which we reject Essence. What would this mean for sets? Applied to our example, Essence states that part of what it is to be $\{x\}$ is the fact that $\{x\}$ depends on its member, x, for its existence and identity. To reject this, one needs to claim that $\{x\}$ could have been what it is without depending on x for its identity. But, how can $\{x\}$ be what it is, i.e. the singleton of x, without depending on x? Is it possible for $\{x\}$ to be the singleton of x if it has another entity, say y, as its member? This is obviously absurd. Then, at least in the case of sets, we

can say that Essence is applicable.

3. 2. Embracing Circularity

Another way to react to the circularity argument is to accept the conclusion but render it harmless by opening a place for circular metaphysical explanations. If we embrace circularity in metaphysical explanations, the argument won't compel us to deny that metaphysical explanations are backed by metaphysical determination relations. But holists, infinitists, and foundationalists aren't in the same boat in the debate concerning circularity.

First of all, metaphysical holists already embrace circularity in metaphysical structures. They take circular chains of metaphysical determination relations to be possible. This means that regress, by itself, isn't a problem for them. Why not, then, embrace both the backing claim and circularity in this matter, and claim that metaphysical explanations, following metaphysical determination relations, form circles?

Circular explanations are usually rejected on the basis of epistemic concerns. For instance, a subject wouldn't gain any knowledge from a circular explanation. Even if there isn't any problem about circularity in general, there is, the objection goes, a problem with circularity in explanations.

In response to this objection, we need to recall the distinction I employed above, between explanations which are dependent on subjects and explanations which aren't. In the sense we use when we talk about metaphysical explanations, explanations are independent of subjects. That is the reason why I claimed that an infinitist can accept the possibility of infinitely long chains of metaphysical explanation, even though no human being can get a complete grasp of it, let alone give a complete account of it. This is to say that epistemic concerns relevant for explanations in the subjectivist sense aren't necessarily relevant for explanations in the objectivist sense. Metaphysical holists, then, can bite the bullet and claim that circularity is acceptable in metaphysical explanations as it is acceptable for them in metaphysical determination relations. Metaphysical holists, therefore,

are under no pressure to reject backing on the face of the circularity argument, for embracing

circularity is consistent with their overall stance in this debate.

Metaphysical infinitists have two options. They can either side with holists and embrace

circularity, which will enable them to hold on to Backing, or they can reject circularity, in which

case they will be under pressure to deny Backing.

Embracing circularity is arguably consistent with metaphysical infinitism in general. The

account of completeness in explanatory chains I employed above, for instance, allows for both

infinite and circular complete chains of metaphysical explanations.[6] If everything to be explained in

a chain gets an explanation, that explanatory chain is complete regardless of whether it is infinite or

circular. If an infinitist choses this path, she will be under no pressure from the circularity argument

to deny Backing.

Metaphysical infinitists, nevertheless, can stay cautious about circularity on the basis of

epistemic concerns. Thus, they can claim an advantage over holism despite being in the same boat

in arguing for the possibility of non-wellfounded chains of being. An example of such an argument

might be as follows. Even though it won't be possible for a subject to grasp an infinite chain of

metaphysical explanations completely, every act of explaining that subject attempts has the

potential to appeal to further links in the chain of explanation, and hence, to yield new knowledge.

Therefore, metaphysical infinitism meets epistemic requirements. However, the same cannot be said

for metaphysical holism. Once a subject grasps a circular chain of metaphysical explanations in its

totality, their acts of explaining will stop yielding new knowledge. For, none of the *explanans*

featuring in their acts of explanations will be new. Therefore, metaphysical infinitism has an

advantage over metaphysical holism. Should metaphysical infinitists choose this latter path and

---

[6] I need to thank an anonymous referee for their helpful comments on the subject of circularity in
relation to metaphysical infinitism.

hold on to their epistemic advantage over metaphysical holism, they will be under pressure from the circularity argument to deny Backing.

Lastly, metaphysical foundationalists have only one viable option regarding circularity. They must reject circularity, for they do believe that there is a problem with circularity in general. Otherwise, the foundationalist case against holism would be weakened, since it is raised mainly on the basis of circularity concerns. So, foundationalists can neither reject Essence nor embrace circularity. The only remaining option is to reject Backing.

3. 3. Rejecting the Backing Claim

The third way to react to the circularity argument is to reject Backing. If one denies that metaphysical explanations are backed by metaphysical determination relations, then there will be no requirement to include the relevant determination relation among the *explanans* in an explanation of a dependent entity's existence and nature. Thus, the circularity will be avoided.

Metaphysical holists, as stated above, can react to the circularity argument by embracing circularity. They are, therefore, under no pressure to deny Backing. Metaphysical infinitists, however, have a choice to make in the face of the circularity argument. They can either hold onto Backing, like metaphysical holists, or they can give up Backing in order to retain an explanatory advantage over holism. Metaphysical infinitists, then, are under some pressure deny Backing in the face of the circularity argument. Metaphysical foundationalists cannot embrace circularity, so they are under substantial pressure to reject Backing.

4.   Conclusion

I argued that Cameron's argument for separating metaphysical explanations from metaphysical determination relations is not successful. I offered, instead, an alternative argument on the basis of premises Cameron makes use of, namely Essence and Backing. Cameron, in fact, comes very close

to identifying the circularity in explanations of the existence and nature of dependent entities. He admits that <E1 ontologically depends on E2> is, by Essence, among the things to be explained in the explanation for the existence and nature of E1; and continues to state that we can explain the existence and nature of E2 because E1 ontologically depends on E2 (Cameron, 2022, p. 100). Yet, he continues to formulate his argument on the basis of the idea that the success of each explanation is hostage to the next explanation, instead of dwelling on the circularity.

Besides reiterating the finitist dogma at the level of success of explanations, Cameron's argument, if it were sound, could motivate only metaphysical infinitists to separate explanations from determination relations. For, the success of explanation was threatened only in the infinitist case. The circularity argument, on the other hand, puts significant pressure on the metaphysical foundationalist to deny Backing, along with putting some pressure on the metaphysical infinitist to do so. In conclusion, although Cameron's argument for separating explanations from determination relations fails, a better argument to do this job is available to him.

References

Billon, A. (2023). A recipe for non-wellfounded but complete chains of explanations (and other determination relations). *Dialectica* (this issue), x(x):xxx–xxx.

Bird, A. (2005). Explanation and metaphysics. *Synthese*, 143(1/2), 89-107.

Bliss, R. (2018). Grounding and reflexivity. In R. Bliss & G. Priest (Eds.), *Reality and its structure: Essays in fundamentality* (pp. 70-90). Oxford University Press.

Bromberger, S. (1965). An approach to explanation. *Analytical philosophy*, *2*, 72-105.

Cameron, R. (2022). *Chains of being: Infinite regress, circularity, and metaphysical explanation*. Oxford University Press.

Lewis, D. K. (1986). Causal Explanation. In *Philosophical papers* (pp. 214-240). Oxford University Press.

Lowe, E. J. (2018). Metaphysics as the science of essence. In A. Carruth, S. Gibb, & J. Heil (Eds.), *Ontology, modality, and mind: Themes from the metaphysics of E.J. Lowe* (pp. 14-34). Oxford University Press.

Oberle, T. (2022). Grounding, infinite regress, and the thomistic cosmological argument. *International Journal for Philosophy of Religion*, 92(3), 147-166.

Pruss, A. R. (1998). The Hume-Edwards principle and the cosmological argument. *International Journal for Philosophy of Religion*, 149-165.

Ratner, L. W. (2003). *Non-linear theory of elasticity and optimal design*. Elsevier.

Rowe, W. L. (1970). Two criticisms of the cosmological argument. *The Monist*, 441-459.