Is the Big Bang the Sole Cause of the Universe? A Response to John J. Park

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Abstract

In a recent paper, John J. Park argues (1) that an abstract object can bring a universe into existence, and (2) that, according to the Big Bang Theory, the initial singularity is an abstract object that brought the universe into existence. According to Park, if (1) and (2) are true, then the *kalam* cosmological argument fails to show that the cause of the universe must be divine. I argue, however, that both (1) and (2) are false. In my argument I analyse the abstract/concrete distinction and conclude that, by its nature, an abstract object is causally inefficacious in the sense that it cannot bring something into existence.

Keywords: John Park, Kalam cosmological argument, Abstract object, Big Bang theory, Singularity

1 Introduction

Contemporary cosmology suggests that the universe had an absolute beginning or, at least, this is what many theists claim. The oft-cited evidence for a cosmic beginning is the Big Bang Theory (also known as the Standard Hot Big Bang model or the Friedmann-Lemaître model). Based on the General Theory of Relativity (GR), the Big Bang Theory predicts that the universe, or rather space itself, expands as time elapses. The constant expansion of space implies that as one extrapolates back in time, the universe becomes denser until one reaches a state of "infinite" density in the finite past. This state is called the "initial singularity". To many theists this state represents the beginning of the universe or, at least, the beginning of classical space-time.

Several theists, therefore, use the Big Bang Theory to support the second premise of the ancient *kalam* cosmological argument (KCA).[1] This argument may be formulated as follows:

(A1) If the universe began to exist, it has a cause of its existence.
(A2) The universe began to exist.
(A3) Therefore, the universe has a cause of its existence.

Once the argument has reached its conclusion, proponents of this argument attempt to show that the cause of the universe must possess divine properties, including the properties of being transcendent, causeless, immaterial, personal, and extremely powerful. Thus, advocates of the KCA believe that because the Big Bang Theory supports (A2), it inadvertently supports classical theism.

However, John J. Park disagrees. In a recent paper, Park (2015) argues that instead of supporting theism, the Big Bang Theory, in fact, *undermines* theism. According to Park, the Big Bang Theory states that the initial singularity brought the universe into existence. Thus, even if the KCA (as

[1] See, for example, Craig and Sinclair (2012).

formulated above) is sound, it does not prove that the universe has a divine cause. Park's argument may be summarised more precisely as follows:

(B1) According to the Big Bang Theory, the initial singularity is a transcendent, abstract object that brought the universe into existence.

(B2) An abstract object, such as the initial singularity, can bring a universe into existence.

(B3) The explanation that *the initial singularity alone brought the universe into existence* is simpler and more parsimonious than the explanation that *God caused the initial singularity that, in turn, brought the universe into existence.*

(B4) Therefore, contrary to the proponents of the KCA, the Big Bang Theory supports atheism or the view that the initial singularity — and not God — is the sole cause of the existence of the universe.

My intention in this paper is to show that Park's argument is unsuccessful. I will argue, firstly, that Park has not offered us any good reason to accept either (B1) or (B2) and, secondly, that there are several good reasons to reject both premises. I will begin by criticising Park's first premise.

2 Is the Singularity an Abstract Object?

According to Park's first premise, (B1), the Big Bang Theory describes the singularity as a transcendent cause of the universe. In other words, the singularity has three distinguishing characteristics, namely, (1) it transcends the universe, (2) it brought the universe into existence, and (3) it is an abstract object. Park writes,

> To be sure, the physical universe does have a cause. It is the singularity. The singularity is not in three-dimensional space. It exists outside of and before the existence of space and time just

> as God is thought to as well. ... [S]pacetime exploded out of the singularity and the Big Bang. Hence, the singularity is the source of the universe. ... This conclusion ... is generally widely accepted in physics (Park 2015, p. 3).

Thus, Park maintains that the Big Bang Theory postulates a transcendent singularity as the cause of the universe. Furthermore, Park argues that the singularity is an abstract object because it has properties and because it is timeless, spaceless, and non-physical. Park explains that "[i]n physics ... the Big Bang singularity is deemed to be an abstract rather than physical object in part because it contains infinite properties such as infinite density and temperature. The initial singularity is also an abstract object because it is held to exist before the existence of spacetime" (Park 2015, p. 5, note 5). Thus, Park maintains that the majority of physicists affirm that the singularity is a transcendent abstract object that brought the universe into being.

However, (B1), raises two serious problems. Firstly, Park offers us no reason to accept this premise. Indeed, Park fails to mention a single physicist or philosopher of science to support (B1)![2] Thus, in view of the fact that this premise is dubious (as we will see below), one should not take (B1) seriously until it is affirmed by several prominent physicists and philosophers of science. Accordingly, since Park has failed to show that (B1) "is generally widely accepted in physics," Park's argument has little force.

Secondly, and most importantly, (B1) is false. The Big Bang Theory does not state that the singularity is an abstract object that brought the universe into existence (nor does any other cosmological theory). In fact, it is not possible for the Big Bang Theory to address the question about the ontological status of the singularity because such a question is a *metaphysical* question and not a *scientific* question. Furthermore, the formal definition of

[2]It goes without saying that it is not recommended for a philosopher to base his/her entire argument on a controversial scientific claim and yet reference no prominent scientist to support the claim.

a space-time singularity in physics is very different to Park's understanding of a singularity. For example, *The Oxford Companion to Cosmology* (2009), a sound reference work written by Andrew Liddle and Jon Loveday, states,

> A space-time singularity is a location where the structure of space-time breaks down. The formal definition of a singularity in general relativity comes from an idea known as geodesic incompleteness; put simply, the space-time is singular if there exist trajectories which come to an end after only a finite time, as experienced by an observer moving along that trajectory. They correspond to a breakdown in predictability of the theory. Typically, singularities are associated with the curvature of space-time becoming infinite (Liddle & Loveday 2009, p. 277).

Thus, a singularity is formally defined in terms of geodesic (or path) incompleteness and not as an object that exists apart from space-time (Wald 1984, p. 215; Ellis, Maartens, & MacCallum 2012, p. 145).[3] Accordingly, when a physicist states that "a singularity exists", he/she means that "space-time has the property of being geodesically incomplete".[4] A geodesic in this sense refers to a space-time line or path along which a freely falling particle moves. If a geodesic has a finite, affine length and is not endless in either direction, it is incomplete. Thus, space-time is singular if it is time-like or null geodesically incomplete. It is important to note that, as Robert M. Wald (1984, p. 216) remarks, "it is this property [of geodesic incompleteness] that is proven by the singularity theorems to hold in a wide class of spacetimes". Hence, the Big Bang Theory does not postulate that the singularity is a transcendent first cause but, rather, that classical space-time is geodesically incomplete.

[3]Sometimes a singularity is defined as a space-time boundary where the curvature of space-time becomes infinite. However, Robert M. Wald (1984, p. 214–215) argues that a space-time may be singular without the curvature becoming infinite. Therefore, it is best to define a singularity in terms of geodesic incompleteness.

[4]Hence, I shall use the phrase "a singularity exists or occurs at x" synonymously with the phrase "space-time is geodesically incomplete or some geodesic reaches an end or boundary at x".

Now, the formal definition of a singularity has three significant implications. Firstly, the fact that the universe has an initial singularity means that the universe has an edge or boundary. In this regard John D. Barrow (2007, p. 39) declares that "[the Big Bang singularity] is the boundary of the Universe".[5] In this context, the phrase "boundary" does not refer to some existing abstract or concrete object, such as a wall or barrier with which an observer may collide with but, instead, it signifies that space-time is inextendible in at least one direction. As an analogy, one could think of the edge or boundary of a walking stick. A walking stick has a boundary or beginning point if it has a finite length, but this fact does not commit one to the existence of a "boundary" abstract object. Thus, although some physicists speak loosely of a singularity as a "point" or "location", this should not be taken at face value. As Tim Maudlin notes, depicting a singularity as a line or point may mislead "the incautious observer" because he/she might assume that "the singularity were some sort of *thing*". However, "the singularity is an edge of space-time itself, where time-like curves simply cannot be continued" (Maudlin 2012, p. 144 [original emphasis]).

Secondly, a singularity does not literally have infinite values. The obvious reason for this is the fact that the term "singularity" does not refer to a real object that is endowed with properties; rather, it refers to a state of affairs in which a geodesic has finite, affine length. Nevertheless, physicists often associate a singularity with the curvature or density of space-time becoming infinite. However, they do *not* mean that the singularity is an abstract object that has the property of being infinite but that, as one extrapolates back in time, space-time curvature tends to infinity, that is, the volume of space-time approaches zero in the limit as its scale factor approaches zero (Heller 2009, p. 24; Craig & Sinclair 2012, p. 129). Moreover, the Big Bang Theory does

[5]Likewise, William R. Stoeger (2010, p. 152) writes, "[b]ut what is the Big Bang? Strictly speaking, it is the past limit of the hotter, denser phases we encounter as we go back farther into the history of the universe." Willem B. Drees (2013, p. 297) also describes a singularity as a "limit", an "edge", or "ontological discontinuity".

not describe the events "at" the singularity (or "at" the edge of space-time), so to speak, because the General Theory of Relativity (GR) breaks down at this limit. Andrei Linde explains:

> In its standard form, the big bang theory maintains that the universe was born about 15 billion years ago from a cosmological singularity — a state in which the temperature and density are infinitely high. Of course, one cannot really speak in physical terms about these quantities as being infinite. One usually assumes that the current laws of physics did not apply then (Linde 1994, p. 48).

Similarly, Joseph Silk (2005, p. 59) remarks that "the universe began at time zero in a state of infinite density. ... Of course the phrase 'a state of infinite density' is completely unacceptable as a physical description of the universe, infinities being abhorrent to physicists. ... A singularity is even worse than an infinity in our equations. It signals a breakdown in the laws of physics". Stephen Hawking and Leonard Mlodinow (2010, p. 165) explain what the phrase "a state of infinite density and curvature" means to a physicist: "To a physicist this means that Einstein's theory breaks down at that point and therefore cannot be used to predict how the universe began, only how it evolved afterwards". Hence, the phrase "a space-time state of infinite density and curvature" denotes that (1) the density and curvature of space-time increases indefinitely as one approaches the boundary to space-time, and that (2) GR no longer holds at this boundary. The obvious corollary is that the Big Bang Theory does not postulate that the initial singularity is an abstract object endowed with infinite values.

Finally, the formal definition of a singularity implies that a singularity cannot bring a universe into existence. In light of the fact that (1) a singularity is a *property* of the universe (i.e. the property of having a boundary or being geodesically incomplete) and that (2) a property of an object cannot cause that object to come into existence, it is not possible for a singularity to

cause space-time to come into existence. Indeed, just as an edge to a walking stick can neither exist without that walking stick nor cause the walking stick to exist, a singularity can neither exist without the universe nor cause the universe. It is important to remember, furthermore, that a singularity may occur not only at the beginning of the universe but also at the centre of a black hole or at a future big crunch (Liddle & Loveday 2009, p. 271). This, in turn, implies that, contrary to Park, physicists and philosophers do not (and should not) treat singularities as the causes of space-time.

It is, thus, clear that Park has misconstrued contemporary cosmology. The Big Bang Theory does not state that the singularity is a transcendent abstract object that brought the universe into being. In fact, instead of being a *cause*, the Big Bang singularity denotes, at most, a *start* to classical space-time. According to George F. R. Ellis, "[the Big Bang singularity] is not merely a start to matter — it is a start to space, to time, to physics itself. It is the most dramatic event in the history of the universe: it is the start of existence of everything" (Ellis 2007, p. 1190).

3 Can an Abstract Object Create a Universe?

According to Park's second premise, (B2), an abstract object can bring a universe into existence. In order to defend this premise, Park (2015, p. 10) acknowledges that he should address the question, "How can it be the case that the singularity, which is an abstract object that does not exist in space-time, causes the universe to come into existence?" I agree that Park should address this question in order to defend (B2). However, he should *also* address the more fundamental question, "Is platonism true?" Platonism, as I shall use the term, is the view that abstract objects exist. Thus, if platonism is false and abstract objects do not exist, then no abstract object (including Park's abstract "singularity") can cause the universe to come into existence. Accordingly, (B2) depends on the truth of platonism. The problem, how-

ever, is that platonism is a controversial position and many philosophers, including myself, are not convinced by the arguments in favour of platonism. Accordingly, Park should offer us some justification for platonism before he addresses how an abstract object can bring a universe into being. However, since Park has not done this, (B2) remains unjustified.

Nevertheless, let us assume, for the sake of argument, that platonism is true. Should one then affirm (B2) or, at least, that (B2) is plausible? I think not. In the first place, Park offers no *offensive* argument to support (B2) and instead he merely responds to four (deficient) objections that one may raise against (B2). More importantly, however, Park overlooks the following significant reason why an abstract object cannot cause the existence of the universe: *An abstract object, by definition, cannot bring something into existence.*

Abstract objects are difficult to define. Nevertheless, philosophers agree that examples of *abstract objects* include a number, property, mathematical truth, and proposition, while examples of *concrete objects* include a dog, tree, person, mind, God, space, event, time, and the universe. The most common method for representing the abstract/concrete distinction is the so-called *way of negation*, whereby abstract objects are defined in terms of a lack of certain features as exhibited by concrete objects (Rosen 2014; Rodriguez-Pereyra 2014). Abstract objects are usually thought to lack spatial location, temporal location, and causal efficacy. As Zoltán Gendler Szabó (2003, pp. 17–18) notes, in current discussions "abstract entities are supposed to lack observational, causal, and spatio-temporal properties, i.e. they are (i) in principle imperceptible, (ii) incapable of causal interaction, and (iii) not located in space-time".

According to Gideon Rosen (2014), "the most widely accepted versions of the Way of Negation" affirm the following:

(C1) If an object is abstract, then it is causally inefficacious (or powerless or effete), that is to say, it cannot cause, or partly cause,

some effect.

If (C1) is true and abstract objects cannot cause an effect or event, then (B2) must be rejected. However, although (C1) appears, at first appearances, to be true, it is nevertheless plausible that if abstract objects exist, they enter into some causal relations. The most obvious example of this is the causal relations between abstract objects themselves. For example, in H. G. Wells' novel *The Time Machine*, the Time Traveller (the main character in the novel) builds a time machine (a device that can carry a person through time). Although both the Time Traveller and the time machine are abstract objects, it may be said that the Time Traveller *causes* (or *partly causes*) the time machine's existence (in the fictional world, of course). Likewise, there is a possible world W in which Abel kills Cain (and not vice versa as described in the Book of Genesis). Although possible worlds, with their objects, are usually regarded as abstract objects, it may, nevertheless, be said that in W, Abel *causes* (or *partly causes*) the death of Cain.

Therefore, if one adopts, for example, both platonism and the counterfactual account of causation, then one may maintain that if the Time Traveller had not existed, nor would his time machine and, if Abel did not exist in W, Cain would lack the property of *being killed by Abel*. In other words, a platonist could argue that certain abstract objects causally depend on other abstract objects for either their existence or their properties. Of course, one may object that talking about the causal relations between abstract objects merely helps us to better understand abstract objects and that such talk should not be taken literally. Nevertheless, let us grant that, if abstract objects exist, they could stand in causal relations with one another. We may, thus, adjust (C1) as follows:

(C2) If an object is abstract, then it is causally inefficacious within the realm of concrete objects, that is to say, it cannot enter into causal relations with concrete objects.

(C2) allows one to affirm that (i) causal inefficacy is a criterion for the abstract/concrete distinction and that (ii) causal interaction between abstract objects is possible. However, as was the case with (C1), (C2) is inconsistent with (B2) because the universe is a concrete object. However, one could challenge (C2) by arguing that abstract objects enter certain types of causal relations with concrete objects. For example, the novel *The Time Machine* was caused (or created) by H. G. Wells at a certain place and over a certain duration. Similarly, certain propositions undergo intrinsic change as a result of certain concrete events. For example, the proposition that *Socrates is married to Xanthippe* was true during the fifth century BC when Xanthippe was Socrates' wife but became false when Socrates died. Or again, if platonism is true, then certain concrete objects are the way they are because certain abstract objects exist. A green apple, for example, is green because the property of *being green* exists. If this property did not exist, no apple could be green. Thus, according to the counterfactual account of causation, the property of *being green* is the cause (or part of the cause) of green apples. Accordingly, a platonist could argue that abstract objects are not causally inefficacious within the realm of concrete objects.

However, in none of the cases discussed above do abstract objects bring something into existence. By "a brings b into existence" I mean that (i) a causes b to come into existence at time t, (ii) b did not exist either timelessly or at any time $t^* < t$, and (iii) a explains why b came into existence at t and not at some other time. Clearly, abstract objects cannot bring something into existence in *this* sense. For example, the property of *being green* or the novel *The Time Machine* cannot bring a cup of coffee into existence at noon tomorrow although certain concrete objects can, such as a human being or a coffee machine. In fact, I can think of no case in which an abstract object brings something into existence and, thus, I believe that the ability to bring something into existence is a necessary (although not sufficient) property of an abstract object. Therefore, (C2) may be adjusted as follows:

(C3) If an object is abstract, then it cannot bring something into existence.

In light of the fact that many (if not most) philosophers wish to define abstract objects in terms of causal inefficacy, I suggest they use (C3), instead of (C1) or (C2), as a criterion for the abstract/concrete distinction. One may then offer a sound abstract/concrete account similar to the following:

(D) An object is abstract iff it satisfies none of the following five conditions, and it is concrete iff it satisfies at least one of the following five conditions: (1) it is a person or mind, (2) it is material or physical, (3) it is space (or space-time) itself, (4) it is a time, moment, duration, or time itself, (5) it can bring something into existence.

(D) is as good as any other abstract/concrete account because it is consistent with the agreed examples of abstract and concrete objects. Therefore, one may conclude that an abstract object, by definition, cannot bring something into existence and this, in turn, implies that Park's second premise, (B2), is false.[6]

In light of the above reason, and also the fact that Park has failed to address this reason, Park's claim that an abstract object can bring the universe into existence is unwarranted and clearly false. Thus, since Park has not succeeded in defending either (B1) or (B2), Park's argument is unsound and

[6]Another reason why it is implausible that an abstract object can cause the universe is that an abstract object lacks the free will needed to bring the universe into existence. If the universe has a cause, this cause must have been in a timeless state (because it brought time itself into being) and then have undergone an intrinsic change whereby it either spontaneously or wilfully brought the universe into existence. However, it is undisputed that in a possible world in which only abstract objects exist (and not one concrete object exists), the entire realm of abstract objects would remain unchanged and no concrete object would come into existence. The reason for this is that only a powerful mind that possesses free will may be timeless and immaterial and yet undergo an intrinsic change whereby it spontaneously or wilfully creates space and time. Therefore, it is extremely implausible that an abstract object could bring the universe into existence.

the Big Bang Theory does not support the claim that the initial singularity is the sole cause of the universe.

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