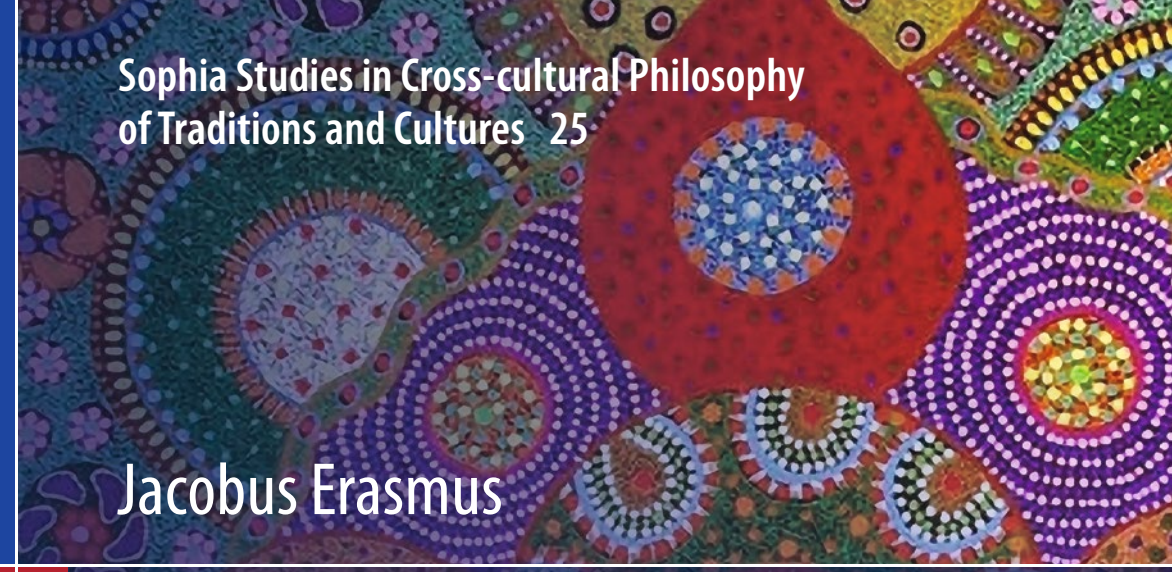

Jacobus Erasmus

The *Kalām* Cosmological Argument: A Reassessment

Springer

Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures

Volume 25

Series Editors

Editor-in-Chief
Purushottama Bilimoria, The University of Melbourne, Australia
University of California, Berkeley, CA, USA

Co-Editor
Andrew B. Irvine, Maryville College, Maryville, TN, USA

Associate Editors
Jay Garfield, The University of Melbourne, Australia

Editorial Assistants
Sherah Bloor, Amy Rayner, Peter Yih Jing Wong
The University of Melbourne, Australia

Editorial Board
Balbinder Bhogal, Hofstra University, Hempstead, USA
Christopher Chapple, Loyola Marymount University, Los Angeles, USA
Vrinda Dalmiya, University of Hawaii at Manoa, Honolulu, USA
Gavin Flood, Oxford University, Oxford, UK
Jessica Frazier, University of Kent, Canterbury, UK
Kathleen Higgins, University of Texas at Austin, Austin, USA
Patrick Hutchings, Deakin University, The University of Melbourne, Australia
Morny Joy, University of Calgary, Calgary, Canada
Carool Kersten, King's College, London, UK
Richard King, University of Kent, Canterbury, UK
Arvind-Pal Mandair, University of Michigan, Ann Arbor, USA
Rekha Nath, University of Alabama, Tuscaloosa, USA
Parimal Patil, Harvard University, Cambridge, USA
Laurie Patton, Duke University, Durham, USA
Stephen Phillips, University of Texas at Austin, Austin, USA
Joseph Prabhu, California State University, Los Angeles, USA
Annupama Rao, Columbia University, New York, USA

The Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures focuses on the broader aspects of philosophy and traditional intellectual patterns of religion and cultures. The series encompasses global traditions, and critical treatments that draw from cognate disciplines, inclusive of feminist, postmodern, and postcolonial approaches. By global traditions we mean religions and cultures that go from Asia to the Middle East to Africa and the Americas, including indigenous traditions in places such as Oceania. Of course this does not leave out good and suitable work in Western traditions where the analytical or conceptual treatment engages Continental (European) or Cross-cultural traditions in addition to the Judeo-Christian tradition. The book series invites innovative scholarship that takes up newer challenges and makes original contributions to the fıeld of knowledge in areas that have hitherto not received such dedicated treatment. For example, rather than rehearsing the same old Ontological Argument in the conventional way, the series would be interested in innovative ways of conceiving the erstwhile concerns while also bringing new sets of questions and responses, methodologically also from more imaginative and critical sources of thinking. Work going on in the forefront of the frontiers of science and religion beaconing a well-nuanced philosophical response that may even extend its boundaries beyond the confines of this debate in the West – e.g. from the perspective of the 'Third World' and the impact of this interface (or clash) on other cultures, their economy, sociality, and ecological challenges facing them – will be highly valued by readers of this series. All books to be published in this Series will be fully peer-reviewed before final acceptance.

More information about this series at http://www.springer.com/series/8880

Jacobus Erasmus

The *Kalām* Cosmological Argument: A Reassessment

Springer

Jacobus Erasmus
School of Philosophy, Faculty of Humanities
North-West University
Potchefstroom, South Africa

ISSN 2211-1107 ISSN 2211-1115 (electronic)
Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures
ISBN 978-3-319-73437-8 ISBN 978-3-319-73438-5 (eBook)
https://doi.org/10.1007/978-3-319-73438-5

Library of Congress Control Number: 2017963274

© Springer International Publishing AG 2018
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

To my parents

Mike and Renée Erasmus

Preface

This book is a substantial revision of my doctoral dissertation entitled *Towards a More Persuasive Kalām Cosmological Argument: Permitting the Actual Infinite*, which was passed in fulfilment of the requirements for the Doctor of Philosophy degree at the North-West University in 2016. However, I estimate that at least fifty percent of the material in this book is new and was not part of my doctoral dissertation. This new material formed part of my postdoctoral research, which I conducted for the School of Philosophy at the Potchefstroom Campus of the North-West University in South Africa.

Every writer quoted in this study has inspired me, and so they all deserve my thanks. I wish to thank my doctoral supervisor, Professor Anné Verhoef, for his wisdom and support. It was Professor Verhoef who first suggested to me that I use my dissertation as the basis of a book. I am also indebted to R. Douglas Geivett for his helpful comments on my doctoral dissertation. I would also like to thank Laureano Luna for the many interesting discussions we have had about the *kalām* cosmological argument. Luna has had a positive influence on me and, in turn, on this work. I wish to thank my parents, Mike and Renée, for their loving encouragement. Lastly, I wish to thank my wonderful wife, Elaine, for her unfailing love, support, and understanding. Not only has Elaine put up with my long hours of study, but she has been willing to listen to my many philosophical ramblings. Elaine, an incredible lady such as you is, indeed, hard to find.

Potchefstroom, South Africa — Jacobus Erasmus
January 2017

Contents

Acronyms

AC	Axiom of choice
BGV	Borde-Guth-Vilenkin theorem
CCC	Conformal cyclic cosmology
CEB	Common English Bible
CMB	Cosmic microwave background
ESV	English Standard Version
GR	General theory of relativity/general relativity
IBE	Inference to the best explanation
MN	Methodological naturalism
NIV	New International Version
NT	New Testament
OT	Old Testament
PN	Philosophical naturalism
PSR	Principle of sufficient reason
SR	Special theory of relativity/special relativity
UP	Unlikelihood principle
ZF	Zermelo-Fraenkel axioms
ZFC	Zermelo-Fraenkel axioms together with the axiom of choice

Chapter 1
Introduction

1.1 What Is the *Kalām* Cosmological Argument?

The cosmological argument is an argument type that attempts to infer the existence of a supernatural being (usually identified with God) from supposed facts about the universe, for example, that the universe exists, or that the universe is contingent because it could have not existed, or that the universe came into existence. Since the cosmological argument is an argument type, the phrase 'the cosmological argument' is usually used in the plural form to refer to the family of theistic arguments (a *theistic argument* is an argument in favour of theism or God's existence) that follow the pattern of inferring God's existence from alleged facts about the universe. The cosmological argument is often classified into the following three types (Craig 2001:282–283):

1. *Leibnizian cosmological arguments*: Those arguments based on the Principle of Sufficient Reason and that do not involve an infinite regress.
2. *Thomistic cosmological arguments*: Those arguments that deny an infinite essentially ordered regress.
3. Kalām *cosmological arguments*: Those arguments that deny an infinite temporal regress.

The *kalām* cosmological argument, then, is one of the versions of the cosmological argument. We may define, in more precise terms, the *kalām* cosmological argument as a type of cosmological argument that tries to prove three claims, namely, (i) that the universe came into existence, (ii) that the universe has a cause of or a sufficient explanation for its existence, and (iii) that this cause or sufficient explanation is, or is grounded in, a transcendent personal being (or God). However, since the significant theistic doctrine of *creatio ex nihilo* (creation out of nothing) states

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_1

that God brought the universe into existence out of nothing (or without the use or pre-existing materials), it is an affirmation of (i), (ii), and (iii). Thus, the *kalām* cosmological argument is essentially a philosophical argument in favour of *creatio ex nihilo*.

In light of the fact that there are various ways in which one may attempt to defend (i), (ii) and (iii), there are various versions of the *kalām* cosmological argument. Hence, as with 'cosmological argument', the phrase '*kalām* cosmological argument' may be used either in the plural form to refer to the family of theistic arguments that follow the pattern of arguing in favour of (i), (ii) and (iii), or in singular form to refer specifically to one of these arguments. Indeed, İsamail Latif Hacınebioğlu (2008:189) suggests that the phrase '*kalāmian* cosmological arguments' be used as the plural form in light of the argument's diversity. Nevertheless, in order to avoid confusion, I will follow convention and use 'the *kalām* cosmological argument' in both the plural and singular forms.

How did the name '*kalām* cosmological argument' originate? The Arabic term *kalām* literally means 'speech,' 'word' or 'talk' (Haleem 1996:71). The term was used in Muslim thought to refer to theological discussions, and it was later used to represent the movement in mediaeval Islamic theology that attempted to clarify and defend the core doctrines of Islam in a rational way. A practitioner of *kalām* is known as a *mutakallim* (plural: *mutakallimūn*). The *mutakallimūn*, as James Pavlin (1996:105) notes, 'believe that the verses of the Qur'ān related to God's Attributes need to be interpreted through argument based on logical proofs.'[1]

Thus, *kalām* or *'ilm al-kalām* (the science of *kalām*) may be translated as 'scholastic theology.' Now, although the infinity arguments of the *kalām* cosmological argument originated in the Judaeo-Christian tradition through John Philoponus (AD *c*. 490–*c*. 570) prior to the mediaeval Arabic *kalām* movement, the argument was developed and vigorously defended by mediaeval *mutakallimūn*. In light of this fact, R. L. Sturch (1970:59–83) and William Lane Craig (1979) conveniently use the term '*kalām*' to distinguish the argument from the other types of cosmological argument. As Craig notes, 'In light of the central role played by this form of the cosmological argument in medieval Islamic theology, as well as the substantive contribution to its development by its medieval Muslim proponents, we use the word "*kalām*" to denominate this version of the argument' (in Craig and Sinclair 2012:101). Since then, this name has been used.

Following Craig, most contemporary scholars represent the *kalām* cosmological argument as the following syllogism:

1. Everything that begins to exist has a cause of its existence.
2. The universe began to exist.
3. Therefore, the universe has a cause of its existence.

[1]Hence, Ibn Khaldūn's (1332–1406) well-known definition of *kalām*, namely, 'the science that involves arguing with rational proofs in defence of the articles of faith and refuting innovators who deviate from the beliefs of early Muslims and Muslim orthodoxy' (Ibn Khaldūn cited by Haleem 1996:75).

Once the argument's conclusion has been reached, its proponents attempt to show that the cause of the universe possesses various divine properties such as being transcendent, personal, beginningless, spaceless, immaterial, changeless and extremely powerful. However, since the *kalām* cosmological argument is an argument for God's existence, I find it appropriate to introduce God into its premises and represent the argument as follows:

1. The universe came into existence.
2. If the universe came into existence, then God brought it into existence.
3. Therefore, God brought the universe into existence.

Nevertheless, regardless of how one represents the argument, the essential feature of the argument is that it attempts to show that God brought the universe into being some finite time ago. Having said that, let me now say something about the purpose of this book.

1.2 Purpose of the Book and Outline of the Chapters

The purpose of this work is twofold: first, to offer a fresh look at the historical background of the *kalām* cosmological argument and, second, to offer a modern and creative defence of the argument. Perhaps the finest discussions on the history of the argument include Harry Austryn Wolfson's (1976:355–465) exposition of *kalām* arguments for the creation of the world, William Lane Craig's (2001) thorough analysis of the cosmological argument from Plato to Leibniz, Richard Sorabji's (2006) study of time and creation in antiquity, and Herbert A. Davidson's (1987) excellent survey of the arguments in favour of creation in mediaeval Islamic and Jewish philosophy. However, the survey of the *kalām* cosmological argument presented in this work is unique in five ways.

First, unlike the other works mentioned above, this work includes, in Chap. 2, an evaluation of the *theological* background of the argument. This is accomplished by, first, taking on the difficult task of assessing whether the Bible affirms or implies *creatio ex nihilo* and, second, surveying some of the most important ancient Jewish and Christian thinkers who affirm *creatio ex nihilo*. Consequently, this book is not intended for the historian and the philosopher of religion only, but also for the theologian interested in the doctrine of *creatio ex nihilo*. Second, Chap. 3 draws on the recent English translation of Philoponus' *Against Proclus on the Eternity of the World 1–5* (2014) in order to provide a detailed, analytical, and unique exposition of Philoponus' infinity arguments in favour of a beginning of time. Third, the works mentioned above focus on al-Ghazālī's *The Incoherence of the Philosophers* (1095), whereas Chap. 4 in this work concentrates primarily on the recent English translation of al-Ghazālī's *Moderation in Belief* (2013) (the *Moderation* was originally published in about 1095) in order to offer a comprehensive account of his cosmological argument. Fourth, Chap. 5 contains a discussion of the rise of set theory and modern cosmology, a topic that is usually overlooked or discussed

too briefly in works dealing with the history of the *kalām* cosmological argument. Finally, Chap. 6 concludes the historical survey with a modern version of the argument that is defended by William Lane Craig.

As regards the second aspect of the purpose of this work, the work attempts to assess and defend the *kalām* cosmological argument from a unique perspective. The *kalām* cosmological argument is based on philosophical arguments against the possibility of an infinite past (i.e., an infinite temporal regress of events). One such argument is the philosophical argument in favour of the impossibility of an actual infinite. Let us refer to this argument as 'the Infinity Argument'. An *actual infinite* is a completed totality comprising infinitely many distinct elements and is, thus, an endless collection whose elements, nevertheless, *exist all at once*. Therefore, according to the Infinity Argument, if the universe is eternal and had no beginning, an actually infinite number of past events (such as years) have occurred. However, the existence of an actually infinite number of things (such as events) is impossible. Therefore, the series of past events must be finite and must have had a beginning. It follows then that the universe came into existence.

The Infinity Argument is, perhaps, the most common argument that is used by advocates of the *kalām* cosmological argument. Important contemporary defenders of the argument include William Lane Craig (1979, 2008, 2012, 2013), Mark R. Nowacki (2007), and J. P. Moreland (2003). Each of these thinkers has championed the argument against the actual infinite to defend the view that the universe began to exist. It is, thus, not surprising that the *kalām* cosmological argument is sometimes identified as the cosmological argument that contends that "it is *impossible* for an *actual infinite* to exist" (Rowe 2007:33 [original emphasis]).

Now, before offering a modern defence of the *kalām* cosmological argument, the work, in Chap. 7, investigates whether the Infinity Argument is a good argument in support of theism. However, the chapter shows that the Infinity Argument is inconclusive and is not a good argument in support of theism for three reasons. First, the argument is incompatible with Platonism (the view that abstract objects exist). Consequently, the Infinity Argument will not convince those Platonists who believe that they have sound arguments in favour of Platonism, and, if the Infinity Argument is to succeed, its proponents must take on the difficult task of arguing against Platonism. Second, the Infinity Argument is incompatible with the standard definition of omniscience and this, in turn, implies that the proponents of the Infinity Argument should (creatively) redefine omniscience and this could be theologically undesirable. Finally, the argument relies on an apparent metaphysical intuition about the actual infinite that is both obscure and controversial. The chapter concludes that, regardless of whether the Infinity Argument is sound, the proponents of the *kalām* cosmological argument would profit from replacing the Infinity Argument with an argument that does not deny the possibility of any actual infinite whatsoever but simply denies the possibility of infinite past time.

Chapter 8, then, defends three arguments in support of the beginning of the universe that do not deny the existence of the actual infinite, namely, the argument

based on traversing infinite time, the argument based on ungrounded causal chains, and the argument based on the paradoxes of beginningless time. In order to defend these three arguments, the chapter analyses what it means for the universe to come into existence.

When it comes to science and the beginning of the universe, most cosmologists who believe that the universe is, or may be, eternal justify their belief by the fact that it is possible to conceivably construct an eternal cosmological model, which is a cosmological model that includes or entails an eternal universe. However, could an eternal cosmological model, by itself, justify belief in the possibility of an eternal universe? Chapter 9 argues that the answer to this question is 'no'. The chapter shows, first, that if one does not engage with the philosophical arguments for a beginning of the universe, and if one does not include in the pool of explanatory options the hypothesis of an absolute beginning when evaluating which hypothesis best explains the discoveries of modern cosmology, then one's belief in the possibility of an eternal universe cannot be justified solely by the fact that there exist several eternal cosmological models. The chapter argues, second, that even if an eternal cosmological model may justify this belief, no such model is currently successful, since the hypothesis that *the universe had a beginning* is at present the best explanation of the discoveries of cosmology.

Finally, Chap. 10 defends the premise that *if the universe came into existence, then God brought it into existence*. In defence of this premise, the chapter refers to a version of the Principle of Sufficient Reason (PSR) that states that every contingent concrete object that exists has a sufficient explanation in an external state of affairs of why it exists. It is shown, first, that we have a strong intuition about the PSR, second, that we have no evidence that the PSR is false and, third, that the denial of the PSR is inconsistent with atheism. It is then argued that, even if the PSR were false, the incredible fine-tuning of the universe renders it highly unlikely that the universe lacks a sufficient explanation. Finally, by way of a conceptual analysis of what an explanation of the universe involves, the chapter concludes that it must be God who brought the universe into being.

1.3 Why Study the *Kalām* Cosmological Argument?

I have assumed thus far that the *kalām* cosmological argument is worthy of serious academic reflection and improvement. One may wonder, however, whether this assumption is true (or at least justified)? Does the argument offer any value for theists? Is it sensible for philosophers of religion, theists and non-theists alike, to pay serious attention to the argument, such as happens in this work? Several scholars do not think so for they perceive theistic arguments, such as the *kalām* cosmological argument, as unimportant or unable to be successful. Roy Clouser, for example, argues that it is not possible for created laws to demonstrate a transcendent Creator. Clouser declares,

> Whatever can be proven using the laws of proof—whether mathematical or logical—is not the creator of the laws of proof by whom they were brought into existence. So without realizing it, the thinkers who tried to prove God's existence . . . unintentionally demoted him to what is in fact a creaturely level of existence. And this is why I say that whatever can be proven would thereby not be God (Clouser 2009b:3).

Clouser sympathises with Herman Dooyeweerd (1894–1977), for elsewhere Clouser explains 'Dooyeweerd also rejected every attempt to prove God's existence, holding instead that "Whatever can be proven would thereby not be God." The reason is that since the being of God is the creative origin of everything including the laws of proof, it is not subject to those laws. Thus attempts to prove his existence inadvertently demote him to the status of a creature by subjecting him to the laws of creation rather than maintaining him as the divine origin of all laws' (Clouser 2009a:5, note 4). Clouser, as I understand him, is claiming that arguments in favour of the existence of God reduce God to a created being, since these arguments assume that God depends on the laws of logic because God exists only if His existence is logical. However, because God transcends reality—He is the creator of all things—*created* laws of logic cannot be used to demonstrate God's existence. Theistic arguments, therefore, end up 'proving' a non-transcendent being that is certainly not God. In other words, it is not possible for created laws to prove a transcendent Creator.

There are two reasons, I believe, why Clouser's objection is unsuccessful. First, setting aside Clouser's assumption that the laws of logic are created as opposed to being grounded in the being of God, Clouser assumes that God designed the 'laws of proof' in such a way that they cannot establish either His nature or His existence. But why think this? Surely an all-powerful and all-loving God can, and, perhaps would even desire to, make His existence knowable through logic. In fact, in Romans 1:19–21, Paul teaches that God's existence may be known through creation. Paul does not exclude logic from 'creation'. Moreover, many theistic arguments, if successful, *do* establish God's transcendence, necessary existence, moral perfection, incorporeality, ultimate wisdom and self-revelation in Christ. Therefore, it seems somewhat more plausible that God created the laws of logic in such a way that logical arguments do not demote God to the status of creature but support the doctrine that God is the only non-dependent reality.

Second, Clouser's objection is self-referentially incoherent. Clouser's argument, in essence, is that we cannot use created laws to prove God's existence for God is not subject to these laws. He explains further: 'Since God is the creator of all the laws of creation there is no hope of our using any of them to construct an account of His uncreated being by doing rationalistic metaphysics or theology' (Clouser 2005:231). According to Clouser's argument, we cannot use the laws of logic to prove any part of God's nature, for all of God's nature, such as His goodness, is not subject to created laws. Thus, Clouser's argument may be written in the *modus ponens* form as follows:

1. If God created the laws of logic, then God's nature cannot be demonstrated using these laws.

2. God created the laws of logic.
3. Therefore, God's nature cannot be demonstrated using the laws of logic.[2]

However, this argument is clearly self-refuting for it attempts to use the laws of logic to demonstrate that God's nature cannot be demonstrated using the laws of logic. Thus, since this argument is a logical argument it should, according to itself, be rejected! Clouser's objection reminds me of the common claim that: 'We can know nothing about the transcendent God' but this, in itself, is a knowledge claim about the transcendent God.

Another common objection to theistic arguments is that, even if successful, these arguments do not conclude to a god who possesses all the properties ascribed to a particular God and, thus, theistic arguments fail to *prove* God. This point is succinctly made by David Hume, the eminent Scottish philosopher, in part 5 of *Dialogues Concerning Natural Religion* (1779). Hume's fictional characters, Philo and Cleanthes, discuss the design argument with Philo declaring to Cleanthes that the design argument fails to show that the cause of the universe is divine, perfect, a singular cause, or still alive. Thus, according to Philo, the design argument leads one to an inadequate theology:

> In a word, Cleanthes, a man, who follows your [design] hypothesis, is able, perhaps, to assert, or conjecture, that the universe, sometime, arose from something like design: but beyond that position he cannot ascertain one single circumstance; and is left afterwards to fix every point of his theology by the utmost license of fancy and hypothesis. . . . I cannot, for my part, think, that so wild and unsettled a system of theology is, in any respect, preferable to none at all (Hume 1824:46).

According to Philo (or Hume), a theistic argument that fails to prove God, or fails to support a theist's theology, has no value for the theist as the perverted theology of such a theistic argument is no better than atheism. This unpleasant conclusion leaves one wondering about the significance, if any, of any theistic argument, such as the *kalām* cosmological argument.

Richard Dawkins, who is perhaps the most popular evangelist for atheism, attacks cosmological arguments on similar grounds. While discussing Aquinas' cosmological argument, Dawkins protests:

> Even if we allow the dubious luxury of arbitrarily conjuring up a terminator to an infinite regress and giving it a name, simply because we need one, there is absolutely no reason to endow that terminator with any of the properties normally ascribed to God: omnipotence, omniscience, goodness, creativity of design, to say nothing of such human attributes as listening to prayers, forgiving sins and reading innermost thoughts . . . [I]t is more parsimonious to conjure up, say, a 'big bang singularity', or some other physical concept as yet unknown. Calling it God is at best unhelpful and at worst perniciously misleading (Dawkins 2006:77–78).

[2] If Clouser wishes to argue that God's existence *only* cannot be established through created laws, then he needs to support this assertion with an argument that does not refer to the fact that any part of God's nature cannot be established through created laws.

Dawkins dismisses cosmological arguments because they conclude to a cause which lacks 'any of the properties normally ascribed to God.' His choice of words, for example, 'dubious,' 'unhelpful' and 'perniciously misleading', expose his distaste for cosmological arguments. It is, thus, fair to conclude that Dawkins deems cosmological arguments, such as the *kalām* cosmological argument, to be unimportant.

Similarly, Millard J. Erickson, a Christian theologian, is of the opinion that natural theology[3] faces serious problems. 'Even if the arguments [of natural theology] succeed in proving the existence of a divine being,' writes Erickson, 'there is still a problem if this is to be considered a proof for the Christian God. For this is a bare theism. Further argumentation is needed to establish that this is the Christian God, with the attributes that are unique to him' (Erickson 2013:135). Although Erickson does not state that theistic arguments are unimportant, he describes theistic arguments as demonstrating obvious 'shortcomings,' 'difficulties' and 'problems' (Erickson 2013:134–135). According to Erickson (2013:137), the conclusion that theistic arguments 'cannot be used to construct a natural theology … seems to fit best all the data of Scripture on the subject.' Taken at face value, Erickson's statements suggest that, because theistic arguments do not conclude to the Christian God, they are insignificant.

The criticisms of Hume, Dawkins and Erickson may apply to the *kalām* cosmological argument as it fails to prove a particular theistic faith.[4] However, the Hume-Dawkins-Erickson objection fails to appreciate cumulative case arguments for God's existence.[5] The objection assumes that, because each individual theistic argument cannot conclude to a being possessing the core properties ascribed to God, it is not possible for a group of such arguments *together* to conclude to such a being. However, this is fallacious because a few successful arguments presented as a cumulative case for God's existence may conclude to a particular theistic God. For example, if the ontological argument, cosmological argument, moral argument and argument for Jesus' resurrection are valid, together they may conclude to a being who is self-existent, spaceless, timeless (at least without creation), beginningless, immaterial and personal, who has maximal power, knowledge and goodness and also who has revealed himself in Jesus of Nazareth. However, this

[3]Natural theology may be defined as the attempt to provide rational, philosophical arguments that (i) rely on theologically neutral premises, and (ii) support the existence and nature of God.

[4]This criticism applies to the majority of theistic arguments. For example, if successful, the moral argument establishes only a being in which goodness is grounded, the fine-tuning argument merely demonstrates a cosmic designer, and the ontological argument fails to evince the Christian God.

[5]A cumulative case involves the use of various individual arguments in combination to support a specific conclusion, with each individual argument increasing the probability of the conclusion. This is a legitimate method for obtaining truth and, as Paul Draper notes, 'the vast majority of well-supported theories in both science and everyday life are established by cumulative cases, not by a single argument or a single piece of evidence' (Draper 2010:414). For example, a homicide detective uses various bits of evidence to find out who murdered the victim. Similarly, many scientists believe that black holes exist because of various pieces of evidence, such as the observations of hot glowing gas and rapidly moving stars.

being is the Christian God. Accordingly, the *kalām* cosmological argument may play an important role in a cumulative case argument in favour of a *particular* theistic faith, such as Christianity.

Moreover, even if one concedes, for the sake of argument, that the *kalām* cosmological argument cannot be used to prove any individual faith, the argument still remains an important and valuable argument that merits attention. There are at least four reasons for this, namely, (1) the argument promotes interfaith dialogue, (2) it promotes interdisciplinary dialogue, (3) it sheds light on the divine attributes, and (4) it addresses one of life's most important questions. Let us briefly discuss these four reasons.

(1) *The* kalām *cosmological argument promotes interfaith dialogue*. The Abrahamic faiths often display hostility towards one another. However, if Jews, Christians, and Muslims were to share a theistic argument that they regarded as worth studying, this would promote interfaith dialogue and it may even lessen the hostility between the Abrahamic faiths. The *kalām* cosmological argument is such a shared theistic argument because the 'First Cause' of the argument may be associated with Judaism, Christianity, or Islam. Similarly, the doctrine of *creatio ex nihilo* is shared by these three faiths. Thus, the *kalām* cosmological argument is important because it unites the Abrahamic faiths in studying and defending a common belief and a shared theistic argument, thereby encouraging interfaith dialogue.

(2) *The* kalām *cosmological argument promotes interdisciplinary dialogue*. Prior to Einstein's *General Theory of Relativity* (GR) that he formulated in 1915, the origin of the universe was a topic that was left to the philosophers. However, GR enabled scientists to develop acceptable models of the cosmos and, today, cosmology is a flourishing science. Thus, proponents of the *kalām* cosmological argument may no longer discuss the origin of the universe in a responsible way without referring to modern cosmology. Likewise, scientists should not neglect the philosophical arguments for and against an eternal universe.

Unfortunately, many scientists are not in favour of philosophy. Joseph Silk notes that, according to most physicists, 'the ultimate questions about the origin of the universe must be answerable by physics rather than by philosophy' (Silk 2001:5). Similarly, Stephen Hawking and Leonard Mlodinow (2010:13) declare, 'Traditionally these [questions about the origin of the universe] are questions for philosophy, but philosophy is dead. Philosophy has not kept up with modern developments in science, particularly physics. Scientists have become the bearers of the torch of discovery in our quest for knowledge.' It is ironic that these assertions are, in themselves, *philosophical* and that these scientists have failed to offer any good reason *why* philosophy is not able to contribute to the debate on the origin of the universe.

Nevertheless, several scientists do recognise the relationship between philosophy and cosmology. For example, the prominent physicists, George F. R. Ellis, Roy Maartens, and Malcolm A. H. MacCallum (2012:554) admit that 'when one probes the far reaches of cosmology, one inevitably starts to engage with philosophical issues.' Noting that one such issue concerns the existence of an actual infinite, they remark, 'One of the reasons that we study cosmology is our fascination with its philosophical aspects; and one that recurs is the idea of infinity in cosmology' (Ellis

et al. 2012:553). Likewise, W. R. Stoeger, Ellis, and U. Kirchner (Stoeger et al. 2008) evaluate the multiverse from a *philosophical* viewpoint. Using the same philosophical arguments against the existence of an actual infinite that the proponents of the *kalām* cosmological argument use, Stoeger et al. (2008:14–17) argue 'that a really infinite set of physical objects is not realisable or actualizable' (Stoeger et al. 2008:17) and, thus, a multiverse comprising an actually infinite number of universes cannot exist. This reveals that philosophy, especially the philosophical aspects of the *kalām* cosmological argument, holds significant relevance for modern cosmology. Accordingly, the *kalām* cosmological argument is valuable because it promotes dialogue between philosophers and scientists, whether they are theists or non-theists.

(3) *The* kalām *cosmological argument sheds light on the divine attributes*. An important task of the philosophy of religion involves analysing the concept and nature of God. This task includes formulating coherent definitions of the divine attributes, such as omnipotence, omniscience, omnipresence, omnibenevolence, transcendence, and eternality. The *kalām* cosmological argument requires us to explore these attributes. For example, the argument leads us to consider God's relationship to time (If God created time, is He timeless?), God's omniscience (If an actual infinite cannot exist, how should we understand God's infinite knowledge?), God's omnipotence (Does creating the universe require omnipotence?), and God's transcendence (If God created the universe, is He completely transcendent?). These topics are all relevant to both philosophers and theologians and, thus, the *kalām* cosmological argument is important because of its contribution to the discussion on these crucial topics.

(4) *The* kalām *cosmological argument addresses one of life's most important questions*. I am convinced that the question of God's existence is one of the most important questions one may ask. What we believe about the existence of God has far-reaching effects on the way in which we live our lives. For example, a person who believes that God does not exist may live without any sense of obligation to serve any 'god'. Such a person would not derive their moral obligations from Holy Scripture, but from elsewhere, perhaps from science, or they might have no moral obligations at all. On the other hand, a person who believes that God does exist may believe he or she has the opportunity to learn to know this unimaginably powerful God through a personal relationship and, thus, such a person may seek this relationship in his or her life. Such a person may, moreover, subscribe to the ethical conduct revealed in Scripture. More importantly, however, the existence of God affects our view of eternity, that is, our view of the afterlife, for example, whether or not heaven and hell exist. Accordingly, reflecting on God's existence is of the utmost importance and the *kalām* cosmological argument may help theists and non-theists alike in their journey of contemplating the divine.

Therefore, the *kalām* cosmological argument is an important and valuable argument that is worthy of serious academic reflection. Scholars may no longer dismiss the argument as insignificant on the grounds that, even if the argument is successful, it does not prove a particular God. In the following chapter we will begin our journey by looking at the doctrine of *creatio ex nihilo*.

References

al-Ghazālī. (2013). *Al-Ghazālī's Moderation in belief: al-Iqtiṣād fī al-i'tiqād*. Chicago: The University of Chicago Press.

Clouser, R. A. (2005). *The myth of religious neutrality: An essay on the hidden role of religious belief in theories* (Revised ed.). Notre Dame: University of Notre Dame Press.

Clouser, R. A. (2009a). A brief sketch of the philosophy of Herman Dooyeweerd. *Axiomathes, 20*(1), 3–17.

Clouser, R. A. (2009b). Can we know God is real? http://www.allofliferedeemed.co.uk/Clouser/CanWeKnow.pdf. Accessed 06 July 2013.

Craig, W. L. (1979). *The kalām cosmological argument*. London: Macmillan.

Craig, W. L. (2001). *The cosmological argument from Plato to Leibniz*. Eugene: Wipf and Stock Publishers.

Craig, W. L. (2008). *Reasonable faith: Christian truth and apologetics* (3rd ed.). Wheaton: Crossway Books.

Craig, W. L. (2013). The kalam argument. In J. P. Moreland, C. Meister, & K. A. Sweis (Eds.), *Debating Christian theism* (pp. 7–19). Oxford: Oxford University Press.

Craig, W. L., & Sinclair, J. D. (2012). The Kalam cosmological argument. In W. L. Craig, & J. P. Moreland (Eds.), *The Blackwell companion to natural theology* (pp. 101–201). Oxford: Wiley-Blackwell.

Davidson, H. A. (1987). *Proofs for eternity, creation, and the existence of God in medieval Islamic and Jewish philosophy*. New York: Oxford University Press.

Dawkins, R. (2006). *The God delusion*. London: Bantam Press.

Draper, P. (2010). Cumulative cases. In C. Taliaferro, P. Draper, & P. L. Quinn (Eds.), *A companion to philosophy of religion* (pp. 414–424, 2nd ed.). Malden: Wiley-Blackwell.

Ellis, G. F. R., Maartens, R., & MacCallum, M. A. H. (2012). *Relativistic cosmology*. Cambridge: Cambridge University Press.

Erickson, M. J. (2013). *Christian theology* (3rd ed.). Grand Rapids: Baker Academic.

Hacınebioğlu, I. L. (2008). *Does God exist? Logical foundations of the cosmological argument*. Istanbul: Insan.

Haleem, M. A. (1996). Early *kalām*. In S. H. Nasr, & O. Leaman (Eds.), *History of Islamic philosophy* (pp. 71–88). London: Routledge.

Hawking, S., & Mlodinow, L. (2010). *The grand design*. London: Bantam Books.

Hume, D. (1824). *The philosophical works of David Hume*. London: G. Fenton.

Moreland, J. P. (2003). A response to a Platonistic and to a set-theoretic objection to the kalam cosmological argument. *Religious Studies, 39*, 373–390.

Nowacki, M. R. (2007). *The kalam cosmological argument for God*. Amherst/New York: Prometheus Books.

Pavlin, J. (1996). Sunni *kalām* and theological controversies. In S. H. Nasr, & O. Leaman (Eds.), *History of Islamic philosophy* (pp. 105–118). London: Routledge.

Philoponus (2014). *Against Proclus on the eternity of the world 1–5*. London: Bloomsbury.

Rowe, W. L. (2007). *Philosophy of religion: An introduction* (4th ed.). Belmont: Wadsworth.

Silk, J. (2001). *The big bang* (3rd ed.). New York: W.H. Freeman and Company.

Sorabji, R. (2006). *Time, creation, and the continuum: Theories in antiquity and the early middle ages*. Chicago: University of Chicago Press.

Stoeger, W. R., Ellis, G. F. R., & Kirchner, U. (2008). Multiverses and cosmology: Philosophical issues. http://arxiv.org/abs/astro-ph/0407329v2. Accessed 31 Dec 2014.

Sturch, R. L. (1970). *The cosmological argument*. Ph.D., University of Oxford.

Wolfson, H. A. (1976). *The philosophy of the kalam*. Cambridge: Harvard University.

Part I
Historical Background of the *Kalām* Cosmological Argument

Chapter 2
The Doctrine of *Creatio ex Nihilo*

2.1 Introduction

The *kalām* cosmological argument endeavours to show that the universe began to exist. However, the ancients were divided on whether the universe had a beginning. This issue was passionately debated in antiquity for it signified a fundamental difference between most Greek philosophers and most thinkers within the Judaeo-Christian tradition (see Dales 1982:495; Sorabji 2006:193).[1] On the one hand, most of the Greek philosophers denied that the material universe had a beginning while most of the thinkers in the Judaeo-Christian and Islamic traditions asserted that the universe had an absolute beginning at creation.

A central issue in the creation debate, and which the ancients rigorously discussed, is the notion of *creatio ex nihilo* (creation out of nothing). This notion has become an important theistic doctrine and states, broadly, that God brought all things into existence without pre-existing materials. Millard J. Erickson clarifies the doctrine as follows:

> The expression *ex nihilo* or 'out of nothing' has sometimes given rise to misunderstanding. 'Nothing' has come to be regarded by some thinkers as virtually a something out of which everything has been made, a kind of substance. ... When we speak of creation out of nothing, however, we are not thinking of nothing as a something out of which everything was made. Nothing, rather, is the absence of reality. Thus, the expression 'without the use of preexisting materials' is preferable (Erickson 2013:342).

[1] Michael Chase (2013:40–41) maintains that the debate of the eternity of the world goes back to at least the pre-Socratic thinkers in the sixth-century BC, such as Pherecydes of Syros and the Orphics, and that '[t]hese sixth-century thinkers, in turn, may well have been inspired by Oriental myths that were very ancient indeed.'

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_2

The doctrine of *creatio ex nihilo* (I shall hereafter omit 'the doctrine of') is, therefore, in stark contrast to the notion of *creatio ex materia* (creation out of matter)—the view that God formed the universe out of pre-existing, eternal matter.

Is it possible to be more precise about what *creatio ex nihilo* is, exactly?[2] According to the *Evangelical Dictionary of Theology*, *creatio ex nihilo* 'means God brought the world into existence "out of nothing" through a purposeful act of his free will. In this the Christian doctrine confesses God as the almighty and sovereign Lord of all existence. . . . The creative act of God sets God apart from all that is created' (Elwell 2001:304). Similarly, Erickson declares that *creatio ex nihilo* signifies 'that the whole of what now exists was begun by God's act of bringing it into existence—he did not fashion and adapt something that already existed independently of him' (Erickson 2013:340). According to Mark Harris (2013:111–112), *creatio ex nihilo* states (1) that time had a beginning, (2) that God made the world literally from nothing, and (3) that God is completely transcendent. Likewise, Paul Copan and William Lane Craig define *creatio ex nihilo* as follows:

> [W]hen we describe what creation out of nothing means, we affirm that without God's initiating creation, only God exists. Upon creation, we have a universe because God willed it into finite, temporal being. Thus, creation out of nothing affirms that the universe is contingent on God, not just in having its (continued) existence in being (ontological dependence) but also in having its temporal origination from nothing preexistent, but simply by the will and word of God (*ex nihilo*) (Copan and Craig 2004:15).

For Gerhard May, however, the doctrine 'specifies God's omnipotence as its sole ground' and is connected to the notion of God's 'unconditioned freedom' (May 2004:xi). Similarly, Stephen M. Barr (2006:257–267), William R. Stoeger (2010:172), and Rodney Holder (2013:73) understand *creatio ex nihilo* simply as the view that, ontologically, the universe depends on God, regardless of whether the universe is eternal or had a temporal beginning. As Holder (2013:73) remarks, 'The main lesson to draw from the doctrine of creation out of nothing is that the universe is totally dependent on God for its existence moment by moment, continuously. . . . Creation is not confined to, or even necessarily dependent on, a first moment'. Thus, we have the following two different views of divine creation:

(A1) God brought the universe into existence some finite time ago without the use of pre-existing materials.
(A2) The universe depends ontologically on God for its existence, regardless of whether it had a temporal beginning.

For the sake of simplicity, let '*creatio ex nihilo*' mean (A1), which is the term's common usage, and let '*creatio ontologia*' mean (A2). Importantly, *creatio ex nihilo* entails *creatio ontologia* because a universe created by God also depends

[2]The doctrine of *creatio ex nihilo* is often divided into two categories: *creatio originans* (originating creation) and *creatio continuans* (continuing creation). The former concerns God's initial act of bringing the universe into existence, while the latter concerns God's continuous conservation of the universe in existence. Unless otherwise indicated, I shall hereafter use the term *creatio ex nihilo* in the former sense.

ontologically on God, but *creatio ontologia* does not entail *creatio ex nihilo* because, as Thomas Aquinas (*Summa Theologica* 1a.44.1; 1a.46.1) notes, a beginningless universe may be dependent on God. Now, since the *kalām* cosmological argument is an argument in favour of *creatio ex nihilo* and not merely in favour of *creatio ontologia*, what is the theological background of the argument? In this chapter I will address this question by, first, evaluating whether there is any Scriptural support for *creatio ex nihilo* and, second, evaluating whether many influential Jewish and Christian thinkers affirmed *creatio ex nihilo*. My hope is that this chapter will inform the reader about the theological background of the *kalām* cosmological argument before we examine the philosophical aspects of the argument in the subsequent chapters. Let us begin, then, by discussing the (surprisingly controversial) topic of whether the biblical writers believed in *creatio ex nihilo*.

2.2 Biblical Support for *Creatio ex Nihilo*

In his influential book, *creatio ex nihilo* (2004), Gerhard May argues that the doctrine of *creatio ex nihilo* was not inherited by Christianity from Hellenistic-Jewish theology because *creatio ex nihilo*, as a theory, is neither found in Scripture nor in early Jewish theology. According to May, the doctrine arose only in the second century CE as a response to the Greek and Gnostic notion that the world was formed out of eternal matter. Although May admits that creation *ex nihilo* 'corresponds factually with the Old Testament proclamation about creation' (May 2004:xi), his argument gives the impression that the doctrine of *creatio ex nihilo* has no scriptural support.

Following May, many scholars argue that neither the Old Testament (OT) nor the New Testament (NT) uphold *creatio ex nihilo*. For example, Willem B. Drees (1990:33–40; 254–267) and Alister E. McGrath (2001:159–166) maintain that the Bible may be interpreted to mean that, although the universe depends ontologically on God, it is eternal and had no temporal beginning. Likewise, Harry Austryn Wolfson declares,

> A conception of creation expressed explicitly in terms which mean creation *ex nihilo* is not to be found either in the Jewish or in the Christian or in the Muslim Scripture (Wolfson 1976:355).

Eric Osborn (2001:65–67), however, accuses May (and others who argue like May) of failing to distinguish between *words* and *concepts*. Osborn rightly observes that the concept of *creatio ex nihilo* may be found without the words 'creation out of nothing,' and vice versa. Osborn's point, I believe, is decisive. The concept of creation out of nothing is apparent in the Jewish and Christian scriptures, despite the fact that they do not use the phrase 'out of nothing'. It will be helpful, then, to say something more about the distinction between *words* and *concepts* before we examine these scriptures.

2.2.1 Words, Concepts, and Creatio ex Nihilo

The same concept may be expressed using various statements and words. The obvious example of this is when the same concept is expressed in different languages. For example, the two statements 'Grass is green' and 'Das Gras ist grün' (in German) express the same concept but use different words. A concept may also be expressed in different ways within the same language. Whether one remarks 'I am hungry' or remarks 'I am feeling uncomfortable from want of food', one is expressing the same concept, albeit through different words. This principle applies to Scripture because the same theological concept may be expressed in various ways. Consider, for example, the doctrine of the Trinity. Most biblical scholars agree that the Bible teaches the concept of the Trinity, even though phrases such as 'the Trinity' or 'God is a Trinity' are absent from the Bible.

This means that one must exercise caution when investigating whether the concept of *creatio ex nihilo* is found in Scripture. If one fails to distinguish between *words* and *concepts*, one could conclude either (i) that *creatio ex nihilo* is unscriptural because the phrase 'creation out of nothing' is absent from Scripture, or (ii) that the scriptural passages that contain a phrase similar to 'creation out of nothing' offer the *strongest* support for *creatio ex nihilo*. Unfortunately, this mistake is all too common. As stated above, many scholars argue that, because the Bible does not explicitly state that God created the universe 'out of nothing', the Bible does not support *creatio ex nihilo*. On the other hand, many scholars claim that 2 Maccabees 7:28[3] offers the strongest support for *creatio ex nihilo* simply because this verse uses the phrase 'from nothing' or 'not from things existent' to describe God's creative act.[4] However, as we shall see below, the strongest scriptural support for the *concept* of creation out of nothing is not found in 2 Maccabees but in other passages that do not use the phrase 'out of nothing'.

Thus, if *creatio ex nihilo* may be expressed in various ways, what are some of these ways? Which sentences or terms may be used to convey the concept of *creatio ex nihilo*? One obvious expression of this doctrine is found in the following statement:

(B1) God created the universe out of nothing, that is, without the use of pre-existing materials.

[3] 2 Maccabees 7:28 states, 'I beg you, child, to look at heaven and earth. See everything that is in them and know that God made these things from nothing, and created humankind in the same way' (CEB).

[4] For example, according to Paul Gavrilyuk (2013:28), 'The statement that gives the strongest biblical backing to the doctrine of *creatio ex nihilo* appears in 2 Maccabees'. Similarly, Rodney Holder (2013:68) claims that 'the doctrine of creation out of nothing . . . is first found clearly in 2 Maccabees 7:28'.

When investigating the scriptural support for *creatio ex nihilo*, it is common for scholars to search Scripture for statements similar to (B1). However, the concept of *creatio ex nihilo* is also found in the following statement:

(B2) God created all things, that is, God created everything apart from Himself in time.

If (B2) is true, then (B1) must be true and, if (B1) is false, then (B2) must be false. Thus, (B2) implies (B1). The reason for this is that the proposition that *God created all things* implies, first, that everything depends on God for its existence, second, that matter had an absolute beginning because God created *all* matter, including any formless or primordial matter, third, that time had an absolute beginning because God created *all* time and *all* events, including any formless time, and, finally, that God transcends His creation because He is above all things.

Thus, if God created (in time) *all things*—which includes all physical reality—then, at some point, God must have brought the universe into existence out of nothing or without the use of pre-existing physical stuff. It seems, then, that (B2) is a valid expression of *creatio ex nihilo*. Indeed, (B2) expresses *creatio ex nihilo* better than does (B1) because the former emphasises the sweeping totality of God's creative act, while the latter focuses solely on the creation of the universe. Consequently, when evaluating whether Scripture supports *creatio ex nihilo*, the following important question should be addressed, namely: Does Scripture affirm that God created all things? As we shall see next, both the OT and NT affirm this and, thus, they support *creatio ex nihilo*.

2.2.2 Bārā'

The first step in examining the OT witness to *creatio ex nihilo* is to analyse the meaning of 'create' in the OT. The most important Hebrew term that means 'create' and that is relevant to our study is *bārā'*.[5] This term has been studied extensively. Most, if not all, of the scholars who study *bārā'* (from the perspective of *creatio ex nihilo*) focus primarily on the issue of whether the term may denote a creation out of nothing.[6] However, I believe that it is more important to evaluate whether *bārā'* means a creation *in time*, as opposed to a creation from eternity past or ontological dependence. As noted above, contemporary thinkers may use the phrase 'God created *x*' to mean two different things, namely, (A1) that God brought *x* into

[5] Another Hebrew term that refers to God's creative act is *qānâ* (or *qānâh*). However, unlike *bārā'*, *qānâ* is seldom used in the OT to mean 'create' or 'Creator.' The term is used three times to refer to God's creating something (Deuteronomy 32:6; Proverbs 8:22; Psalm 139:13) and twice to refer to God as Creator (Genesis 14:19, 22). Therefore, since *bārā'* is the more prominent term, I shall focus exclusively on its meaning in this section.

[6] For example, Copan and Craig (2004:49–59) spent a considerable amount of time arguing that *bārā'* in Genesis 1:1 implies *creatio ex nihilo*.

existence a finite time ago and, thus, *x* has a temporal beginning, or (A2) that *x* ontologically depends on God, regardless of whether it had a temporal beginning.

If the OT affirms that God 'created' all things in terms of (A2), then matter may be eternal because God may have created matter from eternity past. However, if 'created' in this context represents (A1), then the OT is affirming that the universe (including all matter) had an absolute beginning. So does *bārā'* denote a creation in terms of (A1) or in terms of (A2)? The answer, it seems, is that *bārā'* denotes the former, not the latter.

There are four different meanings of *bārā'*, namely, (1) to create, (2) Creator (a title for God), (3) to cut or cut down, and (4) to fatten (Mounce 2006:908). The term is used in the OT forty five times to mean 'to create',[7] and three times to mean 'Creator'.[8] *Bārā'* has the following three important features. First, *bārā'* is always used with God as the subject and is never used with the object of the material out of which God creates (Westermann 1994:98). Other entities, such as angels, humans, or matter, are never said to act with God in creating something. Thus, *bārā'* refers uniquely to God's activity.

Second, the verb *bārā'* is never used in an immediate context in which pre-existing materials are mentioned (Copan and Craig 2004:51–53). As John H. Walton (2009:42) correctly notes, 'It has long been observed that in the contexts of *bārā'* no materials for the creative act are ever mentioned, and an investigation of all the passages [that contain *bārā'*] substantiate that claim.' When the OT authors use the verb, they never state what God creates out of. This implies that *bārā'* may signify a creation either out of something or out of nothing.[9]

Finally, and most importantly, *bārā'* is always used to denote a new activity, that is, an activity in time and not merely ontological dependence. This is made evident by the fact that the object of *bārā'* (i.e., that which is created by God) is always a new thing, whether physical or non-physical, that was created at some moment (Mathews 1996:128). For example, according to the OT, God creates (*bārā'*) the following:

1. All living creatures (Genesis 1:21; 6:7; Psalm 104:30).
2. All humankind (Genesis 1:27; 5:1, 2; 6:7; Deuteronomy 4:32; Psalm 89:47; 102:18; Isaiah 43:1; 43:7; 45:12; 54:16; Ezekiel 28:13, 15; Malachi 2:10).
3. Marvels that have not yet been created (Exodus 34:10).

[7]Genesis 1:1, 21, 27 (x3); 2:3, 4; 5:1, 2 (x2); 6:7; Exodus 34:10; Numbers 16:30; Deuteronomy 4:32; Psalms 51:10; 89:12; 89:47; 102:18; 104:30; 148:5; Isaiah 4:5; 40:26; 41:20; 42:5; 43:1; 43:7; 45:7 (x2), 8, 12, 18 (x2); 48:7; 54:16 (x2); 57:18–19; 65:17; 65:18 (x2); Jeremiah 31:22; Ezekiel 21:30; 28:13, 15; Malachi 2:10; Amos 4:13.

[8]Ecclesiastes 12:1; Isaiah 40:28; 43:15.

[9]Even if *bārā'* were sometimes used in a context in which pre-existing materials are mentioned, this would not affect our conclusion that the verb may signify a creation out of nothing. For example, if we try to stretch the immediate context of Genesis 1:27 (which states that 'God created [*bārā'*] man in His own image') to include Genesis 2:7 (which says that 'the Lord God formed [*yāṣar*] the man of dust from the ground'), then, in light of all the other contexts of *bārā'*, this would still not prove that *bārā'* denotes creation in terms of (A2) and that *bārā'* cannot mean *creatio ex nihilo*.

4. New things that have not yet been created (Numbers 16:30; Isaiah 48:7).
5. A pure heart in a human (Psalm 51:10).
6. Vast areas of land (the north and the south) (Psalm 89:12).
7. Celestial or heavenly objects, such as the sun, moon, stars, heavens, and waters (Psalm 148:5; Isaiah 40:26).
8. Smoke and fire (Isaiah 4:5).
9. Darkness and disaster (Isaiah 45:7).
10. A renewed attitude of praise (Isaiah 57:18–19).
11. New heavens and a new earth (Isaiah 65:17).
12. A nation or a people, such as a new Jerusalem or the Ammonites (Isaiah 65:18; Ezekiel 21:30).
13. Rivers, springs, and plants (Isaiah 41:20).
14. Righteousness and salvation for God's people (Isaiah 45:8).
15. A new state of affairs, such as bringing it about that a woman can protect a man (Jeremiah 31:22).
16. The wind (Amos 4:13).
17. The heavens and the earth (Genesis 1:1; 2:4; Isaiah 42:5; Isaiah 45:12, 18).

Apart from *the heavens and the earth*, it is clear that all the other things created by God are not eternal but have an absolute beginning. Nevertheless, the phrase 'in the beginning' in Genesis 1:1 indicates a starting point of God's creative act and, thus, the phrase implies that even the heavens and the earth were created a finite time ago. As John H. Sailhamer writes, 'The term *beginning* in biblical Hebrew marks a starting point of a specific duration, as in "the beginning of the year" (Dt 11:12). …In opening the account of Creation with the phrase "in the beginning," the author [of Genesis] has marked Creation as the starting point of a period of time' (Sailhamer 1992:83).

Walton (2009:21–45) argues, however, that the ancient world, including the OT authors, used the term 'create' to mean *functional* creation and not *material* creation. In other words, whenever the OT authors claim that God created (*bārā'*) some object *x*, they do not mean that God made a material object but, rather, that God gave *x* a certain function or role for humankind or human society. How does Walton arrive at this unusual conclusion? After evaluating all the usages of *bārā'*, Walton (2009:41) remarks that 'no clear example occurs that demands a material perspective for the verb, though many are ambiguous'. Hence, according to Walton, *bārā'* cannot, in fact, support the notion of creation *ex nihilo*.

Unfortunately, the alleged ambiguous uses of *bārā'* weaken Walton's argument. In many of the passages in which a function of the created object is not mentioned, a material perspective for *bārā'* is the best interpretation. For example, how can the creation of land in Psalm 89:12, or the creation of the celestial objects in Isaiah 40:26, or the creation of the mountains and the wind in Amos 4:13, not imply the creation of physical objects when no function of these objects is mentioned? Moreover, several passages in Genesis that use terms other than *bārā'* for 'create' clearly imply material creation. For example, according to Genesis 1:11, God created vegetation and plants out of the earth, and according to Genesis 2:7, God

created mankind out of dust from the ground. Although these passages mention the material used in the creative act, they do not mention the function of the created objects. I thus sympathise with John Day (2013:4) when he writes:

> [A]lthough Walton is right to emphasize that there is a functional element in the narrative, he is certainly wrong to understand it wholly in such terms, and it is quite unnatural to deny that Genesis 1 gives us an account of the creation of the material universe. That is the only natural way of taking the text, as is shown by the fact that this is the way all other interpreters have read it over the past two thousand years.

Therefore, Walton's argument, I believe, cannot be taken seriously.

Furthermore, apart from *bārā'*, the OT authors had better lexical choices to express the idea that God has *eternally* sustained some object *x* in existence. For example, in order to express eternal ontological dependence, the OT authors may have simply stated '*x* has always been (*hāyâ*) because of God' instead of stating 'God created (*bārā'*) *x*'. It is significant, then, that the OT authors usually use the phrase 'God created *x*'. Therefore, we have good reason to believe that when the term *bārā'* is used in the OT to mean 'to create', it always indicates God creating or renewing something a finite time or period ago. As the biblical scholar, Kenneth A. Mathews, notes,

> 'Created' (*bārā'*) is used in the Old Testament consistently in reference to a new activity. . . . The striking feature of the word is that its subject is always God. It therefore conveys the idea of a special activity accomplished only by deity that results in newness or a renewing (Mathews 1996:128).

Indeed, even the opponents of *creatio ex nihilo* understand the OT as affirming that God created the heavens and the earth some finite time ago, albeit out of an eternal substratum. Thus, if the OT states that God created (*bārā'*) all things, it is not merely affirming that everything depends ontologically on God for its existence, but it is also affirming that God alone is eternal—everything apart from God, including matter, had an absolute beginning. Therefore, we will now evaluate whether the OT does, in fact, claim that God created *all things*.

2.2.3 The Old Testament and Creatio ex Nihilo

2.2.3.1 Genesis

The OT begins with the proclamation, 'In the beginning, God created the heavens and the earth' (Genesis 1:1).[10] Although Genesis 1:1 does not explicitly state that God created all things (or the universe) 'out of nothing', there are three factors that, when taken together, offer good reason to believe that this verse implicitly suggests that God created all things.

[10]Unless otherwise indicated, Scripture quotations are taken from the English Standard Version (ESV) of the Bible.

First, v. 1 should be read as a principal or independent clause and not as a subordinate clause (Westermann 1994:95–97). If v. 1 is taken as a subordinate clause, it would read 'In the beginning, when God created the heavens and the earth, the earth was formless and empty …' Thus, reading v. 1 as a subordinate clause gives the impression that God created the universe, not out of nothing, but out of a pre-existing chaotic state. Claus Westermann (1994:95–97), however, offers the following grounds for reading Genesis 1:1 as a principal clause: (1) There is no reason why the phrase 'In the beginning' cannot refer to an absolute beginning in time. (2) The syntax of vv. 1–3 does not imply that v. 1 is a subordinate clause part of a construct chain, especially in view of the fact that the phrase 'the earth' in v. 2 is not equivalent to 'heaven and earth' in v. 1. (3) The structure of v. 1 does not correspond to other ancient creation stories. These other creation stories (such as *Enuma Elish*) begin by describing the state before creation occurred, but Genesis 1:1 begins immediately with God's creative act. (4) Reading v. 1 as a principal clause is in harmony with the style of the author of Genesis 1. Thus, Westermann (1994:97) concludes, 'The first verse then is to be understood as a principal sentence.'

Second, as Mark F. Rooker (1992:416–419) argues, because (1) *bārā'* is connected to the phrase 'in the beginning' in v. 1, (2) *bārā'* is the most applicable Hebrew term the author of Genesis may use to denote *creatio ex nihilo*, and (3) it is significant that the author of Genesis refrains from mentioning pre-existing matter (given the cultural background of the ancient Near East in which pre-existing matter was of great importance for the pagans), v. 1 is best read as implying *creatio ex nihilo*. Rooker declares,

> [W]hile [*creatio ex nihilo*] is not the inherent meaning of [*bārā'*] or of any word, for that matter, [*bārā'*] would be the best candidate from the semantic pool of Hebrew verbs for expressing a creation that is unprecedented, namely, *creatio ex nihilo*. … [I]f Moses wanted to refer to God as the Reshaper of existing matter, there were better lexical choices at his disposal to convey this idea (Rooker 1992:418–419).

Finally, since the Hebrew OT does not have a term for 'the universe', the phrase 'the heavens and the earth' is a Hebrew idiom (or merism)[11] that refers to either (1) the universe in its completed and ordered state or (2) the entire universe, i.e., all things apart from God (Waltke 1991:3–4; Mounce 2006:329; Pennington 2007:167–168). In light of the context presented in Genesis 1, 'heavens and earth' in v. 1 refers to the latter, namely, all things apart from God (Copan and Craig 2004:43; Erickson 2013:342; Mounce 2006:808; Mathews 1996:142). As Kenneth A. Mathews declares,

> To insist [that 'heavens and earth' means] a finished universe is to enslave the expression to its uses elsewhere and ignore the contextual requirements of Genesis 1. 'Heavens and earth' [in Genesis 1:1] indicates the totality of the universe, not foremostly an organized, completed universe (Mathews 1996:142).

[11] A merism is a rhetoric device that uses two contrasting parts to refer to an entirety. For example, the phrase 'high and low' in the sentence 'I searched my office high and low' is a merism referring to everywhere.

Accordingly, Gordon J. Wenham maintains that v. 1 could be translated as 'In the beginning God created everything' (Wenham 1987:15). Thus, in light of these three factors and the fact that *bārā'* denotes an absolute creation (as noted above), the most favourable interpretation of v. 1 is that God created all things (cf. Mathews 1996:142; Jiří 2011).

Furthermore, in Genesis 2:3–4, the author once again stresses that God created the universe: 'So God blessed the seventh day and made it holy, because on it God rested from all his work that he had done in creation [*bārā'*]. These are the generations of the heavens and the earth when they were created [*bārā'*], in the day that the Lord God made the earth and the heavens.' By using the merism 'the heavens and the earth', v. 4 affirms that God created all things. Moreover, v. 3 strongly suggests that God's work of creating lasted for a finite period of time only, thus implying an absolute creation (because God began creating the entire universe some finite time ago). Therefore, we may conclude that Genesis affirms that God created the universe.

2.2.3.2 Isaiah

The book of Isaiah offers an unambiguous affirmation that God is the creator of all things. First, Isaiah exalts God as the highest being who is without equal. God is described as 'the first and the last', a title that emphasises God's unmatched greatness (Isaiah 41:4; 44:6). As God says about Himself, 'I am God, and there is no other; I am God, and there is none like me' (Isaiah 46:9. Cf. Isaiah 40:18; 45:5, 14, 18, 22). Furthermore, Isaiah describes God alone as eternal: 'The Lord is the everlasting God, the Creator of the ends of the earth' (Isaiah 40:28). No other thing—neither matter nor any other object—is said to be eternal. Consequently, Isaiah does not accommodate the notion of eternal matter, a notion that inevitably likens matter to the eternal God.

Second, Isaiah frequently uses the merism 'the heavens and the earth' to refer to creation (Isaiah 42:5; 44:24; 45:12, 18; 65:17). This merism is used to denote *all things*:

> Thus says the Lord, your Redeemer, who formed you from the womb: 'I am the Lord, who made [*yāṣar*] all things [*kōl*], who alone stretched out the heavens, who spread out the earth by myself' (Isaiah 44:24).

The Hebrew term for 'all things' used here is *kōl*, which, when standing by itself, literally means 'everything' (Mounce 2006:12). Thus, since God is eternal, Isaiah affirms that God made everything outside of Himself.

Finally, Isaiah 66:1–2 implies that God created the universe some finite time ago:

> Thus says the Lord: 'Heaven is my throne, and the earth is my footstool; what is the house that you would build for me, and what is the place of my rest? All these things my hand has made [*yāṣar*], and so all these things came to be [*hāyâ*], declares the Lord.'

In this passage the term *yāṣar* ('made') is used synonymously with the term *hāyâ* ('came to be'). It is significant, then, that the latter term does not denote an eternal

'coming to be' but, rather, signifies a coming into existence at some moment or finite duration. This passage is asserting, in essence, that heaven and earth (or all things) had an absolute beginning. Therefore, Isaiah upholds the belief that God created all things apart from Himself some finite time ago.

2.2.3.3 Jeremiah

As with Isaiah, the prophet Jeremiah explicitly declares that God created all things. Jeremiah 10:11–12, 16 states,

> Tell them this: 'These gods, who did not make the heavens and the earth, will perish from the earth and from under the heavens.' But God made [*'āśâ*] the earth by his power; he founded [*kûn*] the world by his wisdom and stretched out [*nāṭâ*] the heavens by his understanding. . . . [God] is the Maker [*yāṣar*] of all things [*kōl*] (NIV).[12]

This passage has two important features. First, Jeremiah is contrasting God with pagan idols. According to Jeremiah, the Lord is the true God who is eternal and who made the heavens and the earth, while the pagan idols are false gods, they did not create the heavens and the earth, and they are perishable. As noted above, the phrase 'the heavens and the earth' is a Hebrew idiom that refers either to the completed universe or to all things apart from God. Jeremiah makes clear that he means the later, for in v. 16 he declares that God is the maker of all things (*kōl*)—literally everything. Thus, since Jeremiah maintains that God is eternal (10:10), he affirms that God made everything apart from Himself.

Second, the passage implies that God created all things a finite time ago. Although Jeremiah does not use the term *bārā'*, he uses several other terms that imply creation in time. God is said to have made (*'āśâ*) the earth, founded (*kûn*) the world, stretched out (*nāṭâ*) the heavens, and made (*yāṣar*) all things. Each of these terms, when applied to God, refers to God's activity of creating, making, or establishing something at some moment or for some duration. For example, *'āśâ* is used in Exodus 20:11 to denote God's creating over a period of time: 'For in six days the Lord *made* heaven and earth, the sea, and all that is in them, and rested on the seventh day.' Importantly, the OT authors never use *'āśâ*, *kûn*, *nāṭâ*, or *yāṣar* to mean 'eternal ontological dependence'. Thus, Jeremiah 10:11–16 implies that God created all things a finite time ago.

There is no hint in the above OT texts that their authors meant that matter is eternal with God but dependent on God. According to these authors, God is the only eternal being upon whom all else depends. By affirming that God created all things in time, the above OT texts imply *creatio ex nihilo*.

[12]Cf. Jeremiah 51:15, 19: 'He [the Lord] made the earth by his power; he founded the world by his wisdom and stretched out the heavens by his understanding. . . . He is the Maker of all things' (NIV).

2.2.4 The New Testament and Creatio ex Nihilo

The New Testament's (NT) proclamation of God's absolute creation is perhaps more explicit than the OT. St John proclaims that God (the Logos) created *all things* apart from Himself: 'Through him [i.e., the Logos] all things were made; without him nothing was made that has been made' (John 1:3). In addition, St John distinguishes between the eternal Creator (the Logos) who was '*in* the beginning' (v. 1:1) and all creation that came into being (v. 1:3). However, this distinction between Creator and creation would be pointless if St John meant that God is not the sole eternal being. As Jack Cottrell remarks,

> Without *ex nihilo* origination, the things which 'came into being' would have been in a real sense just as much 'in the beginning' as was the Logos; and the whole point of the passage—the exaltation of the Logos—would be undermined (Cottrell 2000:109).

Therefore, John 1:3 affirms that everything apart from God (which clearly includes, if necessary, a primordial substratum) was created by God.

Both St Paul and St Barnabas refer to God as the one 'who made the heavens and the earth and the sea and everything in them' (Acts 14:15; cf. Psalm 146:6). This proclamation 'strongly brings out the distinction between Christian and pagan cosmology' (Guthrie 1981:135) with the former stressing that God is the creator of all things. Elsewhere, St Paul declares that 'there is but one God, the Father, from whom all things came and for whom we live; and there is but one Lord, Jesus Christ, through whom all things came and through whom we live' (1 Corinthians 8:6) and, again: 'For from him [i.e., God] and through him and for him are all things' (Romans 11:36). In his letter to the Colossian church, St Paul emphasises the view that God created everything:

> For in him all things were created: things in heaven and on earth, visible and invisible, whether thrones or powers or rulers or authorities; all things have been created through him and for him. He is before all things, and in him all things hold together (Colossians 1:16–17).

Therefore, according to St Paul, all things originate in God and, thus, 'God . . . gives life to the dead and calls into being things that were not' (Romans 4:17). St Paul's theology clearly excludes *creatio ex materia* and supports *creatio ex nihilo*.

Several other NT passages plainly express the concept of *creatio ex nihilo*. For example, Hebrews 11:3 states that 'By faith we understand that the universe was formed at God's command, so that what is seen was not made out of what was visible.' Taken at face value, this verse rules out *creatio ex materia* because primordial matter, which is visible, is excluded from the 'invisible' stuff (or nothing) out of which what is seen was made. Ephesians 3:9 maintains that God 'created all things.' Likewise, Revelation 4:11 cries 'You are worthy, our Lord and God, to receive glory and honor and power, for you created all things, and by your will they were created and have their being.'

2 Peter 3:5 is often used as support for *creatio ex materia* with the statement that '... long ago by God's word the heavens came into being and the earth was formed out of water and by water.' However, as Paul Copan (2005:47–48) notes, there are three reasons why the phrase 'the earth was formed out of water and by water' does not imply that God created the universe out of matter/water. First, St Peter would have been familiar with the OT passages that exalt God as the creator of all things. Thus, 2 Peter is embracing the biblical worldview that denies any eternal dualism. Second, by claiming that the world was formed out of water, St Peter is probably describing a two-stage creation in which God first created the 'waters' out of which He subsequently formed the world. Finally, St Paul's point is to link the world's creation 'by water' in v. 5 with the world's destruction 'by water' in v. 6. Therefore, we should not read *creatio ex materia* into 2 Peter 3:5.

Thus, *creatio ex nihilo* is implied by the NT affirmations that God created all things outside Himself. We may conclude, therefore, that the biblical authors believed that the universe, having been created by God, had a temporal beginning.

2.3 Important Jewish Proponents of *Creatio ex Nihilo*

There is little doubt that the majority of Jewish scholars have clearly expressed an affirmation of the doctrine of *creatio ex nihilo*. Some of the most prominent Jews who endorse the doctrine are Israeli, ibn Paquda, Chiyya, Maimonides, Albo, Abravanel, Shalom, Bibago, and Arama, to name but a few.

2.3.1 Isaac Israeli

Isaac Israeli (*c*. 855–*c*. 955), who is believed to be the first Jewish Neoplatonist, distinguishes between two kinds of 'creation,' namely, (1) God's act of creating out of nothing, and (2) nature's act of creation out of something.[13] According to Israeli, nature brings 'into being existences from the existing' (*Kitab al-Hudud* 43), whereas only God engages in 'making-anew,' that is, 'making existent existences from the non-existent' (*Kitab al-Hudud* 42). The Israeli scholar, Alexander Altmann, argues that these passages both expose Israeli's 'insistence on creation from nothing,' and suggest that Israeli 'upholds ... the doctrine of *creatio ex nihilo*' (in Altmann and Stern 2009:152–153).

[13] *Kitab al-Hudud* (*Book of Definitions*, date unknown) 42–45.

2.3.2 Bachya ibn Paquda

Bachya/Bahya ben Joseph ibn Paquda (11 century), the notable Jewish philosopher and rabbi, argues in his major philosophical work *Kitāb al-Hidāya ilā Farā'iḍ al-Qulūb* (*Duties of the Heart*),[14] Chapter 4, that an investigation into the nature of God's unity should begin with a demonstration of *creatio ex nihilo*:

> What is the method for investigating the true nature of God's unity? ... One must first investigate whether or not the world has a Creator. Once it is established that the world has a Creator, Who created it and brought it into existence from nonexistence, one then inquires whether He is one or more than one (ibn Paquda 1999:79–81).

Bachya then goes on to offer his three well known premises 'from which it can be deduced that the world has a Creator, Who brought it into existence from nonexistence': (1) things do not bring themselves into existence; (2) there cannot be an infinite series of causes and, thus, there must be a first un-caused cause; and (3) all composite objects have been brought into existence (*Duties* 5; ibn Paquda 1999:81). According to Bachya, if these three premises are established, which he attempted to do, then it follows that there exists a Creator who brought the universe into existence out of nothing.

2.3.3 Abraham Bar Chiyya

Abraham bar Chiyya/Hiyya (1065–*c*. 1136), the influential astronomer, mathematician, and philosopher (who introduced Ptolemy's writings to the Hebrews for the first time), appears to embrace a two-stage account of creation[15] with God first creating the potentiality of matter *ex nihilo*, and then actualising this potentiality and giving matter form. Moreover, according to Chiyya, since time, matter, and motion came into existence, the universe cannot be eternal (see Rudavsky 2003:165).

2.3.4 Moses Maimonides

Moses Maimonides (*c*. 1135–1204), whose legacy and influence on Jewish history must not be underestimated, goes a step further and stresses that the doctrine of creation is a principle of the Law. In his *Guide of the Perplexed* (12 century), which is considered the single most significant Jewish philosophical discourse ever written, Maimonides distinguishes between three theories regarding the eternity of the universe, namely, (1) that God brought all things, other than Himself, into existence out of non-existence, (2) that God formed the universe out of pre-existing

[14] Judah ibn Tibbon was the first to translate *Duties of the Heart* into Hebrew in about 1160.

[15] *Hegyon ha-Nefesh ha-Atzuvah* (*Meditation of the Sad Soul*, date unknown), part 1.

eternal matter, and (3) that the orderly arrangement of the universe is both dependent on and co-eternal with God because the universe *has* always been and *will* always remain in this orderly state (*Guide* 13).

Maimonides argues, thereafter, that all of the arguments in favour of the second and third theories fail as conclusive proof of an eternal universe (*Guide* 14–22). On the other hand, the first theory of *creatio ex nihilo* is the superior and preferable theory (*Guide* 23). Indeed, according to Maimonides, *creatio ex nihilo* is a *fundamental* teaching of the Torah, ranked directly below the teaching of God's unity (*Guide* 13). 'All who follow the Law of Moses, our Teacher, and Abraham, our Father,' declares Maimonides, 'assume that nothing is eternal except God, and that the theory of *creatio ex nihilo* includes nothing that is impossible' (*Guide* 13). Thus, Maimonides maintains that the doctrine of creation out of nothing should be considered a fundamental Jewish doctrine because it demonstrates the possibility of miracles, revelation, and God's intervening in the universe at any moment (*Guide* 25). If God, of His own will, brought the universe into existence out of non-existence, then all the miracles recorded in Scripture are clearly possible and, moreover, God may undoubtedly reveal the Law to Moses. Conversely, if the universe were eternal with events occurring out of necessity, as the third theory implies, then God could not intervene in history, miracles would not be possible, and the Torah could not have been revealed to Moses. Therefore, as Herbert A. Davidson points out, what is important for Maimonides is 'the conception of a deity who can intervene in nature and interrupt the natural course of events. The thesis of creation entails, and the eternity of the world excludes, such a deity' (Davidson 2005:368). The doctrine of *creatio ex nihilo* is, therefore, in the opinion of Maimonides, an extremely significant doctrine.

2.3.5 Joseph Albo

Joseph Albo (*c*. 1380–1444), the fifteenth century theologian and philosopher, holds the doctrine of creation out of nothing in high regard. Although Albo does not consider *creatio ex nihilo* as one of the three fundamental Jewish beliefs nor as one of the eight derivative principles of the Law, he does regard it as one of the six Jewish dogmas in which every Jew must believe.[16] The Jewish historian, Isaac Husik, describes Albo's position as follows:

> Creation *ex nihilo* is neither a fundamental nor a derivative principle of religion generally or of Judaism specially because . . . they can exist without this dogma. At the same time it is a truth which it behooves every religionist and particularly every Jew to believe. It follows from the principle of the existence of God. If God cannot create *ex nihilo*, there is a defect in him (Husik 1969:415).

Thus, Albo is yet another important Jewish figure who endorses the doctrine of *creatio ex nihilo*.

[16] *Sefer ha-'Ikkarim* (*Book of Principles* [1425]) 1.23.

2.3.6 Isaac Abravanel, Abraham Shalom and Abraham Bibago

Both Isaac ben Judah Abravanel/Abrabanel (1437–1508), the Portuguese Jewish philosopher and theologian, and Abraham ben Isaac ben Judah ben Samuel Shalom (died 1492), the Italian Jewish theologian, are noted for defending the doctrine of creation out of nothing. For Abravanel, 'the doctrine of creation *ex nihilo* is the fundamental dogma of Judaism' (Feldman 1993:33).[17] Consequently, Abravanel felt impelled to contribute to the Jewish defence of the doctrine. In common with Abravanel, Shalom claims that *creatio ex nihilo* is the foundation of the Torah.[18] Similarly, Abraham Bibago (15th century), a notable Spanish Jewish philosopher and theologian of the fifteenth century, argues that *creatio ex nihilo* is one of the most important principles of the Torah.[19]

2.3.7 Isaac Arama

Another notable Jewish defender of *creatio ex nihilo* is Isaac ben Moses Arama (*c*. 1420–1494), the Jewish theologian and rabbi who has been called 'one of the greatest' preachers of the fifteenth century (Heller-Wilensky 1953:132). Arama is well known for his *Akeydat Yitzchak* (*Binding of Isaac* [date unknown]), which is a philosophical commentary on the Pentateuch. According to Sarah Heller-Wilensky (1953:136), Arama regards *creatio ex nihilo* as the most important dogma of religion, for all other religious beliefs are grounded in the doctrine of creation. As with Chiyya, Arama offers a two-stage account of creation: God first brought matter into existence out of nothing, and then He created the universe out of this matter (Heller-Wilensky 1953:140). Furthermore, although Arama believes that *creatio ex nihilo* is taught in Scripture, he nevertheless offers several arguments in favour of the doctrine with one being the *kalām* argument on the impossibility of infinite time (Heller-Wilensky 1953:138–139). Hence, we may consider Arama as a strong defender of creation out of nothing.

In short, the doctrine of *creatio ex nihilo* is clearly a significant doctrine of Judaism. Despite the fact that a small number of Jews, many of whom appear to have been influenced by the Greeks, embrace the view that matter is eternal, most of the influential Jewish thinkers have deemed the doctrine to be a fundamental Jewish dogma. In fact, as Charles H. Manekin notes, shortly after the fifteenth century, 'the belief in the temporal creation of the world ex nihilo . . . became a fundamental doctrine of philosophical Judaism' (Manekin 2003:363).

[17] *Mifalot Elohim* (*Works of God* [1503]) 1.3.

[18] *Neweh Shalom* (1574) 1.3.

[19] *Derek Emunah* (*The Path of Faith* [1521]) 3.1.

2.4 Important Christian Proponents of *Creatio ex Nihilo*

2.4.1 Clement of Rome

St. Clement of Rome (AD *c*. 30–*c*. 99), also known as Pope Clement I, was a Bishop of Rome. It is generally believed that Clement was a companion of St. Paul (Philippians 4:3) and one of the first Apostolic Fathers.[20] Although Clement's first epistle to the Christians in Corinth, *1 Clement* (AD *c*. 97),[21] was not canonised, it was, nevertheless, highly esteemed by the early Church.[22]

Clement does not explicitly discuss *creatio ex nihilo*. However, he does declare that God is both the 'Father and Creator of the universe' (*1 Clement* 19)[23] and 'the great Creator and Lord of all' (*1 Clement* 20). Furthermore, Clement states that 'the Creator and Master of all things rejoices in his works. For he established the heavens by his all-superior power, and by his incomprehensible understanding he set them in order' (*1 Clement* 33).[24] Again, in Chapter 59 Clement emphasises that God is 'the Creator of all' and 'the ultimate source of all creation' (Ehrman 2003a:141). In light of the fact that Clement was acquainted with Paul and his writings, Clement's claim that God is the creator of 'all things' is clearly intended to be in harmony with Paul's declaration that God has complete dominion over *all* creation (1 Corinthians 8:6; Romans 11:36) and that, through Jesus, *all things* were created (Colossians 1:16). The significance of these all-inclusive statements made by Clement and Paul is, thus, that nothing is excluded from God's creative act, for 'all things,' including matter, have been created by God. Accordingly, although the *phrase* 'creation out of nothing' does not appear in these passages of *1 Clement*, these passages conform remarkably well with the *concept* of creation out of nothing.

One problematic passage, however, is *1 Clement* 60.1: 'For you through your works have revealed the everlasting structure of the world. You, Lord, created the earth.'[25] It may appear, at first glance, that Clement is asserting that the structure of the world or, at least matter, is eternal. However, there are two things we should bear in mind when analysing this paragraph, lest we mistake Clement to be affirming

[20]For example, in his *Church History* 3.4, Eusebius of Caesarea (AD *c*. 260–*c*. 340) remarks that Clement 'was appointed third bishop of the church at Rome' and that Clement was Paul's 'co-laborer and fellow-soldier.'

[21]Despite the fact that *1 Clement* does not claim to be written by Clement of Rome, I am following tradition in attributing the letter to him. For a brief discussion on the authorship of *1 Clement*, see Ehrman (2003a:21–23).

[22]Eusebius refers to *1 Clement* as a 'remarkable merit' that 'has been publicly used in a great many churches both in former times and in our own' (*Church History* 3.16).

[23]Unless otherwise indicated, quotations of the early Christians are taken from Schaff (1885).

[24]This quotation is taken from Bart D. Ehrman's (2003a:93) translation of *1 Clement*.

[25]This quotation is taken from Michael W. Holmes' (2006:70) translation of *1 Clement*.

creatio ex materia. First, Clement uses the adjective 'eternal' or 'everlasting' (ἀέναος) elsewhere to describe a *created* thing. This occurs in *1 Clement* 20.10 where he says that 'the eternal fountains, created for enjoyment and health, provide their life-giving breasts to humans without ceasing' (Ehrman 2003a:73–75).[26] Here Clement is describing the fountains as being both eternal and created. Moreover, in the following verse (20.11) we read that 'the great Creator and Master of all' ordered the fountains to exist in harmony. However, as God is the creator and master of all, God obviously created the fountains.[27] Thus, the fountains are described as 'eternal' or 'ever-flowing' (ἀέναοί), not because they are *really* eternal, but because they constantly provide humans with water. Thus, Clement is using metaphorical, perhaps even poetic, speech to make his point. Hence, when Clement describes the structure of the world as 'everlasting,' he is not necessarily maintaining that matter is eternal and he may simply be using hyperbole to bring home his point forcefully.

Second, the very first sentence of *1 Clement* 60.1 expresses a phenomenological description of the world, not an ontological description. In his notable commentary on *1 Clement*, Horacio E. Lona (1998:599–600)[28] contends that the first sentence of verse 60.1 reflects a religious view of the experience of the world. In other words, the created reality is seen from the perspective of one who regards it as a phenomenon that is brought about by God.[29] In other words, Clement is saying that the structure of the world appears to us, as humans, as everlasting or, more precisely, as a complex, composite reality ordered by God.[30] The phrase 'the everlasting structure of the world' should be understood, then, as a hyperbolical statement which is intended to emphasise the complexity of the phenomenal world.

Therefore, Clement does not endorse the view that God created the universe out of primordial matter. On the contrary, there are numerous passages in *1 Clement* that emphasise God as creator of all. This view—that God created everything apart from Himself—may not be a philosophically developed notion of *creatio ex nihilo*, nevertheless, if this is Clement's view, then he would surely be affirming the doctrine of *creatio ex nihilo*.

---

[26]Holmes (2006:52) translates this passage as follows: 'the ever-flowing springs, created for enjoyment and health, give without fail their life-sustaining breasts to humankind.'

[27]Cf. *1 Clement* 60.1, where Clement declares that God created the world, certainly including its fountains.

[28]I am indebted to Michael W. Holmes for bringing this reference to my attention.

[29]Clement's expression resembles Wisdom 7:17–18, where the author of Wisdom claims to have received from God knowledge of the composition and structure of the world and the beginning and end of times.

[30]Lona (1998:599, note 4) points out that the term ἀέναος, which is used in *1 Clement* 60.1, should not be translated as 'eternal', but rather 'everlasting', because the former translation is associated with a world view that is foreign to the author. However, the term 'everlasting,' unlike the term 'eternal,' may denote a complex composite that has, nevertheless, been created.

2.4.2 *Odes of Solomon*

The *Odes of Solomon*, which were composed in about AD 100, have been termed the 'Earliest Christian Hymnbook' (Charlesworth 2009:xiii). Although this collection is titled 'Odes of Solomon,' the author of the *Odes* remains unknown. Nevertheless, the Odist was most likely a Jew who eventually became a Christian (Charlesworth 2009:xvii).[31] The *Odes* may best be described as Jewish-Christian, since some odes reflect a purely Jewish tradition, other odes are clearly Christian, and yet other odes possess both Jewish and Christian characteristics.[32]

Three of the Odist's views, taken together, support the doctrine of *creatio ex nihilo*. First, the Odist claims that there was a beginning to time. The Son of the Most High, or the Word, is said to be in His Father 'before time' (Ode 41:14).[33] Second, according to the Odist, God existed *before* anything else did. God's 'sanctuary' or 'holy place' was designed by God before he made other things (Ode 4:1–2). Ode 16:18 makes a similar claim, namely, that 'there is nothing outside of the Lord, because He was before anything came to be.' Finally, the Odist states that God created everything: 'You, O Lord, have made all' (Ode 4:15). However, it is difficult to bring these three views into harmony with the notion of *creatio ex materia*, which states that time and matter had no absolute beginning, God did not exist *before* the primordial matter, and God did not create *all things* (because primordial matter is uncreated). On the other hand, these three views do harmonise well with the notion that God created *ex nihilo*. Therefore, although the *Odes* do not offer a sophisticated account of creation, they do support the doctrine of *creatio ex nihilo*.

2.4.3 *The Shepherd of Hermas*

The *Shepherd of Hermas* is a Christian work which was probably composed over a long period of time, sometime in the middle of the second century, perhaps AD 110–140 (Verheyden 2006:397; Ehrman 2003b:169). The work was highly esteemed in the early Church, so much so that several early Christians considered it to be canonical (Ehrman 2003b:169). *Hermas* is divided into three sections of different natures, viz. five visions (Chapters 1–25), ten commandments (Chapters 26–49), and twelve parables (Chapters 50–114).

---

[31] See *Ode* 24.

[32] The Jewish odes are 1, 5, 6, 9, 11, 14–16, 18, and 20–21; the Christian odes are 2, 4, 7, 8, 10, 12, 17, 19, 22–24, 27–29, and 31–42; and the rest of the odes are both Jewish and Christian (Cf. Charlesworth 2009:xviii–xix).

[33] Unless otherwise indicated, quotations of the *Odes* are taken from James H. Charlesworth's (1985:735–771) translation, which is also available online from http://www.earlychristianwritings.com/text/odes.html [Accessed October 09, 2014].

As regards creation, *Hermas* affirms three views that, as a whole, support creation *ex nihilo*, namely, (1) God created all things, (2) God is the only eternal being, and (3) God created out of nothing. First, we read that God 'created and completed all things, and made everything that exists' (*Commandment* 1.1.1).[34] Likewise, *Parable* 5.5.2 stresses that God is 'the one who created all things and completed them and empowered them.' Thus, nothing is excluded from God's creative work; everything that exists, be it formless matter, was created by God. Second, *Hermas* upholds God's unique, unparalleled eternity. *Parable* 9.12.2 describes the Son of God as 'older than all His creatures,' while *Parable* 5.6.5 states that the Holy Spirit 'preexisted and created all things' (Ehrman 2003b:335). These passage are straightforward: God preceded creation in the sense that He existed in the absence of the universe (all things), which He brought into being a finite time ago. Thus, nothing but God is eternal. Finally, *Commandment* 1.1.1 instructs us to believe that God created out of nothing:

> First of all, believe that God is one, who created and completed all things, and made everything that exists out of that which did not, who contains all things but is himself alone, uncontained (Ehrman 2003b:237).[35]

Similarly, *Vision* 1.1.6 declares that God 'created, increased, and multiplied that which exists out of that which does not exist' (Ehrman 2003b:177). Hence, according to *Hermas*, God created everything that exists out of non-being or nothing.

May (2004:27), on the contrary, dismisses these latter two passages (*Commandment* 1.1.1 and *Vision* 1.1.6) as imitating the 'Jewish way of talking' about non-being, which does not address the issue of absolute nothingness. Similarly, J. Noel Hubler (1995:110–111) argues in his doctoral dissertation that the phrase 'out of non-existence' used in *Hermas* does not, on its own, denote absolute nothingness. According to Hubler, to take this phrase 'in the strong absolute sense requires a clear context which denies a material cause for generation or creation' (Hubler 1995:111). Such a context, says Hubler, cannot be found in *Hermas*.

May and Hubler, however, overlook *Hermas'* affirmation that God is the only eternal being who created all things. They offer us no explanation of how the phrase 'out of that which did not exist' *cannot* mean 'out of absolutely nothing' in light of the context that stresses the sweeping totality of creation. There is no indication whatsoever that the statements 'all things' and 'everything that exists' are used by the author of *Hermas* to mean 'all things except a pre-existing, eternal matter.' It may, thus, be said that *Hermas* does offer support for the notion of *creatio ex nihilo*, while not presenting any support for the notion of *creatio ex materia*.

[34] This quotation is taken from Ehrman's (2003b:237) translation of *Hermas*.

[35] Schaff (1885) translates this passage as follows: 'First of all, believe that there is one God who created and finished all things, and made all things out of nothing. He alone is able to contain the whole, but Himself cannot be contained.'

2.4.4 Aristides of Athens

Aristides was a second century Christian philosopher and apologist from Athens. He is well known for his *Apology of Aristides* (*c.* AD 125), which he delivered directly to the Emperor Hadrian in about AD 125. There are minor differences between the complete Syriac version of the *Apology* and the slightly abbreviated Greek version.[36] The latter appears in the Christian romance novel entitled *The Life of Barlaam and Josaphat*, which, according to Robert Lee Wolff (1937), was probably written in about 978 by St. Euthymius (*d.* 1028). Scholars are unsure about whether the Syriac version represents Aristides' original text more accurately than does the Greek version. Nevertheless, Wolff (1937:243–247) argues that 'Euthymius [most likely] made use of the original Greek [text of Aristides, which] . . . he inserted bodily into his narrative.' Thus, since the differences between the Syriac and Greek versions are minor, we may safely assume that both texts faithfully represent Aristiede's *fundamental* theological concepts.

In his *Apology*, Aristides makes the following three significant claims. First, *all things depend on God for their existence*: '[God] is not in need of anything but all things are in need of him . . . and in Him stands fast all that exists' (*Apology* 1 [Syriac]). Second, *God created all things*. God is described as the one 'who made all things for the sake of mankind' (*Apology* 1 [Syriac]). Similarly, God is said to be 'the Creator and Fashioner of all things' (*Apology* 15 [Greek]). Aristides stresses this point when he declares that '[God] has no name, for everything which has a name is kindred to things created' (*Apology* 1 [Syriac]). The obvious inference from this latter statement is that, since all matter (whether formless or orderly) has a name, it is created. Finally, in the Greek version Aristides affirms that *God created out of nothing*:

> Let us proceed then, O King, to the elements themselves that we may show in regard to them that they are not gods, but perishable and mutable, produced out of that which did not exist at the command of the true God, who is indestructible and immutable and invisible (*Apology* 4 [Greek]).

Here the elements are described as created, not out of some pre-existing substrate, but out of non-being or nothing. The Syriac version states that the elements are 'a created thing, liable to ruin and change,' although it does not elaborate on whether they were 'produced out of that which did not exist.' Nevertheless, regardless of which version of the *Apology* most accurately represents Aristides' thought here, in view of the fact that he strongly maintains that God created all things and that God is not in need of anything, it is difficult to see how Aristides may have endorsed *creatio ex materia*. It may, thus, be concluded that the *Apology* is far more consistent with creation *ex nihilo* than it is with creation *ex materia*.

[36] Both versions of the *Apology*, as translated by D.M. Kay, are available in parallel online from http://www.tertullian.org/fathers/aristides_02_trans.htm (Accessed November 15, 2014). Quotations of the *Apology* are taken from this translation.

2.4.5 *Other Notable Christian Thinkers*

Creatio ex nihilo was espoused by many other influential Christian thinkers. For example, in his *Address to the Greeks*, Tatian the Assyrian (*c*. 120–*c*. 180 AD) declares that 'the Logos, begotten in the beginning, begat in turn our world, having first created for Himself the necessary matter . . . For matter is not, like God, without beginning, nor, as having no beginning, is of equal power with God; it is begotten, and not produced by any other being, but brought into existence by the Framer of all things alone.'[37] Tatian's contemporary, Theophilus of Antioch (died *c*. 183–185 AD), attacks those who claim that matter is uncreated and eternal. According to Theophilus, if we insist that matter is eternal, then we cannot claim that God is the creator of *all* things, in fact we should then affirm that matter is equal to God.[38]

Athenagoras of Athens (133–190 AD) view of divine creation is less clear than that of Tatian and Theophilus. Athenagoras states that matter is both created and perishable[39] and, yet, he elsewhere suggests that God is an artificer who creates by forming and energising matter.[40] Nevertheless, in light of the fact that several church fathers affirmed a two-stage creation—which is the view that God first created primordial matter or chaos that He subsequently formed into the universe—and that the doctrine of *creatio ex nihilo* does not exclude such a two-stage creation (Erickson 2013:340), in all likelihood Athenagoras endorsed a two-stage creation with the first stage denoting *creatio ex nihilo* (Copan and Craig 2004:134–136).

The three Church Fathers, Irenaeus of Lyons (*c*. 130–*c*. 202), Tertullian (*c*. 160–*c*. 225), and Origen (*c*. 184–*c*. 253), go even further and claim that *creatio ex nihilo* is a crucial component of the Christian faith. In his *Adversus haereses* (*Against heresies*) 2.10.4, Irenaeus highlights the importance of *creatio ex nihilo* by distinguishing between a human architect, who creates out of existing materials, and the divine Creator, who creates out of nothing.[41] The notable Irenaeus scholar, M.C. Steenberg, expounds on Irenaeus' view as follows:

> The nature of God as one who creates *ex nihilo* reveals to Irenaeus significant details on the character of the physical and spiritual worlds, about the very being of beings. In turn, that a being (or more specifically, all beings) are fashioned *ex nihilo*, is revelatory for him of the character of God as creator of such realities. . . . Misconceptions over the manner of creation–especially those that deny or do not fully express a creation from nothing–ultimately serve to distort the notion of God as good and powerful which . . . lies at the heart of Irenaeus' whole theology (Steenberg 2008:39).

Tertullian, the second century theologian who, in all likelihood, was the first to use the term '*Trinitas*' (Trinity) to describe the relationship between the Father, Son, and Holy Spirit, appears to be more relentless than Irenaeus. In his *Adversus*

[37] *Address to the Greeks* 5.

[38] *Apologia ad Autolycum* (*Apology to Autolycus*) 2.4.

[39] *Embassy for the Christians* (*c*. 177 AD), Chapter 4.

[40] *Embassy*, Chapters 10, 19, and 24.

[41] Cf. *Adversus haereses* 2.10.2; 2.10.3; 2.11.1; 2.14.4; 2.28.7; 2.30.9; 4.20.2.

Hermogenem (*Against Hermogenes*) 1, Tertullian criticises Hermogenes for denying *creatio ex nihilo* and, in turn, for placing matter on the same level with God. Furthermore, Tertullian argues that Genesis 1:1 plainly teaches that God created all things out of nothing.[42] Most noteworthy, however, is the fact that Tertullian identifies *creatio ex nihilo* as a 'rule of faith,' thus implying that the doctrine is a fundamental and orthodox doctrine for all believers.[43] Similarly, Origen expresses bewilderment at the fact that many of his peers believed matter is eternal. 'I cannot understand how so many distinguished men,' declares Origen, 'have been of opinion that . . . matter . . . was uncreated, i.e., not formed by God Himself, who is the Creator of all things.'[44]

2.4.6 Bishop Tempier's Condemnation of 1277

We have focused solely on the views of Christians of classical antiquity. However, it will be useful to mention Bishop Tempier's condemnation of 1277, since this event effectively illustrates that, by the high middle ages, *creatio ex nihilo* had become an orthodox doctrine of Christianity.

During the thirteenth century, the University of Paris had one of the leading arts faculties in Europe. Dominated by the Christian milieu of Paris at the time, the members of the faculty of arts were required to treat the authority of philosophy as inferior to the authority of faith, and they were required to submit to the dogmas of the Church (see Ebbesen 1998:269). However, in 1277, Pope John XXI heard reports that heresy has been committed by members of the faculty of arts at the University of Paris and, thus, he requested the Bishop of Paris, Stephen Tempier, to investigate these reports. Subsequently, on March 7, 1277, Bishop Tempier issued a list of 219 condemned propositions and threatened to excommunicate anyone teaching or supporting these propositions (Thijssen 2013). Tempier's list is one of several lists that were assembled into organised collections of prohibited beliefs or articles. The propositions prohibited in these lists were clearly contrary to the orthodox teachings of the Christian Church. As Hans Thijssen remarks, 'The collection of Parisian Articles must have had some kind of official status, and must have circulated among medieval scholars. Bachelors in theology were required by oath not to maintain anything 'in favor of articles that have been condemned at the Roman curia or in Paris'' (Thijssen 2013).

Regarding the doctrine of *creatio ex nihilo*, Tempier's list strongly prohibited any view entailing an eternal universe and any antithesis of *creatio ex nihilo* was condemned as heresy. For example, the twenty second condemned proposition states that 'God cannot be the cause of a newly-made thing and cannot produce

[42] *Adversus* 19.

[43] *Adversus* 33; *De Praescriptione Haereticorum* (*Prescription against Heretics*) 13.

[44] *De Principiis* (*On First Principles*) 2.1.4.

anything new' (Tempier 2010:542). Thus, it was regarded as heresy to deny that God has the ability to create something 'new,' such as matter, which has not existed before. Proposition 39 denies the uniqueness of God's divine eternity because 'all the separated substances are coeternal with the first principle [God]' (Tempier 2010:543),[45] while Proposition 85 states that 'the world is eternal as regards all the species contained in it, and that time, motion, matter, agent, and receiver are eternal' (Tempier 2010:545). Hence, belief in eternal matter was considered to be blasphemy. Furthermore, it was unacceptable for a Christian to believe that 'time is infinite at both ends' (Tempier 2010:545 [proposition 88]) or that 'it is not true that something comes from nothing or was made in a first creation' (Tempier 2010:549 [proposition 188]). Moreover, if one affirmed that God had created the universe out of nothing, one was prohibited from maintaining that this 'nothing' was really something, namely, an empty void or vacuum that had been set up 'before the world's generation' (Tempier 2010:190 [proposition 188]).

What was condemned, then, is the view that (1) God cannot create *ex nihilo*, (2) God is not the only eternal being, (3) the world, matter, and time are eternal, that (4) time is infinite, and (5) there was not a first, absolute creation out of nothing. Therefore, since the antithesis of these views is *creatio ex nihilo*, the doctrine of *creatio ex nihilo* was not merely considered an *important* Christian doctrine in the thirteenth century, but it was considered an *orthodox* doctrine that was not to be opposed.

2.5 Conclusion

The *kalām* cosmological argument is a philosophical argument that originated in the sixth century when the doctrine of *creatio ex nihilo* was accepted by the majority of Jews and Christians. Indeed, as we will see in the next chapter, John Philoponus' philosophical arguments in favour of a beginning of time, and which form the foundation of the *kalām* cosmological argument, were formulated by Philoponus to counter those who defended *creatio ex materia*. Thus, since the biblical authors implicitly affirmed *creatio ex nihilo*, we may conclude that the *kalām* cosmological argument is the result of the theological conviction that God brought the universe into existence out of nothing.

[45] Cf. Proposition 37: 'That the first principle is not the proper cause of eternal things except metaphorically, because it conserves them–that is, because unless it existed, they would not exist' (Tempier 2010:543).

References

Altmann, A., & Stern, S. M. (2009). *Isaac Israeli: A neoplatonic philosopher of the early tenth century*. Chicago: University of Chicago Press.

Barr, S. M. (2006). *Modern physics and ancient faith*. Notre Dame: University of Notre Dame Press.

Charlesworth, J. H. (1985). Odes of Solomon: A new translation and introduction. In J. H. Charlesworth (Ed.), *The old testament pseudepigrapha* (Vol. 2, pp. 725–771). Garden City: Doubleday.

Charlesworth, J. H. (2009). *The earliest Christian hymnbook: The odes of Solomon*. Eugene: Cascade Books.

Chase, M. (2013). Discussions on the eternity of the world in antiquity and contemporary cosmology. *Schole, 7*(1), 20–68. http://www.nsu.ru/classics/schole/7/schole-7-1.pdf. Accessed 19 May 2014.

Copan, P. (2005). Creation ex nihilo or ex materia? A critique of the Mormon doctrine of creation. *The Southern Baptist Journal of Theology, 9*(2), 32–54. http://www.sbts.edu/media/publications/sbjt/sbjt_2005summer4.pdf. Accessed 10 Mar 2015.

Copan, P., & Craig, W. L. (2004). *Creation out of nothing: A biblical, philosophical, and scientific exploration*. Grand Rapids: Apollos/Baker Academic.

Cottrell, J. (2000). *What the Bible says about God the Creator*. Eugene: Wipf and Stock Publishers.

Dales, R. C. (1982). Discussions of the eternity of the world during the first half of the twelfth century. *Speculum, 57*(3), 495–508.

Davidson, H. A. (2005). *Moses maimonides: The man and his works*. Oxford: Oxford University Press.

Day, J. (2013). *From creation to babel: Studies in genesis 1-11*. London: Bloomsbury.

Drees, W. B. (1990). *Beyond the big bang: Quantum cosmologies and God*. La Salle: Open Court.

Ebbesen, S. (1998). The Paris arts faculty: Siger of Brabant, Boethius of Dacia, Radulphus Brito. In J. Marenbon (Ed.), *Medieval philosophy* (Routledge history of philosophy, Vol. 3, pp. 269–290). London: Routledge.

Ehrman, B. D. (Ed.). (2003a). *The apostolic fathers* (Loeb classical library, Vol. 1). Cambridge, MA: Harvard University Press.

Ehrman, B. D. (Ed.). (2003b). *The apostolic fathers* (Loeb classical library, Vol. 1). Cambridge, MA: Harvard University Press.

Elwell, W. A. (Ed.). (2001). *Evangelical dictionary of theology* (2nd ed.). Grand Rapids: Baker Academic.

Erickson, M. J. (2013). *Christian theology* (3rd ed.). Grand Rapids: Baker Academic.

Feldman, S. (1993). R. Isaac Abravanel's defense of creation "ex nihilo". *Proceedings of the World Congress of Jewish Studies, 2*, 33–40.

Gavrilyuk, P. (2013). Creation in early Christian polemical literature: Irenaeus against the Gnostics and Athanasius against the Arians. *Modern Theology, 29*(2), 22–32.

Guthrie, D. (1981). *New testament theology*. Downers Grove: InterVarsity Press.

Harris, M. (2013). *The nature of creation: Examining the Bible and science*. London: Routledge.

Heller-Wilensky, S. (1953). Isaac Arama on the creation and structure of the world. *Proceedings of the American Academy for Jewish Research, 22*, 131–150.

Holder, R. D. (2013). *Big bang big God: A universe designed for life?* Oxford: Lion Books.

Holmes, M. W. (Ed.). (2006). *The apostolic fathers in English* (3rd ed.). Grand Rapids: Baker Academic.

Hubler, J. N. (1995). *Creatio ex nihilo: Matter, creation, and the body in classical and Christian philosophy through Aquinas*. Ph.D. dissertation, University of Pennsylvania, Pennsylvania.

Husik, I. (1969). *A history of mediaeval Jewish philosophy*. New York: Atheneum.
ibn Paquda, R. B. (1999). *Duties of the heart*. Jerusalem: Feldheim.
Jiří, M. (2011). Interpretation of bere'šît in the context of genesis 1:1–3. *Andrews University Seminary Studies, 49*(1), 33–44. http://www.auss.info/auss_publication_file.php?pub_id=1655&journal=1&type=pdf. Accessed 21 Sept 2015.
Lona, H. E. (1998). *Der erste Clemensbrief*. Göttingen: Vandenhoeck & Ruprecht.
Manekin, C. H. (2003). Hebrew philosophy in the fourteenth and fifteenth centuries: An overview. In D. H. Frank, & O. Leaman (Eds.), *History of Jewish philosophy* (Routledge history of world philosophies, Vol. 2, pp. 350–378). London: Routledge.
Mathews, K. A. (1996). *Genesis 1–11:26*. Nashville: Broadman & Holman Publishers.
May, G. (2004). *Creatio ex nihilo: The doctrine of 'Creation out of Nothing' in early Christian thought*. London: T & T Clark International.
McGrath, A. E. (2001). *A scientific theology: Nature* (Vol. 1). Grand Rapids: William B. Eerdmans Publishing Company.
Mounce, W. D. (Ed.). (2006). *Mounce's complete expository dictionary of old & new testament words*. Grand Rapids: Zondervan.
Osborn, E. (2001). *Irenaeus of lyons*. Cambridge: Cambridge University Press.
Pennington, J. T. (2007). *Heaven and earth in the Gospel of Matthew*. Leiden: Brill.
Rooker, M. F. (1992). Genesis 1:1–3: Creation or re-creation?: Part 2. *Bibliotheca Sacra, 149*, 411–427.
Rudavsky, T. M. (2003). Medieval Jewish neoplatonism. In D. H. Frank, & O. Leaman (Eds.), *History of Jewish philosophy* (Routledge history of world philosophies, Vol. 2, pp. 149–187). London: Routledge.
Sailhamer, J. H. (1992). *The Pentateuch as narrative: A biblical-theological commentary*. Grand Rapids: Zondervan.
Schaff, P. (Ed.). (1885). *Ante-Nicene fathers*. Grand Rapids: Christian Classics Ethereal Library. http://www.ccel.org/node/70. Accessed 18 Sept 2014.
Sorabji, R. (2006). *Time, creation, and the continuum: Theories in antiquity and the early middle ages*. Chicago: University of Chicago Press.
Steenberg, M. C. (2008). *Irenaeus on creation: The cosmic Christ and the saga of redemption* (Supplements to Vigiliae Christianae, Vol. 91). Leiden/Boston: Brill.
Stoeger, W. R. (2010). The big bang, quantum cosmology and *creatio ex nihilo*. In D. B. Burrell, C. Cogliati, J. M. Soskice, & W. R. Stoeger (Eds.), *Creation and the God of Abraham* (pp. 152–175). Cambridge: Cambridge University Press.
Tempier, S. (2010). Condemnation of 219 propositions. In A. Hyman, J. J. Walsh, & T. Williams (Eds.), *Philosophy in the middle ages: The Christian, Islamic, and Jewish traditions* (3rd ed., pp. 541–550). Indianapolis: Hackett Publishing Company, Inc.
Thijssen, H. (2013). Condemnation of 1277. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Winter 2013 ed.). http://plato.stanford.edu/archives/win2013/entries/condemnation/. Accessed 28 Oct 2014.
Verheyden, J. (2006). The shepherd of hermas. *The Expository Times, 117*(10), 397–401.
Waltke, B. K. (1991). The literary genre of Genesis, chapter one. *Crux, 27*(4), 2–10.
Walton, J. H. (2009). *The lost world of Genesis one: Ancient cosmology and the origins debate*. Downers Grove: IVP Academic.
Wenham, G. J. (1987). *Genesis 1–15*. Word biblical commentary. Waco: Word Books.
Westermann, C. (1994). *Genesis 1–11: A continental commentary*. Minneapolis: Fortress Press.
Wolff, R. L. (1937). The apology of aristides: A re-examination. *The Harvard Theological Review, 30*(4), 233–247.
Wolfson, H. A. (1976). *The philosophy of the kalam*. Cambridge, MA: Harvard University Press.

Chapter 3
Philoponus' *Creatio ex Nihilo* Argument

3.1 Introduction

John Philoponus (AD *c*. 490–*c*. 570),[1] the influential Christian theologian, philosopher, and scientist from Alexandria, may be called the father of the *kalām* cosmological argument. Philoponus studied at the Alexandrian Neoplatonist school under Ammonius (*c*. 440–*c*. 520), who had studied under Proclus (*c*. 411–485). A popular method of practising philosophy between the second and sixth centuries was to write commentaries on Aristotle's (384–322 BC) works (see Falcon 2013). Consequently, Philoponus' contemporaries were to a great extent influenced by Aristotle's philosophy, including Aristotle's account of an eternal universe. In fact, Ammonius, Proclus and Simplicius (*c*. 490–*c*. 560), Philoponus' fellow student and intellectual opponent, all argued against the Christian belief in a beginning of the universe. However, although Philoponus found himself surrounded by this Neoplatonic philosophy, he remained unpersuaded by the arguments in favour of an eternal universe.

Before Philoponus, Christians merely offered theological grounds for the doctrine of *creatio ex nihilo*—the belief that God had brought the universe into existence out of nothing or without pre-existing materials. However, Philoponus changed this by advancing philosophical arguments in favour of a universe with a beginning. Philoponus' most influential arguments make use of the concept of infinity to show that the universe cannot be eternal. These arguments are formulated in *de Aeternitate Mundi contra Proclum* (*Against Proclus On the Eternity of the World*

[1] John Philoponus is also known as John of Alexandria or John the Grammarian. It is unclear why the byname 'Philoponus', which literally means 'lover of work', was applied to Philoponus. Nevertheless, it would seem that Philoponus received this name either (1) because of his voluminous writings or (2) because he was plausibly a member of a community of Christian lay workers called *Philoponeions* (Lang 2001:3–4).

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_3

[AD 529]), a treatise in which Philoponus responds to Proclus' eighteen arguments in favour of an eternal universe,[2] and developed further in the sixth book of *de Aeternitate Mundi contra Aristotelem* (*Against Aristotle On the Eternity of the World* [*c*. AD 530]), in which Philoponus criticises Aristotle's arguments in favour of eternal motion. These infinity arguments, which were available to the Arabic thinkers in the Middle Ages, 'became a most important source for medieval proofs of creation' (Davidson 1987:94). The mediaeval thinkers embraced, repeated and refined Philoponus' infinity arguments to support their own versions of the *kalām* cosmological argument.[3]

In order to fully appreciate Philoponus' infinity arguments, we will analyse Aristotle's unprecedented notion of infinity before we survey Philoponus' arguments.

3.2 Aristotle on Infinity

Aristotle has the reputation of being 'among the greatest philosophers of all time' (Shields 2015), and for good reason: his many works have guided and inspired philosophers from Antiquity through to the present day. One of Aristotle's many contributions to philosophy is his unique account of infinity in *Physics* 3.5–7. This account profoundly influenced Philoponus' infinity arguments and the later development of the *kalām* cosmological argument. In the first four chapters of *Physics* 3, Aristotle makes the point that it is not possible to study nature without discussing the infinite (*apeiron*) because the study of nature is concerned with continuous things, such as change, motion, magnitudes, and time, and something is thought to be continuous if it is infinitely divisible. 'Hence,' writes Aristotle, 'it is incumbent on the person who treats of nature to discuss the infinite and to inquire whether there is such a thing or not, and, if there is, what it is' (*Physics* 3.4, 202b30–202b37).[4]

Now, according to Aristotle, the infinite must exist in some sense, for denying the infinite completely would lead to three impossible consequences, namely, (1) time will have a beginning and end, (2) a magnitude will be indivisible, and (3) number will be finite (*Physics* 3.6, 206a9–206a13). On the other hand, Aristotle rejects the sense in which the infinite exists in fulfilment, such as an actually infinite magnitude (*Physics* 3.5). Therefore, according to Aristotle, there is a sense in which the infinite exists, and a sense in which it does not exist. In order to distinguish between these two senses of the infinite, Aristotle uses the notions of the *potential*

[2]Proclus' treatise *de Aeternitate Mundi contra Christians* (*Against Christians On the Eternity of the World*) is lost. Nevertheless, Philoponus conveniently summarises Proclus' eighteen arguments.

[3]In fact, Philoponus offers two sets of arguments against an eternal universe, one based on the concept of infinity and the other based on the notion that a finite universe contains finite power (see Davidson 1987:86). I shall focus exclusively on the former set of arguments.

[4]All quotations of Aristotle are taken from *The complete works of Aristotle* (1984) edited by Jonathan Barnes.

infinite and the *actual infinite* (*Physics* 3.6, 206a14–206a25). An *actually* infinite collection exists in fulfilment because it is a completed totality of infinitely many distinct members, while a *potentially* infinite collection denotes an indefinite process that is never complete because it is always possible to add another member to the sequence or collection. Since Aristotle denies the actual infinite (*Physics* 3.5),[5] he concludes that the infinite has potential existence only: 'The infinite, then, exists in no other way, but in this way it does exist, potentially and by reduction' (*Physics* 3.6, 206b13).

It is important to note that, when Aristotle ascribes 'potential' existence to the infinite, he does not mean that the infinite *will be* actual but, rather, that the infinite may exist in a restricted sense only. Aristotle explains:

> We must not construe potential existence in the way we do when we say that it is possible for this to be a statue—this will *be* a statue, but something infinite will not be in actuality. Being is spoken of in many ways, and we say that the infinite is in the sense in which we say it is day or it is the games, because one thing after another is always coming into existence. For of these things too the distinction between potential and actual existence holds (*Physics* 3.6, 206a19–206a24).

Therefore, although Aristotle defines 'potential existence' elsewhere as the possibility to be actual (*Metaphysics* 5.7), he is clear that he is using the phrase 'potential infinite' in another sense. Thus, Aristotle is not making the contradictory claim that the infinite is a possibility that cannot be actualised.

Aristotle's potential infinite, then, is characterised by at least three features. First, contrary to what Aristotle's predecessors claimed, the potential infinite does not have nothing outside itself but, rather, it *always* has something outside itself (Physics 3.6, 206b34–207a6). As Jonathan Lear (1979:191) notes, 'The essence of Aristotle's interpretation of the way in which the infinite is said to exist is that there will *always* be possibilities that remain unactualized.' In other words, because new members may be added endlessly to a potential infinite, it always has potential members outside of itself. Second, a potentially infinite sequence comprises an endless process of coming into being or going out of existence (*Physics* 3.6, 206a32–206a34). Finally, the potential infinite 'is always finite, but always different' because, as an endless sequence, it never reaches infinity as a limit (*Physics* 3.6, 206a26–206a34).

Oddly enough, however, Aristotle believed that the notion of the potential infinite allows one to affirm that time is eternal and beginningless but not actually infinite (*Physics* 3.6, 206a9–206a13; 3.8, 208a20–208a21; 8.1, 252b11–251b28). The question, thus, arises as to why time, if it is eternal, is not actually infinite? The

[5] In *Physics* 3.4, 204a7, Aristotle distinguishes further between two modes of infinity, namely, infinite addition and infinite division. Thus, according to Aristotle, one may distinguish between four types of the infinite: (1) Actually infinite addition, (2) actually infinite division, (3), potentially infinite addition, and (4) potentially infinite division. Therefore, in actual fact, Aristotle denies the first three types of the infinite (although he affirms the existence of a potentially infinite magnitude *by addition* only if it is identical to, or the inverse of, some potentially infinite sequence *by division* [*Physics* 3.6, 206b4–206b12; 3.7, 207b16–207b21]).

reason, according to Aristotle, is because time's 'infinity does not persist but consists in a process of coming to be' (*Physics* 3.7, 207b15). Events come into being and go out of existence as time passes and, thus, an actually infinite number of events do not exist simultaneously. Consequently, Aristotle concedes that, although time is eternal, it is not actually infinite. As we shall see next, nearly nine centuries later, Philoponus charged Aristotle with being inconsistent because an infinite sequence of past days entails an actual infinite.

3.3 Philoponus' Infinity Argument

Philoponus begins his infinity argument, which comprises a set of various infinity arguments, in *Against Proclus* by emphasising that 'Aristotle has proved by many arguments … that the infinite can in no way actually exist, and this is agreed to be so by all without exception' (*Against Proclus* 8.1–8.5).[6] Philoponus accepts Aristotle's potential/actual distinction of the infinite and hopes to use Aristotle's own arguments to demonstrate the impossibility of an eternal universe. Philoponus defines two kinds of the actual infinite, namely, one whose members exist all at once (such as an infinite collection of planets) and the other whose members come into existence bit by bit (such as an infinite sequence of events) (*Against Proclus* 9.20–9.24). Let us term the former the *simultaneous infinite* and the latter the *successive infinite*. According to Philoponus, neither a simultaneous nor a successive infinite can exist. In fact, the possibility of the latter is even more difficult to affirm than the possibility of the former (*Against Proclus* 10.5–10.20). This is because the existence of a simultaneous infinite, whose members exist all at once, does not depend on the sequence being traversed but, rather, the existence of a successive infinite requires the impossible task of traversing the sequence.

Philoponus' overall infinity argument against an eternal universe comprises various scattered propositions. A careful evaluation of these propositions reveals three distinct arguments, one based on the impossibility of the *existence* of an actual infinite, one based on the impossibility of *traversing* an actual infinite, and one based on the impossibility of *increasing* an actual infinite (Cf. Davidson 1987:86–89). Let us explore each argument, respectively.

3.3.1 The Argument Based on the Impossibility of an Actual Infinite

Philoponus' first argument against an eternal universe appears in *Against Proclus* 8.21–10.1 and comprises two main propositions. The first proposition states that

[6] All quotations of Philoponus' *Against Proclus* are taken from *Against Proclus on the Eternity of the World 1–5* (2014) translated by Michael Share.

if 'the infinite cannot actually exist … [then] the world cannot coexist with God from everlasting' (*Against Proclus* 8.27–9.4). Philoponus emphasises that he was using 'infinite' here in terms of quantity, such as infinite magnitude or number, and not in terms of quality, such as infinite power (*Against Proclus* 8.5–8.6). This is an important distinction for Philoponus as he believed that it was both possible and necessary that God has infinite power (*Against Proclus* 5.17–6.15). Thus, Philoponus' first proposition simply maintains that an inevitable consequence of an eternal universe is that an actually infinite number of *things*, such as human beings, plants, or animals, will come into existence:

> If the world *had* existed from everlasting, it would be absolutely necessary for the number of things that have come into existence—I mean men and plants and the other individuals in each species—to have become actually infinite as well. … So since, if the world is ungenerated, the time that has elapsed is also actually infinite, the individual things that have come to be in this infinite time must, I imagine, be actually infinite in number too. And so it will follow that, if the world is ungenerated, an infinite number actually exists and has occurred (*Against Proclus* 9.4–9.19 [original emphasis]).

It is interesting to note that Philoponus' argument concerns an infinite number of physical objects and not temporal events. Philoponus could have argued, for example, that infinite time entails an actually infinite sequence of *events*, such as days or years, but he does not do this. Instead, he makes the stronger claim that, if the universe is eternal, an actually infinite number of *physical* objects would (or at least could) exist, either simultaneously or successively. This latter claim is stronger than the former because Aristotle denies the possibility of an actually infinite body or number of physical objects. Hence, Philoponus has shown, in essence, that Aristotle may not affirm both (1) that time is eternal and (2) that an actually infinite magnitude is impossible, for the former negates the latter.

The second proposition in Philoponus' argument claims that an actual infinite cannot in any way exist, neither as a simultaneous sequence nor as a successive sequence (*Against Proclus* 9.21–11.1). Relatiely little is offered in support of this second proposition but Philoponus indicated that he hoped to demonstrate the proposition in greater detail in another work.[7] Nevertheless, in *Against Proclus*, Philoponus does maintain that the impossibility of a *simultaneous infinite* is proved by Aristotle, is uncontroversial, and is self-evident. He then argues that, for these very same reasons, a *successive infinite* is impossible. 'If it were at all possible for the infinite to have emerged into actuality by existing a bit at a time,' declares Philoponus, 'what further reason could there be to prevent it from also existing in actuality all at once?' (*Against Proclus* 10.6–10.8). The point here is that, if the members of an actual infinite can exist at different times, then surely they can exist at the same time. For example, if a simultaneous infinite is possible,

[7] Although this work is lost, it may be the work that is summarised in an important Arabic manuscript that Shlomo Pines translated into English (see Pines' article entitled 'An Arabic Summary of a Lost Work of John Philoponus', which has been reprinted in [Pines 1986:294–326]). Unfortunately, because this Arabic manuscript merely summarises Philoponus' arguments, it does not illuminate any details of his arguments that he may have provided.

then nothing could prevent the members in a successive infinite sequence of past human generations from existing simultaneously. Furthermore, Philoponus argues that, because 'the traversing of the infinite by, as it were, counting it off unit by unit ... is impossible' and that 'the infinite is by its nature untraversable', a successive infinite is impossible (*Against Proclus* 10.20–10.23). Thus, if a simultaneous infinite is impossible, then, so too, is a successive infinite. Philoponus concludes, therefore, that, because the actual infinite cannot exist, the universe cannot be eternal.

We may use these propositions to summarise Philoponus' first argument based on the impossibility of an actual infinite as follows:

1. If the universe is eternal, an actually infinite number of physical things, such as human beings, plants, or animals, either exist at once or have come into existence successively.
2. An actually infinite number of things cannot exist at once because:
   (a) This premise is proved by Aristotle.
   (b) Everyone agrees that this premise is true.
   (c) This premise is self-evident.
3. An actually infinite number of things cannot come into existence successively because:
   (a) First argument:
      (i) If an actually infinite number of things can come into existence successively, they can also exist at once.
      (ii) As argued above, an actually infinite number of things cannot exist at once.
      (iii) Therefore, an actually infinite number of things cannot come into existence successively.
   (b) Second argument:
      (i) If an actual infinite has come into existence successively, then an actual infinite has been traversed.
      (ii) An actual infinite is, by its nature, untraversable.
      (iii) Therefore, an actual infinite cannot come into existence successively.
4. Therefore, the universe is not eternal.

Needless to say, Philoponus' first argument does not permit the actual infinite because it denies that any actual infinite whatsoever may exist. According to Philoponus, even an actually infinite sequence of things that come into and go out of existence cannot exist. This is seen in his denying the possibility of a successive infinite sequence of individuals, who do not all exist simultaneously. Thus, the existence of the actual infinite—both the simultaneous infinite and the successive infinite—is impossible.

3.3.2 The Argument Based on the Impossibility of Traversing an Actual Infinite

The second argument in favour of a beginning of the universe appears in *Against Proclus* 10.1–11.2 and *Against Aristotle* 1178.16–1179.10. This argument rests on the following four propositions. First, if the universe is eternal, an actually infinite sequence of motions has come into existence bit by bit, with each motion generated after the other. By 'motion' Philoponus seems to mean any event, such as the birth of an individual, the ignition of a fire, or the revolution of a planet. Moreover, each motion in the sequence depends on all the prior motions in the sequence. Thus, Philoponus is presupposing that, for any object or motion x, if x requires pre-existing objects or motions in order to exist, then x will not be generated until these prior things have been generated (*Against Aristotle* 1178.10–1178.13). For example, the birth of Socrates required the birth of all his ancestors, or a boat requires wood. Thus, Philoponus' first proposition maintains that an eternal universe entails an infinite *causal* sequence of motions.

Second, a successive infinite must be traversed because its members do not come into being all at once but, rather, they come into being one at a time. In view of the fact that this coming into being may be counted, a traversable sequence is also countable. However, the third proposition maintains that a successive infinite cannot be traversed because the infinite is, by its nature, untraversable and uncountable (*Against Proclus* 10.10–10.25). Therefore, using these three propositions, Philoponus argues that, fourth, if the universe is eternal, motion could never occur or be generated. For, if a motion *M1* may occur only after an actually infinite number of prior motions (*M2*, *M3*, *M4*, ...) have occurred, *M1* would never occur (*Against Aristotle* 1178.16–1179.10). As an example, Philoponus asks us to suppose that the motion which causes fire to come into existence depends on an infinite sequence of prior motions and generations. For example, fire cannot be generated until a change in the air occurs, which could not occur until water changed into air, which could not occur until another motion occurred, and so on *ad infinitum*. According to Philoponus, because the infinite cannot be traversed, the fire—or any other motion—would never occur. However, this is an absurd conclusion because motions have occurred. It follows, therefore, that the universe is not eternal.

We may summarise Philoponus' argument based on the impossibility of traversing an actual infinite as follows:

1. If the universe is eternal, motion could never occur because:
   (a) If the universe is eternal, any motion requires an actually infinite sequence of prior motions.
   (b) Any motion requiring an actually infinite sequence of prior motions can never occur because the actual infinite is, by definition, untraversable and, thus, an actually infinite sequence of motions cannot occur one after the other.
   (c) Therefore, if the universe is eternal, no motion could occur.

2. Motion does occur.
3. Therefore, the universe is not eternal.

Unlike Philoponus' first argument (which is based on the impossibility of an actual infinite), this second argument of his permits the actual infinite for, although this second argument denies the successive infinite, it leaves open the possibility of a simultaneous infinite. The argument does not show, for example, that God could not create an actually infinite number of planets simultaneously, or that God knows an actually infinite number of truths. The argument shows, at most, that an actually infinite sequence whose members come into existence bit by bit cannot exist, such as an actually infinite sequence of celestial revolutions. This second argument is, therefore, more modest than the first.

3.3.3 The Argument Based on the Impossibility of Increasing an Actual Infinite

Philoponus' final argument is based on the notion that an actual infinite cannot be increased in number, neither through addition nor multiplication (*Against Proclus* 11.2–11.20; *Against Aristotle* 1179.12–1179.25). The two key propositions in this argument are as follows. First, if the universe were eternal, an actual infinite would be increased constantly. In order to demonstrate this, Philoponus argued that, if the universe were eternal, new individuals would constantly be added to the infinite collection of previous individuals:

> [I]f the world had no beginning and the number of men living before, say, Socrates was infinite, and those living from Socrates until the present time have been added to it, there will be something greater than the infinite, which is impossible. And if the number of men that have lived is infinite, the number of horses that have lived is certainly also infinite. So you will be doubling the infinite again. And if you add to these the number of dogs as well, you will triple the infinite, and if each of the other species is added it will be multiplied many times over (*Against Proclus* 11.2–11.10).

In *Against Aristotle* 1179.15–1179.25, Philoponus offers a similar thought experiment: Suppose the spheres move at different speeds and Saturn completes one revolution every thirty years, Jupiter completes one revolution every twelve years, and the moon completes one revolution every month. Now, if the universe is eternal, Saturn has revolved an actually infinite number of times, Jupiter has revolved nearly three times this amount, and the moon has revolved three hundred and sixty times this amount. Therefore, an eternal universe entails that different sized infinities exist and have been traversed.

The second proposition in this argument is that one can neither add new members to an actual infinite, nor multiply an actual infinite because 'this is among the greatest of impossibilities, for it is not possible to be greater than the infinite, not to mention many times greater' (*Against Proclus* 11.11). The principle that the infinite cannot be increased was accepted in the Aristotelian tradition until the fourteenth

century when attempts were made to find a coherent theory of varying infinities (Davidson 1987:88; Sorabji 2006:217–218). Hence, because his opponents accepted this principle, Philoponus probably saw no need to defend it. Thus, Philoponus asserts that an eternal universe requires the impossible task of increasing the infinite and, therefore, the universe cannot be eternal.

We may summarise Philoponus' argument based on the impossibility of increasing an actual infinite as follows:

1. If the universe is eternal, one infinite is larger than another because:
   (a) First argument:
      (i) If the universe is eternal, the sequence *A* of all individuals before 469 BC is actually infinite.
      (ii) Adding all the individuals who existed after 469 BC to sequence *A* results in sequence *B*, which is larger than sequence *A*.
      (iii) Therefore, if the universe is eternal, sequence *B* is larger than sequence *A*.
   (b) Second argument:
      (i) If the universe is eternal, the sequence *A* of Saturn's revolutions is actually infinite.
      (ii) The sequence *B* of Jupiter's revolutions is nearly three times larger than Saturn's revolutions, and sequence *C* of the moon's revolutions is three hundred and sixty times larger than Saturn's revolutions.
      (iii) Therefore, if the universe is eternal, sequence *C* is larger than sequence *B*, which is larger than sequence *A*.
2. It is impossible for one infinite to be larger than another.
3. Therefore, the universe is not eternal.

To summarise, these three infinity arguments form part of Philoponus' overall case against Aristotle's eternal universe. Although we have treated his arguments individually, Philoponus presents them together as a single argument (which I refer to as *Philoponus' infinity argument*) which is essentially as follows: If the universe were eternal, then there would exist varying sized actual infinities that have been traversed; however, this is impossible because an actual infinite can neither exist, be traversed, nor be increased; therefore, the universe had a beginning.

3.4 A Critique of Philoponus' Infinity Argument

In this section I evaluate Philoponus' infinity argument against an eternal universe from the perspective of the modern philosophy of religion. More precisely, I show that a theist today cannot use Philoponus' infinity argument in its original form as an argument for God's existence. Of course, Philoponus formulated his argument

in a milieu vastly different to that of modern academia and, thus, it seems unfair to criticise Philoponus as if he were a contemporary philosopher. Nevertheless, by helping us to discover the strengths and weaknesses of Philoponus' argument, such a critique will ultimately help us improve the *kalām* cosmological argument.

Philoponus' infinity argument has two shortcomings. Perhaps the most obvious failing is that it is not a complete proof for God's existence. Although Philoponus argues that the universe began to exist, he stops there. He does not attempt to infer a First Cause from creation. Thus, Philoponus' infinity argument cannot properly be described as either a cosmological argument or a theistic argument. In all fairness, Philoponus cannot be blamed for this shortcoming as he was not trying to prove the existence of God. Instead, he merely wished to support the doctrine of *creatio ex nihilo* by arguing that the universe had a beginning. Nevertheless, the point is that, in order to use Philoponus' infinity argument as a theistic argument, it is incumbent on the theist to supplement it with another argument for a divine creator.

The second problem with Philoponus' infinity argument is that it does not take modern set theory into account. Before the nineteenth century, most scholars agreed with Philoponus that an actual infinite was impossible. However, during the nineteenth century, several mathematicians, in particular, Georg Cantor, began to develop set theory—a mathematical theory of sets that, inter alia, offers a coherent understanding of the actual infinite and allows one infinite to be larger than another. Therefore, since set theory is now widely accepted by mathematicians, Philoponus' first and third arguments will not convince many people today. The proponents of these arguments may no longer assert that the impossibility of actualising or increasing an actual infinite was proved by Aristotle, is uncontroversial and is self-evident. Stronger arguments than these assertions are needed to show that an actual infinite is metaphysically impossible.

In light of the above two reasons, Philoponus' infinity argument cannot be used *in its original form* as a theistic argument. However, the argument based on the impossibility of traversing an actual infinite is the strongest of Philoponus' infinity arguments, for it is not challenged by set theory and also it relies on the intuitive notion that the actual infinite is, by definition, untraversable. Therefore, I believe that a theist may use, and should further develop, this argument to support the doctrine of *creatio ex nihilo*.

3.5 Philoponus' Influence on *Kalām*

Philoponus' influence on subsequent thinkers, especially the followers of *kalām*, must not be underestimated. The Arabic term *kalām*, which literally means 'speech,' 'word' or 'talk' (Haleem 1996:71), came to be used to represent the movement in mediaeval Islamic theology that attempted to clarify and defend the core doctrines of Islam rationally. The *mutakallimūn* (the practitioners of *kalām*) 'believe that the

verses of the Qur'ān related to God's Attributes need to be interpreted through argument based on logical proofs'(Pavlin 1996:105).[8] Thus, the term *kalām* may be translated as 'scholastic theology.'

The *mutakallimūn*, influenced by Philoponus' works, produced several proofs for a created world. As Sajjad H. Rizvi (2011:12) remarks, 'Inspired by John Philoponus's famous attack on Proclus (d. 485) and Aristotle's defense of eternalism, [Islamic theologians] have asserted that not only was the concept of an eternal cosmos coeval with God absurd, it was also heretical.' Philoponus' infinity arguments were available to the *mutakallimūn* in the Middle Ages (see Davidson 1987:93–94) and the *mutakallimūn* welcomed them, refined them, and used them in their own formulations of the cosmological argument. Important defenders of these *kalām* proofs include al-Kindī (*c*. 801–*c*. 873), al-Fārābī (872–950), Ibn Sīnā (980–1037), al-Ghazālī (1058–1111), and Ibn Rushd (1126–1198).[9]

The *mutakallimūn* supplemented Philoponus' arguments in favour of creation with their own *kalām* proofs for a divine creator. Philoponus insisted that the universe had a beginning but he stoped at that point. He does not infer the existence of God from creation. However, in contrast to Philoponus, the *mutakallimūn* try to deduce a divine creator from the proposition that the world came into existence. Hence, the typical *kalām* approach for proving the existence of God comprises the following three steps: (1) Show that the universe came into existence, (2) show that whatever comes into existence has a cause of its coming into existence, and (3) show that the cause of the universe is divine. One of the most important adherents of this *kalām* approach was al-Ghazālī, who will be discussed in the next chapter.

References

Aristotle. (1984). *The complete works of Aristotle: The revised Oxford translation* (Vol. 1). Princeton: Princeton University Press.

Craig, W. L. (2001). *The cosmological argument from Plato to Leibniz*. Eugene: Wipf and Stock Publishers.

Davidson, H. A. (1987). *Proofs for eternity, creation, and the existence of God in medieval Islamic and Jewish philosophy*. New York: Oxford University Press.

Falcon, A. (2013). Commentators on Aristotle. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Fall 2013 ed.). http://plato.stanford.edu/archives/fall2013/entries/aristotle-commentators. Accessed 25 Nov 2015.

[8]Hence, Ibn Khaldūn's (1332–1406) well-known definition of *kalām*, namely, 'the science that involves arguing with rational proofs in defence of the articles of faith and refuting innovators who deviate from the beliefs of early Muslims and Muslim orthodoxy' (Ibn Khaldūn cited by Haleem 1996:75).

[9]We also see traces of Philoponus' infinity arguments in the Jewish scholars Saadia ben Joseph (882–942), Maimonides (1135–1204), Gersonides (1288–1344), Crescas (*c*. 1340–*c*. 1410), and Arama (*c*. 1420–1494); and the Christian theologian St. Bonaventure (1221–1274). For a survey of the infinity arguments against an eternal world in mediaeval philosophy and theology, see Craig (2001:48–126) and Davidson (1987:86–153).

Haleem, M. A. (1996). Early *kalām*. In S. H. Nasr, & O. Leaman (Eds.), *History of Islamic philosophy* (pp. 71–88). London: Routledge.

Lang, U. M. (2001). *John Philoponus and the controversies over Chalcedon in the sixth century: A study and translation of the* Arbiter. Leuven: Peeters.

Lear, J. (1979). Aristotelian infinity. *Proceedings of the Aristotelian Society, 80*, 187–210.

Pavlin, J. (1996). Sunni *kalām* and theological controversies. In S. H. Nasr, & O. Leaman (Eds.), *History of Islamic philosophy* (pp. 105–118). London: Routledge.

Philoponus. (2014). *Against Proclus on the eternity of the world 1–5*. London: Bloomsbury.

Pines, S. (1986). *Studies in Arabic versions of Greek texts and in mediaeval science* (The collected works of Shlomo Pines, Vol. 2). Leiden: E.J. Brill.

Rizvi, S. H. (2011). Mīr dāmād in India: Islamic philosophical traditions and the problem of creation. *Journal of the American Oriental Society, 131*(1), 9–23.

Shields, C. (2015). Aristotle. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Fall 2015 ed.). http://plato.stanford.edu/archives/fall2015/entries/aristotle. Accessed 25 Nov 2015.

Sorabji, R. (2006). *Time, creation, and the continuum: Theories in antiquity and the early middle ages*. Chicago: University of Chicago Press.

Chapter 4
Al-Ghazālī's *Kalām* Cosmological Argument

4.1 Introduction

Abū Hāmid Muhammad al-Ghazālī, also known simply as al-Ghazālī (1058–1111), was a Muslim lawyer, theologian and mystic. Al-Ghazālī is one of the most important *kalām* scholars in Muslim intellectual history and he is regarded as a scholar without equal, the greatest figure in the history of Islam, and the greatest Muslim after Muhammad (see al-Ghazālī 2013:xvii). As a *mutakallim*, al-Ghazālī opposed the Arabic philosophers (*falāsifa*). One may distinguish *kalām* from *falsafa* ('philosophy') in early Islam (see Dhanani 1994:3; Groff 2007:162–164). The term *falsafa* came to denote the mediaeval Islamic philosophy that was heavily influenced by Aristotle and Neoplatonism. In contrast to the *mutakallimūn*, the *falāsifa* (practitioners of *falsafa*) asserted the supremacy of reason over revealed religion.[1] Hence, the *mutakallimūn* held *falsafa* in contempt and charged the *falāsifa* with unorthodoxy. In the twelfth century, *kalām* overcame *falsafa*.

During the debate between the *mutakallimūn* and the *falāsifa*, al-Ghazālī immersed himself in the work of Ibn Sīnā and other Arabic philosophers until he could defeat them on their own grounds. It is in his *Tahāfut al-falāsifa* (*The Incoherence of the Philosophers* [1095]) that al-Ghazālī delivers his devastating attack on the *falāsifa*. Indeed, the *kalām* critique of Islamic philosophy culminated in the *Incoherence*. As Michael E. Marmura remarks:

> Al-Ghazālī's *Tahāfut al-falāsifa* … marks a turning point in the intellectual and religious history of medieval Islam. It brought to a head a conflict between Islamic speculative theology (*kalām*) and philosophy (*falsafa*) as it undertook to refute twenty philosophical doctrines. … [Furthermore,] al-Ghazālī … explained [the Islamic philosophers] so clearly and so well that he rendered philosophical ideas accessible to nonphilosophers. …

[1] Important proponents of *falsafa* include al-Fārābī (872–950), Ibn Sīnā (980–1037) and Ibn Rushd (1126–1198).

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_4

> After al-Ghazālī, no Islamic theologian worth his salt avoided detailed discussion of the philosophical theories al-Ghazālī had criticized. *Kalām* thereafter became, as it had never been before, thoroughly involved with the theories of the *falāsifa* (Marmura 2000:xv–xvi).

Although al-Ghazālī does not offer a complete argument in favour of God's existence in the *Incoherence*, he argues in this work that the world began to exist. In fact, of the twenty discussions in the *Incoherence*, the longest discussion concerns the past eternity of the world with al-Ghazālī championing Philoponus' argument based on the impossibility of an actual infinite to show that the world and time are created.

Al-Ghazālī completed another significant work, *Al-Iqtiṣād fī al-I'tiqād* (*Moderation in Belief*), at about the same time as the *Incoherence* in 1095. *Moderation* is al-Ghazālī's most penetrating work of Ash'arite theology. The work comprises two prefaces, four introductions and four treatises. In the fourth treatise al-Ghazālī tries to show that a divine cause brought the universe into existence. Thus, the *Moderation* goes further than the *Incoherence* by including an extensive argument to support the existence of God. However, these two works complement each other because, taken together, they reveal al-Ghazālī's complete cosmological argument based on the impossibility of an actual infinite. Al-Ghazālī's cosmological argument comprises two steps. First, he argues that the world has a cause and, second, he argues that this cause is God. We shall now analyse these two steps.

4.2 First Step: The World Has a Cause

Al-Ghazālī begins the *First Proposition* of the *Moderation* with the following syllogism: 'The occurrence of every occurrent has a cause; the world is an occurrent; it necessarily follows that it has a cause' (al-Ghazālī 2013:27). Al-Ghazālī goes on to define the key terms he uses in his argument. First, by 'world' he means 'all existents other than God,' that is to say, 'all the bodies and their modes' (al-Ghazālī 2013:27). Al-Ghazālī defines a *body* as something extended in space and a *mode* as something not extended in space but that requires a body in which to subsist. The world, then, comprises all bodies with their modes, which, in today's terms, is the universe.

Second, by an 'occurrent' he means 'that which was nonexistent and then became existent' (al-Ghazālī 2013:28). In order to clarify what he means, al-Ghazālī (2013:28–29) distinguishes between impossibility, necessity and contingency. If something is *impossible*, it cannot be an occurrent because it cannot become existent and nor can a *necessary* thing be an occurrent, since its nonexistence is impossible. Thus, an occurrent, according to al-Ghazālī, is something whose existence is *contingent* in the sense that both its existence and its nonexistence are possible.

Finally, by 'cause' al-Ghazālī means 'the giver of preponderance' or the deciding factor (al-Ghazālī 2013:29). The cause of an occurrent is that which changes the occurrent's nonexistence into existence by giving the occurrent 'preponderance over

nonexistence' (al-Ghazālī 2013:27). In other words, an occurrent 'can … enter the domain of actual existence only through an agent that "tips the scales … in favor of its existing"' (Davidson 1987:162). Thus, if the cause does not exist, and no other thing causes the occurrent, then the occurrent will remain nonexistent. Al-Ghazālī's argument may be represented as follows:

1. Any contingent thing that comes into existence has a cause.
2. The world is a contingent thing that came into existence.
3. Therefore, the world has a cause.

We shall now analyse al-Ghazālī's defence of the argument's two premises. According to al-Ghazālī, the first premise, which states that *any contingent thing that comes into existence has a cause*, is a self-evident truth. 'This principle must be affirmed,' he declares, 'for it is a priori and necessary according to reason' (al-Ghazālī 2013:28). Al-Ghazālī asserts that, if a person does not affirm this principle, he or she probably does not understand what is meant by 'occurrent' or 'cause'. However, once a person understands these terms, which, as we have seen, al-Ghazālī defines, that person would naturally believe that every occurrent has a cause. Hence, al-Ghazālī defends the first premise, not by offering a proof, but by explaining the meaning of *occurrent* and *cause* and insisting that the premise is self-evident.

Second, *the world is a contingent thing that came into existence*. Al-Ghazālī does not consider this premise to be self-evident and, hence, he supports the premise with the following argument: 'If we say that the world is an occurrent, then we now intend by "the world" only bodies and substances. … [However,] no body is devoid of occurrents; whatever is not devoid of occurrents is an occurrent; it necessarily follows that every body is an occurrent' (al-Ghazālī 2013:30). The context of the argument clarifies that, by the phrase 'no body is devoid of occurrents' al-Ghazālī means 'no *body and extended substance* is devoid of occurrents'.[2] Hence, the second premise is established by proving two other premises, namely, (1) all bodies and extended substances contain occurrents, and (2) whatever contains occurrents is itself an occurrent. Al-Ghazālī defends these two premises as follows.

First, *no body and extended substance are devoid of occurrents* because they are not without motion or rest, which are themselves occurrents (al-Ghazālī 2013:31). According to al-Ghazālī, this premise is indubitable because a human body is not without modes, such as aches, sicknesses, hunger, or thirst, which are occurrents. Similarly, the bodies of the world are not without alterations of their states and these alterations, or motions, are occurrents. Consequently, bodies and modes contain motion. Furthermore, al-Ghazālī (2013:32) argues that *rest* is also an occurrent. If a stationary, extended substance, such as the earth, were in a state of rest from eternity, it would remain in this state forever and motion would be impossible. However, motion can take place in any extended substance and, therefore, rest cannot be eternal and it must be an occurrent. The conclusion is that all bodies and extended substances contain occurrents.

[2]This is clear because al-Ghazālī responds to those who may ask, 'Why did you say that every body and extended substance is not devoid of occurrents?' (al-Ghazālī 2013:30–31).

The second premise, which claims that *whatever is not devoid of occurrents is itself an occurrent*, is at the heart of al-Ghazālī's argument. Drawing on Philoponus' infinity arguments, al-Ghazālī defends this premise by contending that,

> If the world were anteriorly eternal [i.e. eternal without a beginning] yet not devoid of occurrents, then there would be occurrents that have no beginning, from which it would necessarily follow that the revolutions of the celestial spheres are infinite in number; and that is absurd, because it leads to absurdity, and what leads to absurdity is absurd (al-Ghazālī 2013:37).

Thus far we have examined the *Moderation*. However, al-Ghazālī defends the second premise in both the *Moderation* and the *Incoherence*. In the latter work he writes, 'The world's past eternity is impossible because it leads to affirming circular movements of the heavenly sphere whose number is infinite and whose individual units are innumerable' (al-Ghazālī 2000:18). He then goes on to show the impossibility of infinity (al-Ghazālī 2000:18–19). The argument in support of the second premise may be outlined as follows:

(A1) If the world is eternal, the revolutions of the celestial spheres amount to an actual infinite.
(A2) An actually infinite number of revolutions of the celestial spheres leads to absurdity.
(A3) Therefore, an eternal world leads to absurdity and so is itself absurd.

Premise (A1) is straightforward: If Saturn, for example, completes one revolution every few years, and, if the world is eternal, Saturn would have completed an actually infinite number of revolutions in an infinite number of years. Therefore, al-Ghazālī argues, an eternal world leads to an infinite number of revolutions.

In support of premise (A2), al-Ghazālī (2000:18–19) offers the following thought experiment to illustrate the absurdity of the infinite: Suppose Jupiter completes two and a half revolutions for every one revolution that Saturn completes. If both these planets have been revolving from eternity, both of them would have completed the *same* number of revolutions. However, this is absurd because Jupiter has completed two and a half revolutions more than Saturn has completed. Al-Ghazālī raises a further difficulty by asking 'Is the number of the rotations even or odd, both even and odd, or neither even nor odd?' (al-Ghazālī 2000:18). According to al-Ghazālī, the supporter of the actual infinite is forced to affirm that the rotations are neither even nor odd and, again, this is absurd.

In the *Moderation*, al-Ghazālī (2013:37–38) underscores three different absurdities. First, an infinite sequence of revolutions is a completed sequence that has come to an end. However, the nature of the infinite precludes the infinite both from being completed and from coming to an end. Second, the infinite number of completed revolutions must either be even, odd, neither even nor odd, or both even and odd. However, all four cases are impossible. Finally, the thought experiment shows that one infinite may be smaller than another infinite because the infinite sequence of revolutions completed by Saturn is smaller than the infinite sequence of

revolutions completed by Jupiter. The problem, however, is that one infinite cannot be smaller than another because the infinite, by definition, cannot be in short supply of something.

Although these three absurdities concern an infinite number of revolutions of the celestial bodies, al-Ghazālī appears to find the existence of any actual infinite difficult to accept. Aladdin M. Yaqub comments,

> It is clear that al-Ghazālī believes that the concept of actual infinity is incoherent. … The problem he sees … that is implied by the concept of actual infinity is the *completion* of actually infinitely many terms. His point is that the concept of the actual infinite implies both (1) that it has no end and (2) that an infinity of terms has been completed. He sees these propositions as inconsistent with each other, because he takes (1) to imply that no infinite sequence has been completed (Yaqub in al-Ghazālī 2013:16, note 38 [original emphasis]).

Hence, al-Ghazālī's thought experiment based on the celestial revolutions exposes his belief in the impossibility of an actual infinite. Therefore, because an actual infinite cannot exist and the world contains occurrents, al-Ghazālī concludes that the world is itself an occurrent requiring a cause.

At this point in his argument, al-Ghazālī remarks, 'only the existence of the cause is now known to us. Whether it is eternal or occurrent and its attributes are not yet known to us' (al-Ghazālī 2013:41). His next step is to uncover the divine nature of the First Cause.

4.3 Second Step: The Cause of the World Is God

After arguing in the *Moderation* that the world has a cause, al-Ghazālī devotes several chapters to the characteristics of this cause. The most important attributes which he ascribes to the cause of the world, and on which we shall focus, are eternality, incorporeality, oneness, power and volition. Al-Ghazālī believes God alone may possess these attributes. Moreover, he argues that the cause of the world must satisfy three conditions, namely, (1) the cause must have the necessary power to create the world, (2) the cause must have exhaustive knowledge of the world, and (3) the cause must have the free will to choose to create the world. According to al-Ghazālī, God alone satisfies these three conditions. Therefore, al-Ghazālī affirms that the cause of the world is God. As Yaqub comments,

> [According to al-Ghazālī,] God … is the only being that has sufficient power, knowledge, and will to create the occurrents in the world. Since no created entity, human beings included, satisfies all these three conditions, none of them can be a causal agent. It follows that God is the sole causal agent in existence, who directly creates all occurrents (Yaqub in al-Ghazālī 2013:261).

Al-Ghazālī's cosmological argument does not stop at the existence of a *First Cause* but concludes with the existence of *God*. We shall now evaluate these attributes of eternality, incorporeality, oneness, power and volition respectively.

4.3.1 Eternality

Al-Ghazālī argues that the cause of the world must be both eternal anteriorly (i.e., eternal without a beginning) and eternal posteriorly (i.e., eternal without an end). He defines *eternal anteriorly* as existence that is not preceded by nonexistence and *eternal posteriorly* as continuous, endless existence that never ceases (al-Ghazālī 2013:41–42). As regards the former, if the cause of the world were contingent, it would need another cause, and this cause would need another cause, and so on. However, an infinite regress of causes is impossible.[3] Therefore, the regress of causes must end at an uncaused, necessary being, whom al-Ghazālī (2013:41) calls 'the Maker of the world'.

As regards the posteriorly eternal, al-Ghazālī maintains that a cause without a beginning must also be without an end. His reasons are as follows: If the anteriorly eternal ceases to exist, its annihilation would have a cause. This cause either (1) is an agent who annihilates the eternal through power, or (2) is an opposite to the eternal, or (3) is the termination of one of the necessary preconditions for the existence of the eternal. However, these three cases are impossible (al-Ghazālī 2013:42–45). First, although an agent may produce *existence* through power, *nonexistence* is not a thing and so it cannot be produced. Consequently, an agent cannot cause the annihilation of something through power. It should be noted that this argument is not convincing because surely it is possible for an agent to annihilate something through power. For example, if Jones throws a book into a fire and the book burns up, Jones' action of throwing the book into the fire caused (or partly caused) the book to cease to exist. In that case, although Jones has not produced nonexistence, he has caused an existent to cease to exist.

Second, al-Ghazālī maintains that the anteriorly eternal cannot be annihilated by its opposite or contrary 'because the existence of the contrary, if it is assumed to be occurrent, would be annulled by its being contrary to the anteriorly eternal' (al-Ghazālī 2013:43). Furthermore, if the contrary were eternal, it would have annihilated the anteriorly eternal from eternity rather than now. Unfortunately, al-Ghazālī offers no further explanation for this argument. As a result, it is unclear what he deems the opposite or contrary of the anteriorly eternal to be. Is it the created world? Some nonexistent? Some other eternal existent? Moreover, al-Ghazālī fails to explain why an eternal, personal being, who is endowed with free will, cannot annihilate another eternal being. I therefore find this second argument difficult to affirm.

Finally, al-Ghazālī argues that, if the anteriorly eternal is annihilated through the termination of a precondition for its existence, this precondition is either contingent or eternal. However, the precondition cannot be contingent because, if it were, the anteriorly eternal would be contingent and, therefore, the precondition must be anteriorly eternal. However, we now face the same problem, namely, how can

[3] Although al-Ghazālī does not explain why an infinite *regress of causes* is impossible, one may assume his reason is that the existence of any actually infinite sequence is impossible.

this anteriorly eternal precondition be annihilated? The only answer is that the precondition is annihilated through the termination of one of its own anteriorly eternal preconditions and this, in turn, leads to the same problem. This will continue *ad infinitum*. Since such an infinite regress is impossible, the anteriorly eternal cannot be annihilated through the termination of one of its preconditions. Al-Ghazālī's conclusion is that the cause of the world is eternal and has neither beginning nor end.

4.3.2 Incorporeality

Next, al-Ghazālī (2013:45–48) tries to show that the cause of the world is incorporeal (immaterial). First, he contends that the cause cannot be an extended substance because, if it were, it would not be eternal. According to al-Ghazālī, any extended substance is not devoid of occurrents, such as motion and rest. However, anything that is not devoid of occurrents is itself an occurrent and, therefore, an extended substance cannot be eternal. As al-Ghazālī has already argued that the cause is eternal, he concludes that it cannot be an extended substance. Second, al-Ghazālī asserts that the cause of the world cannot be a body because a body comprises two or more extended substances. Finally, he argues that the cause cannot be a mode (i.e. something whose existence requires a body or substance in which to subsist) because '[i]nsofar as the body [or substance] is necessarily an occurrent, what resides in it must be an occurrent as well' (al-Ghazālī 2013:47). Thus, since the cause of the world is neither an extended substance, nor a body, nor a mode, the cause must be an incorporeal object that is distinct from the world.

4.3.3 Oneness

An essential attribute of the *kalām* concept of God is the attribute of unity or oneness (Davidson 1987:164–165). Therefore, al-Ghazālī (2013:73–77) finds it necessary to argue that God is one. The phrase 'God is one' means that '[God], and no other, is the creator of everything other than Himself' (al-Ghazālī 2013:73).[4] In other words, one First Cause exists, as opposed to a plurality of existing causes. Al-Ghazālī summarises his proof for God's oneness as follows:

> [I]f a partner for Him were posited, it would be either similar to Him in all respects, higher than Him in rank, or lower than Him in rank. Since each of these is impossible, what leads to them is also impossible (al-Ghazālī 2013:73).

[4]Because al-Ghazālī believes that God is the cause of the world, he uses the term 'God' here rather than 'the cause of the world'.

According to al-Ghazālī, if two First Causes exist, they are either similar in every way or one is superior to the other. However, both are impossible. First, the world cannot have identical causes because two things are distinct if they are *not* similar in every way. If two things are similar in all respects, they are the same thing. Therefore, if the world has a plurality of identical causes, the world, in fact, has only one cause (al-Ghazālī 2013:73–74).

Second, al-Ghazālī argues that the world cannot have two (or more) causes that differ in rank because the superior cause would, in reality, be the ultimate cause of the world (al-Ghazālī 2013:74). When al-Ghazālī speaks about the 'cause of the world,' what he has in mind is a First Cause that created everything other than itself. Thus, the First Cause is the highest ranked cause. However, because al-Ghazālī argues elsewhere that an infinite regress of causes is impossible (al-Ghazālī 2013:41), he maintains that there exists one First Cause that created everything outside itself.

4.3.4 Power

Power is a further attribute which is ascribed to the cause of the world. In his typical fashion, al-Ghazālī offers the following syllogism in support of this contention:

1. Every well-designed product is produced by a powerful agent.
2. The world is a well-designed product.
3. Therefore, it is produced by a powerful agent (al-Ghazālī 2013:83).

This is a standard teleological argument for a cosmic designer. Although it is an independent argument, al-Ghazālī offers this argument alongside his cosmological argument to support the claim that the First Cause possesses power. Unlike his elaborate defence of the cosmological argument, however, al-Ghazālī's defence of the above teleological argument is straightforward: the first two premises are self-evident. These two premises, he claims, are proved through observation and their truth is recognised through reason and, thus, no rational person could deny them. Davidson (1987:227) perceives that al-Ghazālī 'indicates a preference for the teleological argument—which he describes as "inborn" in man and as so evident that "setting up a demonstration" is, in reality, superfluous.' Hence, because al-Ghazālī believes that both premises are obvious, he concludes that the cause of the world must be endowed with incredible power.

4.3.5 Volition

The final attribute on which we shall focus, and which al-Ghazālī associates with the First Cause, is personhood. His most important argument in favour of this attribute

is the argument in support of divine will (al-Ghazālī 2013:105–110).[5] According to al-Ghazālī, the nonexistence and existence of the world are equally possible. Similarly, creation at one time and creation at another time are equally possible (al-Ghazālī 2013:105). Accordingly, the First Cause must have *decided* to actualise the existence of the world a certain finite time ago. However, only a personal agent equipped with free will has the capacity to decide between two equal or similar possibilities. The First Cause must, therefore, be a personal agent endowed with free will. He argues:

> The world came to existence whence it did, having the description with which it came to exist, and in the place in which it came to exist, through will, will being an attribute whose function is to differentiate a thing from its similar. … But since … there was an inescapable need for a specifying agent that would specify one thing from its similar, it was said: 'The Eternal has, beyond power, an attribute that has as its function the specifying of one thing from its similar' (al-Ghazālī 2000:22).

In this argument, al-Ghazālī is appealing to the principle of determination. According to this principle, which was often used by the *mutakallimūn*, an agent is required to choose to bring the world into existence (see Craig 2001:54–58; cf. Wolfson 1976:440–441). Accordingly, the First Cause, as maintained by al-Ghazālī, is a 'cause' in the sense that it freely determines to produce its effect, as opposed to necessarily coinciding with its effect. As William Lane Craig explains,

> According to Ghāzālī, … God is not the 'cause' of the world in the sense that a cause is that which necessarily accompanies its effect. But God is a cause in the … sense … [that He is] a free agent that precedes its effect. Thus, the effect (the universe) need not follow upon the heels of the cause (God), but can appear a finite number of years ago when God willed from eternity that it should (Craig 2001:56).

When faced with the question 'Why did the First Cause not create the world sooner?' the principle of determination allows al-Ghazālī to respond that the First Cause chose from eternity to create the world a particular finite time ago. The First Cause need not have a *sufficient reason* for choosing to create the world when it did so, it merely needed to decide to do so. As an example, al-Ghazālī (2000:23–24) asks us to imagine a man gazing with desire at two equal dates (the fruit) that are in front of him. We are asked to further suppose that the man may take no more than one date. Moreover, nothing makes one date preferable to the other because both dates look identical, are equally good, are an equal distance away from the man, etc. Now, if the man lacks volition, he will remain undecided and never choose a date. However, if the man possesses volition, he will inevitably choose one date of his own free will, even if he has no particular reason for choosing that particular date. Likewise, if the First Cause lacked free will, it could not choose between creating the world and not creating the world, nor could it choose when to create the world. Consequently, the world would either exist eternally or it would never come into existence. However, since the world began a finite time ago, its cause must have free will and so be a personal agent.

[5] Al-Ghazālī also contends that the First Cause possesses power, knowledge and life (al-Ghazālī 2013:83–105), thus suggesting that the First Cause is a person.

In short, al-Ghazālī argues that whatever comes into being has a cause and, because the world came into being, the world has a cause. Furthermore, through an analysis of the nature of this cause, al-Ghazālī concludes that the cause is one eternal, incorporeal and powerful agent who is equipped with free will, and God alone possesses these attributes. We may, thus, schematise al-Ghazālī's cosmological argument as follows:

1. It is a self-evident truth that any contingent thing that comes into existence has a cause.
2. The world is a contingent thing that came into existence:
   (a) The world comprises all bodies and extended substances.
   (b) Every body and extended substance contain occurrents.
   (c) Whatever contains occurrents is itself an occurrent:
      (i) If something containing occurrents may be eternal, the world may be eternal.
      (ii) If the world is eternal, the revolutions of the celestial spheres amount to an actual infinite.
      (iii) An actually infinite number of revolutions of the celestial spheres leads to three absurdities, namely, (1) that an infinite sequence has been completed and come to an end, (2) that the infinite sequence of revolutions is neither even nor odd, and (3) that one infinite is larger than another infinite.
      (iv) Therefore, because an eternal world leads to absurdity, it is itself absurd.
      (v) Therefore, anything containing occurrents cannot be eternal.
   (d) Therefore, every body and extended substance is an occurrent.
   (e) Therefore, the world is an occurrent, i.e., a contingent thing that came into existence.
3. Therefore, the world has a cause.
4. If the world has a cause, this cause is God because the cause must be eternal, incorporeal, one, powerful and endowed with free will, and God alone possesses each of these attributes.
5. Therefore, God caused the existence of the world.

4.4 A Critique of Al-Ghazālī's *Kalām* Cosmological Argument

In the previous chapter we saw that it is not possible for a theist to use Philoponus' infinity argument, without adjustments, to prove God's existence. The reason for this is that the argument neither (1) infers God's existence from the beginning of the universe nor (2) accommodates set theory. The question then arises as to whether al-Ghazālī's *kalām* cosmological argument faces similar problems? I think it does.

First, although al-Ghazālī tries to infer God's existence from creation, his inference is weak. This weakness is a result of the fact that al-Ghazālī offers no philosophical argument to support his first premise. For al-Ghazālī, it is self-evident that *any contingent thing that comes into existence has a cause*. However, contemporary philosophers have attacked this seeming self-evidence. According to Graham Oppy (2006:153), for example, 'it is not in the least bit obvious that everything that begins to exist has an efficient cause of its beginning to exist'. Likewise, after showing that 'begins to exist' is an extremely elaborate and complex notion, Wes Morriston (2000:155) concludes that the premise that *whatever begins to exist has a cause* 'is not obviously supported by any widely shared metaphysical intuition'. Again, Quentin Smith (2007) argues that, even if the universe came into existence, it need not have an external cause because it could be self-caused. Even physicists attack al-Ghazālī's first premise. One such physicist is Alexander Vilenkin (2011:11), who maintains that, just as the decay of a radioactive atom at a given time (apparently) lacks a cause, 'no cause is needed for [the] quantum creation of the universe'. Therefore, since al-Ghazālī's first premise is not self-evident to many contemporary scholars, a theist may no longer rely on intuition only to support this premise and additional arguments are required.

Second, although al-Ghazālī's argument against the actual infinite is more sophisticated than that of Philoponus, it does not address set theory. Set theory allows an actual infinite to be neither even nor odd, and it also allows one infinite to be smaller or larger than another, which al-Ghazālī rejects. Of course, al-Ghazālī cannot be blamed for failing to address set theory, for this theory was developed several centuries after al-Ghazālī. Nevertheless, in order to reject the metaphysical possibility of an actual infinite, it is imperative that contemporary proponents of al-Ghazālī's argument interact with set theory.

In summary, al-Ghazālī advances a full-blown cosmological argument for God's existence. At the heart of al-Ghazālī's argument lies the notion that, because an actual infinite leads to absurdities, it is itself absurd. Al-Ghazālī's *kalām* cosmological argument has significantly influenced natural theology. His influence will be seen when we discuss William Lane Craig's contemporary defence of the *kalām* cosmological argument in Chap. 6. But before examining Craig's argument, we will examine the rise of set theory and modern cosmology in the next chapter.

References

al-Ghazālī. (2000). *The incoherence of the philosophers: A parallel English-Arabic text*. Provo: Brigham Young University Press.

al-Ghazālī. (2013). *Al-Ghazālī's moderation in belief: al-Iqtisād fī al-i'tiqād*. Chicago: The University of Chicago Press.

Craig, W. L. (2001). *The cosmological argument from Plato to Leibniz*. Eugene: Wipf and Stock Publishers.

Davidson, H. A. (1987). *Proofs for eternity, creation, and the existence of God in medieval Islamic and Jewish philosophy*. New York: Oxford University Press.

Dhanani, A. (1994). *The physical theory of kalām: Atoms, space, and void in Basrian Mu'tazilī cosmology*. Leiden: E.J. Brill.

Groff, P. S. (2007). *Islamic philosophy A-Z* (Philosophy A-Z series). Edinburgh: Edinburgh University Press.

Marmura, M. E. (2000). Translator's introduction. In *The incoherence of the philosophers: A parallel English-Arabic text* (pp. xv–xxvii). Provo: Brigham Young University Press.

Morriston, W. (2000). Must the beginning of the universe have a personal cause?: A critical examination of the kalam cosmological argument. *Faith and Philosophy, 17*(2), 149–169.

Oppy, G. (2006). *Arguing about gods*. New York: Cambridge University Press.

Smith, Q. (2007). Kalam cosmological arguments for atheism. In M. Martin (Ed.), *The Cambridge companion to atheism* (pp. 182–198). New York: Cambridge University Press.

Vilenkin, A. (2011). The principle of mediocrity. http://arxiv.org/abs/1108.4990v1. Accessed 23 Dec 2015.

Wolfson, H. A. (1976). *The philosophy of the kalam*. Cambridge, MA: Harvard University Press.

Chapter 5
The Rise of Set Theory and Modern Cosmology

5.1 Introduction

Philoponus and al-Ghazālī could not have anticipated the rise of set theory and modern cosmology that occurred during the nineteenth century. These two independent fields have a direct bearing on the *kalām* cosmological argument. Set theory challenges the mediaeval concept of infinity, while cosmology has much to say about the nature of time and the origin of the universe. Consequently, it is not possible to understand the modern versions of the *kalām* cosmological argument without a basic understanding of both set theory and cosmology, nor may one defend the argument today without interacting with these two fields. Accordingly, this chapter offers a brief overview of set theory and cosmology.

5.2 Set Theory

Before the nineteenth century there was no coherent mathematical theory of the actual infinite. As noted in Chap. 3, Aristotle had distinguished between the potential infinite and the actual infinite (*Physics* 3.6, 206a14–206a25). According to Aristotle, it is not possible for an infinite magnitude to exist in actuality but, rather, an infinite is purely potential because something may either be divided or be added to endlessly without ever reaching infinity as a limit.

Aristotle's understanding of the infinite was widespread until the nineteenth century. As Charles C. Pinter notes, 'classical mathematicians made a distinction between the "actual" infinite—in which infinitely many objects are conceived of as existing simultaneously—and the "virtual" infinite, which is simply the potential to exceed any given finite quantity. The "virtual" infinite was regarded as safe, hence admissible, whereas the "actual" infinite was taboo' (Pinter 2014:1). This

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_5

understanding of the infinite is seen, for example, in Carl Friedrich Gauss' (1777–1855) letter to Heinrich Christian Schumacher (1780–1850) on July 12, 1831 in which Gauss denies the actual infinite:

> But concerning your proof, I protest above all against the use of an infinite quantity as a completed one, which in mathematics is never allowed. The infinite is only a manner of speech specifying a limit to which certain ratios may approach as closely as desired when others may increase indefinitely (Gauss 1860:269).[1]

Despite Gauss' claim that the infinite is but a manner of speaking, there was a distinct trend in Germany in the nineteenth century to accept the coherence of the actual infinite (Ferreirós 2007:18). The most influential mathematicians who defended the actual infinite during this period included Bernard Bolzano (1781–1848), Bernhard Riemann (1826–1866), Richard Dedekind (1831–1916), and Georg Cantor (1845–1918). The work of these mathematicians, especially that of Cantor, initiated the development of set theory.[2]

Modern set theory is the mathematical theory of the formal properties of sets as units. In everyday speech a set is equated with a collection. Set theory, however, regards a set as not simply a collection but as a special type of collection. For example, Cantor defines a set as 'any collection into a whole … M of definite and separate objects *m* of our intuition or our thought. These objects are called the "elements" of M' (Cantor 1915:85). Cantor's concept of a set has intuitive appeal. Unfortunately, this concept of a set was found to generate various contradictions and paradoxes (Fraenkel 1966:10–11; Pinter 2014:3–18). One of the most famous of these paradoxes is Russell's Paradox, the brainchild of Bertrand Russell. Russell describes the paradox as follows:

> Form … the assemblage of all classes which are not members of themselves. This is a class: is it a member of itself or not? If it is, it is one of those classes that are not members of themselves, *i.e.* it is not a member of itself. If it is not, it is not one of those classes that are not members of themselves, *i.e.* it is a member of itself. Thus of the two hypotheses—that it is, and that it is not, a member of itself—each implies its contradictory. This is a contradiction (Russell 1919:136).

This paradox invalidates the view that any well-defined condition or property may determine the members of a set. If any condition may generate a set, the set of *all sets that are not members of themselves* may be generated. However, such a set is

[1] Gauss' original German passage reads: 'Was nun aber Ihren Beweis … betrifft, so protestire ich zuvörderst gegen den Gebrauch einer unendlichen Grösse als einer Vollendeten, welcher in der Mathematik niemals erlaubt ist. Das Unendliche ist nur eine Façon de parler, indem man eigentlich von Grenzen spricht, denen gewisse Verhältnisse so nahe kommen als man will, während anderen ohne Einschränkung zu wachsen verstattet ist.' Some suggest that, in this passage, Gauss' aim is not to criticise the actual infinite per se, but to condemn Schumacher's unjustified assumptions about geometrical figures in infinity. Nevertheless, Gauss' clear disapproval of the actual infinite in this passage shows he favoured the potential infinite (see Ferreirós 2007:20–21).

[2] For a detailed survey of the early development of set theory, see Ferreirós (2007). For a shorter discussion, see Ferreirós (2012).

absurd because, if it is a member of itself, it is not a member of itself and, if it is not a member of itself, it is a member of itself. Thus, the intuitive notion that any condition or property may determine a set must be false.

Russell's Paradox, together with various other paradoxes, resulted in mathematicians abandoning Cantor's general concept of a set. Abraham A. Fraenkel notes that 'During many decades the attempts to "improve" Cantor's definition [of a set] have remained utterly unsuccessful, and it has become inevitable *to renounce a definition of the general concept of set*' (Fraenkel 1966:11 [original emphasis]). Most mathematicians have, therefore, adopted an axiomatic approach to defining a set. Such an approach uses axioms (i.e. underlying propositions) to abstractly define certain terms, such as 'set' and 'is member of', in such a way so as to avoid contradictions. The first axiomatisation of set theory was offered by Ernst Zermelo (1908). The axioms of set theory were further developed by Thoralf Skolem (1887–1963), Fraenkel (1891–1965), and John von Neumann (1903–1957) into the standard axiom system of set theory, also known as the Zermelo-Fraenkel axioms (ZF) together with the Axiom of Choice (AC), or ZFC. In view of the fact that the axiomatic approach to set theory is the easiest way in which to avoid contradictions, ZFC 'is probably the best-known, and best-loved, version of set theory' today (Oppy 2006:20).

Although Cantor's concept of a set has been abandoned, Fraenkel (1966:10) highlights two important features of Cantor's concept of a set, both of which are used in modern set theory. First, the members of a set are *separate* objects because they cannot be included in a set more than once. For example, the set {1, 2, 3, 4} is identical to the set {1, 4, 2, 4, 3, 4}, even though we listed '4' three times in the latter definition of the set. Second, the members of a set are *definite* because the intrinsic nature of a set and its members determine which members it contains. Accordingly, a set is specified by its members because two sets are identical if they have the exact same members, and adding a member to or removing a member from a set produces a distinct set; for example, adding the number 3 to the set {1, 2} produces a distinct set {1, 2, 3}.[3] Hence, a set is a static collection and not a dynamic collection that may change.

This feature of a set results in the fact that, as regards infinity, set theory is solely concerned with the actual infinite rather than the potential infinite (Nowacki 2007:37–40). In view of the fact that the potential infinite is a dynamic concept that describes a finite collection that may grow indefinitely, set theory has no room for the potential infinite. Rather, set theory relates to a certain static class, termed a set. I shall now describe in greater detail the notion of a class, a proper class, a set, a finite class, an actual infinite, and a potential infinite.

[3] In set theory addition is defined as the union of two sets *A* and *B*, and this union produces the set of all members each of which belong to either *A* or *B*. Subtraction is defined as the intersection of two sets, and this intersection produces the set of members each of which belong to both *A* and *B*. For example, the union set of {1, 2, 3} and {2, 3, 4} is {1, 2, 3, 4}; whereas the intersection set of {1, 2, 3} and {2, 3, 4} is {2, 3}.

Definition 1 A *class* is a well-defined collection of entities taken as a completed totality.

In the above, 'well-defined' means that the entities in the collection are totally determined because they satisfy a common condition. Each entity (in the world being taken into account) that satisfies the condition belongs to the class and is called a *member* or *element* of the class. If some object x is a member of some class A, we denote this by writing $x \in A$, and if x is not a member of A, we write $x \notin A$.

A class may be empty if no entity in the world considered satisfies the condition. Consider, for example, the class A of planets in our solar system. A's world or domain is *our solar system*, and A's condition is that *each member must be a planet*. Therefore, A has eight members (namely: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune), i.e. the cardinality of A is 8, which is symbolised as $|A| = 8$. However, the class B of tigers under my bed is empty and has no members, i.e. $|B| = 0$.

Another feature of a class is that it is a unit or completed totality because all its members belong to the class simultaneously. This does not, however, mean that the members of the class exist in reality simultaneously (or exist at all) but, rather, that they form the class all at once. In this context we may differentiate between mathematical existence and real existence. Any entity that may be used in mathematical discourse has mathematical existence, regardless of whether that entity corresponds to reality. For example, each member of *the class of all books I hope to write* belongs to a mathematical class and so has mathematical existence but does not exist in the real world. However, if one day I write a book in this class, that book would come into existence and really exist. Therefore, the members of a class do not need to simultaneously exist in reality, they merely need to belong to a mathematical class all at once.

Definition 2 A *proper class* is any class that *cannot* be a member of another class. In other words, if $A \notin B$ for any class B, then A is a proper class.

The notion of a proper class was introduced in set theory to avoid the contradictions and paradoxes discovered in Cantorian set theory. For example, *the collection of all sets that are not members of themselves* is a proper class. However, by defining a proper class as a class that is not a member, one avoids Russell's Paradox because *the collection of all sets that are not members of themselves* is not itself a set, but a proper class. Moreover, any proper class has the same number of members as the infinite class of all sets (Pinter 2014:47) and is, therefore, infinite as well. Consequently, a proper class is a type of actually infinite collection that cannot be a member of another class.

Definition 3 A *set*, on the other hand, is any class that *can* be a member of another class. In other words, if $A \in B$ for some class B, then A is a set.

Thus, a set is any class that is not a proper class. This implies that any operation carried out on a set always generates another set and never creates a proper class. Examples of a set include the collection of planets in our solar system, the collection

of colours, or the collection of apples on my desk. One usually defines a set by listing the members between curly brackets {}. For example, the set A of the first five natural numbers (excluding zero) may be defined as follows:

$$A = \{1,\ 2,\ 3,\ 4,\ 5\}.$$

However, if the members of a set are too numerous to list, then one may define a set by describing its elements. For example, A may also be defined as follows:

$$A = \{x | \text{x is a natural number between 1 and 5, inclusive}\}.$$

The above statement is read, 'A is the set of all x such that x is a natural number between 1 and 5, inclusive'.

Furthermore, for any set S and relation R, if the members of S may be arranged or ordered according to R, then the ordered pair $(S,\ R)$ is called an *ordered set*. For example, the set A of planets in our solar system may be ordered according to the *smaller than* relation $<$, producing the ordered set $(A,\ <)$, which may be written out as follows:

$$\text{(Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, Mercury)}.$$

Furthermore, since a class is a completed totality, a set may either be finite or actually infinite, but not potentially infinite.

Definition 4 A class S is *finite* iff it has n members, where n is any natural number. In other words, S is finite iff $\exists x \in \mathbb{N}\,[|S| = x]$, where $\mathbb{N} = \{0,\ 1,\ 2,\ 3,\ \ldots\}$.

Definition 5 A class is *actually infinite* (*properly infinite* or just *infinite*) iff (i) it is not finite and (ii) it may be placed into a one-to-one correspondence with a proper part of itself.

In order to better understand the notion of the actual infinite, let us describe what is meant by a one-to-one correspondence and by a proper part. First, a one-to-one correspondence occurs between one class (or set or sequence) and another class when some rule is used to pair each member of the first class with one, and only one, member of the second class, such that no two members of the second class are paired with the same member of the first class. For example, the set of the first three planets in our solar system may be placed into a one-to-one correspondence with the set of each planet's radius (km)[4]:

$$\begin{array}{ccccc} \{\text{Mercury}, & & \text{Venus}, & & \text{Earth}\} \\ \updownarrow & & \updownarrow & & \updownarrow \\ \{2439.7, & & 6051.8, & & 6371\} \end{array}$$

[4]These figures of the planets' radii are taken from NASA's planet chart, available online at http://solarsystem.nasa.gov/planetinfo/charchart.cfm [Accessed 02 March, 2016].

However, the finite set of the first seven natural numbers {1, 2, 3, 4, 5, 6, 7} cannot be placed into a one-to-one correspondence with the finite set of the first four natural numbers {1, 2, 3, 4} because the last three members of the first set cannot be assigned to any member in the second set.

Second, a proper part of a class *A* is any class containing some, but not all, members of *A*, and contains no other member. For example, the set of planets in our solar system whose names (in English) begin with the letter 'M' (i.e. the set {Mercury, Mars}) is a proper part of the set of planets in our solar system. Thus, an *actual infinite* is any class (or set or sequence) whose members may be paired with one and only one member of a proper part of itself. An example of an actual infinite is the set of natural numbers as this set may be placed into a one-to-one correspondence with the set of even numbers, which is a proper part of itself:

$$\begin{array}{l} \{1,\ 2,\ 3,\ \ldots\} \\ \ \updownarrow\ \ \updownarrow\ \updownarrow \\ \{2,\ 4,\ 6,\ \ \ldots\} \end{array}$$

A peculiar consequence of the definition of an actual infinite is that various infinite classes or sequences may have exactly the same size or cardinality. For example, although the set *A* of natural numbers has an infinite number of members more than the set *B* of even numbers (for *A* contains all odd numbers *and* all even numbers), *A* is exactly the same size as *B*. However, this contradicts Euclid's fifth axiom, which states that *the whole is greater than the part*. Nevertheless, most mathematicians today believe that Euclid's axiom applies to finite classes only, and not to infinite classes. As Calvin Jongsma writes,

> Self-evident properties that hold for finite sets may not simply be assumed to be true for sets in general. A set can be a proper part of the whole and still be equinumerous with it. … No contradiction automatically arises, so long as we don't postulate Euclid's axiom as holding universally for sets (Jongsma 2016:4).

In his work on the cardinality of infinite sets, Cantor used ω (the Greek letter omega) to identify the infinite ordinal numbers, and he used $\aleph$ (the Hebrew letter aleph) to identify the infinite cardinal numbers. Accordingly, ω (or ω_0) is the first infinite ordinal and it denotes the set of all the finite ordinals. Since the finite ordinals are identified with the natural numbers ($\varnothing = 0$, $\{\varnothing\} = 1$, $\{\varnothing, \{\varnothing\}\} = 2$, etc.), ω represents the set $\mathbb{N}$ of natural numbers. Thus, the sequence of ordinal numbers is as follows:

$$0,\ 1,\ 2,\ \ldots,\ \omega,\ \omega + 1,\ \omega + 2,\ \ldots,\ \omega + \omega,\ \omega + \omega + 1,\ \ldots$$

$\aleph_0$ (read 'aleph-null') is the first infinite cardinal number and it represents the cardinality of any class that may be placed into a one-to-one correspondence with $\mathbb{N}$. Thus, the set of natural numbers {1, 2, 3, …}, the set of even numbers {2, 4, 5, …}, and the set of odd numbers {1, 3, 5, …} all have the same cardinal number, namely, $\aleph_0$. But $\aleph_0$ is neither the only nor the largest cardinal number,

for Cantor showed that there is a larger cardinal number, namely, $\aleph_1$, which is smaller than $\aleph_2$, which is smaller than $\aleph_3$, etc. Indeed, there is an *infinite* sequence of cardinal numbers:

$$\aleph_0,\ \aleph_1,\ \aleph_2,\ \ldots,\ \aleph_\omega,\ \aleph_{\omega+1},\ \aleph_{\omega+2},\ \ldots,\ \aleph_{\omega+\omega},\ \aleph_{\omega+\omega+1},\ \aleph_{\omega+\omega+2},\ \ldots$$

Such magnitudes are mind-boggling. Nevertheless, the salient feature of any actual infinite is that it may be placed into a one-to-one correspondence with a proper part of itself. Moreover, the actual infinite is a *completed totality* because it is an endless class whose members are, nevertheless, present all at once. Thus, we may define the actual infinite as any non-finite, endless, completed class that may be placed into a one-to-one correspondence with a proper part of itself.

Definition 6 A *potential infinite* (or *virtual infinite*, *improper infinite*, *variable finite*) is any indefinite, endless process or sequence, such as endless addition or endless division.

As noted above, since set theory concerns static classes only, it does not concern the potential infinite. However, the concept of the potential infinite is important for an understanding of the *kalām* cosmological argument. The potential infinite is not a class, a proper class, nor a set; but rather, a potential infinite is any dynamic collection or sequence that increases endlessly towards infinity as a limit but never becomes actually infinite. For example, the process of counting all the natural numbers resembles a potential infinite because it is not possible for one ever to complete this counting process (for once a number has been counted, another always follows). Thus, although a potential infinite increases endlessly towards infinity, it is always finite.

We may understand the potential infinite in terms of the limit of a function, which is a concept that is essential to differential and integral calculus. The limit L of a function $f(x)$ is the value that $f(x)$ approaches as x approaches a given real number c. This may be symbolised as:

$$f(x) = L$$

In a limit problem, although x gets closer and closer to c, it never reaches c and, thus, the value of $f(c)$ is irrelevant to the value or existence of the limit. In some cases, $f(c)$ does not exist at all. For example, consider the function $(x) = \frac{1}{x}$. As x approaches infinity, the limit of this function is 0:

$$f\left(\frac{1}{x}\right) = 0$$

In this case, although x never reaches infinity and $f\left(\frac{1}{0}\right)$ is undefined, the limit of $f\left(\frac{1}{x}\right)$ is 0. Such a limit function resembles an indefinite process that is never complete and, thus, it emphasises the essential nature of a potentially infinite

sequence. Importantly, since a potentially infinite sequence increases indefinitely, it is not a completed totality. In other words, it is not an unbounded collection or sequence whose members are present all at once. Therefore, the fundamental difference between the potential infinite and the actual infinite is that the former is not a completed totality whereas the latter is.

Our above discussion of set theory shows that the modern understanding of the infinite is very different to the ancient understanding of the infinite. Furthermore, we have seen how modern set theory offers a way in which to talk about the actual infinite in a coherent manner. Nevertheless, apart from set theory, the nineteenth century also witnessed the emergence of another fascinating discipline, modern cosmology, to which we turn next.

5.3 Modern Cosmology

The term 'cosmology', which originates from the Medieval Latin term *cosmologia*, refers to the study of the cosmos or universe. Cosmology is an ancient practice that stems from the human desire to understand the world (Harrison 2000:17). Cosmology can, and has been, practised from a mythical, religious, philosophical, and scientific perspective (Liddle and Loveday 2009:82). However, modern cosmology (sometimes called *physical cosmology* or *scientific cosmology*) is a relatively young science that began in the medieval era and came to fruition in the twentieth century (see Duhem 1985; Silk 2001:9–29).

Modern cosmology (hereafter simply 'cosmology') is the branch of physics and astrophysics that studies the origin, evolution, and physical structure of the universe. To gain a better understanding of cosmology, we must define two important terms, namely, *the universe* and *the observable universe*. First, the phrase 'the universe' refers to all physical reality, that is to say, all space, time, matter, energy, and material or physical objects. Some scholars, however, distinguish between the terms 'the Universe', 'a universe', and 'the universe' (Harrison 2000:13–15; Liddle and Loveday 2009:314–315). For these scholars, *the Universe* means 'all physical reality', *a universe* means 'a model of the Universe', and *the universe* means 'our current understanding of the Universe as revealed by modern science'. Unfortunately, physicists sometimes cause confusion by using these terms in different senses and without defining them. Furthermore, since these terms appear very similar, the general reader may easily confuse their meanings. Therefore, to avoid confusion, I shall use the terms 'the Universe' and 'the universe' synonymously to mean 'all physical reality', and, unless otherwise indicated, I shall not use the term *a universe* to mean 'a model of the universe' but, rather, to mean a 'spacetime reality'.

Second, the phrase 'the observable universe' refers to the part of the entire universe that we can observe (Liddle and Loveday 2009:314). The observable universe includes all galaxies and distant objects that may be seen through our largest telescopes. Thus, as our telescopes improve, the observable universe widens (Silk 2001:38–46; Schutz 2003:346–347). Accordingly, *observational cosmology*,

one of the several branches of cosmology, studies the observable universe, while *physical*, *astrophysical*, and *quantum cosmology* all study the aspects of the universe that are beyond direct observation, such as the hot big bang phase of the universe, the early development of galaxies, and the period, if any, prior to the hot big bang phase (Ellis 2007:1183).[5] These various branches of cosmology overlap and supplement each other to offer a rich cosmological description of the universe (Schutz 2009:335; Ellis 2007:1183).

Let us briefly examine the history of cosmology and physics. It may be said that modern physics began in 1687 when Isaac Newton (1642–1727) published his *Philosophiae Naturalis Principia Mathematica* ('Mathematical Principles of Natural Philosophy'). In the *Principia*, Newton developed the first theory of gravity. According to Newton, gravity is a 'centripetal force … by which bodies are drawn or impelled, or any way tend, towards a point as to a centre' (Newton 1934:2). In other words, gravity is the force that attracts or propels bodies towards a central point, such as the force that pulls things on the earth towards the centre of the earth. Newton's theory of gravity is based on his famous three Laws of Motion (Newton 1934:13):

1. Every body will remain in its state of rest, or of uniform motion in a straight line, unless it is compelled to change its state by external forces applied to it.
2. A body's acceleration or change of motion is proportional to the force applied to it, and the change will occur in the direction of the force applied.
3. For every action there is always an equal and opposite reaction.

By using these three laws, Newton was able to show that the strength of the force of gravity between two bodies depends on both the distance between the bodies and their masses (*Principia*, Book III, Propositions VI–VII; Newton 1934:411–415). We may express Newton's law of gravity more precisely as the following equation:

$$F = G\frac{m_1 m_2}{r^2}$$

where 'F' is the force of gravity, 'G' is the gravitational constant, 'm_1' and 'm_2' are the masses of the two bodies, and 'r' is the distance between the two bodies.

Now, after defining gravity as the force responsible for certain motions, Newton realised that he was making some assumptions about how a body moves through space and time.[6] Thus, in order to clarify these assumptions, Newton distinguishes

[5]The various branches of cosmology may also be categorised according to the period in the life of the universe on which they focus. Accordingly, *cosmogeny* is the study of if and how the universe came into existence, *cosmothanatology* is the study of if and how the universe will be destroyed, *cosmogony* is the study of the early evolution of the universe, and *eschatology* is the study of the future and final stages of the universe (Harrison 2000:515).

[6]Indeed, as Tim Maudlin (2012:5) remarks, 'The role of absolute space in Newton's theory is so deep and pervasive that it seems impossible to make sense of anything he writes without accepting its existence.'

between *absolute* time and space and *relative* time and space. In what has become one of the most analysed sections of the *Principia*, Newton writes:

> I. Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration: relative, apparent, and common time, is some sensible and external (whether accurate or unequable) measure of duration by the means of motion, which is commonly used instead of true time; such as an hour, a day, a month, a year.
> II. Absolute space, in its own nature, without relation to anything external, remains always similar and immovable. Relative space is some movable dimension or measure of the absolute spaces; which our senses determine by its position to bodies; and which is commonly taken for immovable space (Newton 1934:6).

Three points in Newton's definition of time and space deserve attention. First, Newton treats time and space as two different entities. Time is a one-dimensional, ordered sequence of instants that flows, whereas space is a three-dimensional arena of motion that has a Euclidean geometry. Since time and space are different entities, the points of space persist through time. Thus, Newton understands motion as the change of location at different times, and he understands rest as remaining at the same place at different times.

Second, Newton's absolute/relative distinction is essentially a distinction between time and space *themselves* and our *measures* of time and space. According to Newton, there is only one absolute time and one absolute space, which are both 'without relation to anything external', whereas there are many different measures of absolute time and absolute space. Thus, for example, relative space is the area measured by a ruler, while absolute space is the quantity itself that we are trying to measure.

Finally, absolute time and space, according to Newton, are both infinite. In his *General Scholium* of the *Principia*, Newton explains why he believes this:

> [T]he true God is not eternity and infinity, but eternal and infinite; he is not duration or space, but he endures and is present. He endures forever, and is everywhere present; and, by existing always and everywhere, he constitutes duration and space. Since every particle of space is *always*, and every indivisible moment of duration is *everywhere*, certainly the Maker and Lord of all things cannot be *never* and *nowhere* (Newton 1934:545 [original emphasis]).

The above passage reflects Newton's strong theistic commitment. Here Newton is saying that everlasting time results from God's eternity, and infinite space results from God's omnipresence. As Robert Rynasiewicz (Rynasiewicz 2014) notes, 'Newton did not regard space and time as genuine substances (as are, paradigmatically, bodies and minds), but rather as real entities with their own manner of existence as necessitated by God's existence (more specifically, his omnipresence and eternality)'. Thus, Newton's absolute time and space are not self-sufficient substances but, rather, they are consequences of God's nature.

However, since absolute time is eternal and absolute space is infinite, the Newtonian universe does not have a beginning, i.e. it did not come into being a finite time ago. Indeed, according to Newton, absolute time and space would exist even if the universe were devoid of material objects. Newton's physics, therefore, supports

the view that past time is actually infinite. Although there were a few critics, most notably Gottfried Wilhelm von Leibniz [1646–1716]), of Newton's physics, most scientists were Newtonians until the birth of Albert Einstein's *Special Theory of Relativity* (SR) in 1905.

In the nineteenth century, several years before Einstein had developed SR, James Clerk Maxwell (1831–1879) theoretically demonstrated that electricity and magnetism are closely related because they can be unified into *electromagnetic waves*. Maxwell showed that these waves travel through space at the speed of light, and this led him to correctly predict that light itself is an electromagnetic wave. At the time of Maxwell's work, all known waves were understood as perturbations in some medium (e.g., water is the medium of ocean waves; air is the medium of sound waves) and, thus, scientists assumed that light waves are also perturbations in a medium. The difficulty, however, was working out which medium accommodates light waves. Unlike the other electromagnetic waves, light waves can travel through seemingly empty space and also through solid objects, such as a glass jar. Consequently, scientists eventually assumed that the medium of light is an invisible, all-permeating substance that they termed 'the aether'.

Given the almost property-less nature of the aether, it was widely believed that the aether was in a state of absolute rest (some even claimed that the aether *is* absolute space) (Dainton 2010:315). However, in 1887 Albert Michelson (1852–1931) and Edward Morley (1838–1923) experimentally demonstrated that light travels at the exact same speed for all observers, regardless of the observer's speed relative to the light source. For example, a sound wave travels past you faster if you are moving towards its source than if you are moving away from it. However, you would always observe a light wave travelling past you at the same speed, irrespective of your direction and speed. This strange feature of light could not be explained by classical physics. Eager for a solution, George FitzGerald (1851–1901) and Hendrick A. Lorentz (1853–1928) ingeniously proposed the *compensation theory*. According to this theory, the speed at which light passes us does vary, depending on our motion and direction. Nevertheless, we always observe light travelling at the same speed because our measuring instruments contract and our clocks slow down as we move through the aether. Lorentz developed equations, known as the Lorentz transformations, that show the amount of contraction and time dilation required to conceal the changes in the speed of light in different inertial frames (i.e. frames that are at rest or moving at a constant velocity in a straight line).

However, Einstein was dissatisfied with the fact that classical mechanics postulated the equivalence of all inertial frames for the formulation of natural laws, while the foundational theory of electromagnetism postulated that the aether was *the* inertial frame that must be given preference (see Einstein 2001:150). So, in his seminal paper, *Zur Elektrodynamik Bewegter Körper* (On the Electrodynamics of Moving Bodies) published in 1905,[7] and which marks the birth of SR, Einstein proposed that there is no need for the aether or a preferred inertial frame. Although

[7] For an English version of this paper see (Einstein 1998).

Einstein uses Lorentz's transformation equations, SR is very different to the compensation theory. According to SR (or Einstein), there is no aether or privileged inertial frame because all inertial frames are equivalent. Thus, there is no *absolute* time, space, motion, rest, or simultaneity, for these notions are merely relative. Hence, SR presents a drastically different view of space and time to that of Newton.

SR was designed to explain certain special cases only, such as the physical relativity of all uniform motion. However, SR neither provides an account of gravity nor is it consistent with Newton's theory of gravity. Therefore, in 1907 Einstein focused on trying to extend the relativity principle to account for gravity. In 1915, after several years of work, Einstein finally published his theory of gravity, the *General Theory of Relativity* (GR). According to GR, gravity is not a force, as proposed by Newton, but is merely the warping of space and time. In other words, material objects do not exert a gravitational pull on each other but, rather, material objects bend spacetime with these bends or curvatures in spacetime producing the effects that we link with gravity. GR is supported by empirical evidence and has superseded Newton's theory as the currently accepted theory of gravity in modern physics (Dainton 2010:351–352).

It is important to note that GR gave scientists the ability to develop acceptable models of cosmology. In fact, Einstein was the first to create such a model in 1917, when he applied his recently discovered gravitational theory to the universe (Einstein 1917). To his surprise, Einstein found that, in its original form, GR describes a universe that is neither static nor eternal but is, instead, expanding or contracting in size. This expansion or contraction will occur because material objects are drawn together due to the spacetime curvature that they themselves create. However, this conclusion was inconsistent with Einstein's initial assumptions that the universe is static and that the magnitude of space is independent of time. Thus, in order to preserve these assumptions, Einstein added an unnecessary hypothetical term, called the *cosmological constant* or Λ, to his equations. Einstein used the cosmological constant simply as a repulsive force to counter-balance the gravity created by the uniform distribution of matter. Therefore, the postulation of the cosmological constant was ad hoc because it 'was not required by the theory as such nor did it seem natural from a theoretical point of view' (Einstein 2001:137).

Nevertheless, shortly after Einstein proposed his initial model, the Russian mathematician Alexander Friedmann (1888–1925) and the Belgian astronomer (and priest) Georges Lemaître (1894–1966) independently formulated solutions to GR that describe an expanding universe. Furthermore, in 1927 Lemaître discovered that Einstein's initial model was extremely unstable because the slightest irregularity in the distribution of matter would cause the universe either to expand or contract. This implied that, even if Einstein's model were correct, it was very unlikely that the universe would remain in a static state forever. Remarkably, the Friedmann-Lemaître prediction of an expanding universe was confirmed in 1929 by Edwin Hubble (1889–1953) who, by building on the work of Vesto Slipher (1875–1969), discovered that the distant galaxies are moving further and further apart from each other. Although this discovery shocked many, the expansion of the universe is now an accepted fact (Liddle 2015:117).

Now, the expansion of space implies that as one extrapolates back in time, the universe becomes denser and denser until one reaches a state of 'infinite' density in the finite past. This state is called the 'initial singularity' or the 'big bang', and to many this state represents the beginning of the universe. As the physicists John D. Barrow and Frank J. Tipler notoriously remark, 'At this singularity, space and time came into existence; literally nothing existed before the singularity, so, if the Universe originated at such a singularity, we would truly have a creation *ex nihilo*' (Barrow and Tipler 1986:442). Cosmologists today are making every effort to find a model of the universe that is without the initial singularity. We will not discuss these attempts at this point (see Chap. 9). However, suffice to say that cosmology has much to say about the origin of the universe.

In conclusion, we have seen how the developments of set theory are applicable to the philosophical discussions on the actual infinite, while the developments of modern cosmology are applicable to the discussions on the beginning of the universe. For this reason, it is imperative that the contemporary proponent of the *kalām* cosmological argument, who intends to argue that an actually infinite sequence of events is impossible and that the universe came into existence, interacts with both set theory and cosmology. The next chapter will explain how William Lane Craig, the contemporary proponent of the argument, has done just this.

References

Barrow, J. D., & Tipler, F. J. (1986). *The anthropic cosmological principle*. New York: Oxford University Press.

Cantor, G. (1915). *Contributions to the founding of the theory of transfinite numbers*. New York: Dover Publications.

Dainton, B. (2010). *Time and space* (2nd ed.). Durham: Acumen.

Duhem, P. (1985). *Medieval cosmology: Theories of infinity, place, time, void, and the plurality of worlds*. Chicago: The University of Chicago Press.

Einstein, A. (1917). Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie (Cosmological considerations in the general theory of relativity). *Koniglich Preußische Akademie der Wissenschaften, Sitzungsberichte Berlin*, 142–152.

Einstein, A. (1998). On the electrodynamics of moving bodies. In J. J. Stachel (Ed.), *Einstein's miraculous year: Five papers that changed the face of physics* (pp. 123–160). Princeton: Princeton University Press.

Einstein, A. (2001). *Relativity: The special and general theory*. Routledge classics. New York: Routledge.

Ellis, G. F. R. (2007). Issues in the philosophy of cosmology. In J. Butterfield, & J. Earman (Eds.), *Philosophy of physics: Part B* (pp. 1183–1285). Amsterdam: Elsevier.

Ferreirós, J. (2007). *Labyrinth of thought: A history of set theory and its role in modern mathematics* (2nd ed.). Basel: Birkhäuser.

Ferreirós, J. (2012). The early development of set theory. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Winter ed.). http://plato.stanford.edu/archives/win2012/entries/settheory-early/. Accessed 16 Mar 2015.

Fraenkel, A. A. (1966). *Abstract set theory* (3rd ed.). Amsterdam: North-Holland Publishing Company.

Gauss, C. F. (1860). Gauss an Schumacher, den 12. Juli 1831. In C. A. F. Peters (Ed.), *Briefwechsel zwischen C. F. Gauss und H. C. Schumacher* (Vol. 2, pp. 268–271). Altona: Gustav Esch.

Harrison, E. R. (2000). *Cosmology: The science of the universe* (2nd ed.). Cambridge: Cambridge University Press.

Jongsma, C. (2016). Discrete mathematics: Chapter 5, set theory & infinity. In *Faculty work: Comprehensive list*. http://digitalcollections.dordt.edu/faculty_work/429. Accessed 08 May 2016.

Liddle, A. (2015). *An introduction to modern cosmology* (3rd ed.). Chichester: Wiley.

Liddle, A., & Loveday, J. (2009). *The Oxford companion to cosmology*. Oxford: Oxford University Press.

Maudlin, T. (2012). *Philosophy of physics: Space and time*. Princeton: Princeton University.

Newton, I. (1934). *Sir Isaac Newton's mathematical principles of natural philosophy and his system of the world*. Berkeley: University of California.

Nowacki, M. R. (2007). *The kalam cosmological argument for God*. Amherst/New York: Prometheus Books.

Oppy, G. (2006). *Philosophical perspectives on infinity*. New York: Cambridge University.

Pinter, C. C. (2014). *A book of set theory*. Mineola/New York: Dover Publications.

Russell, B. (1919). *Introduction to mathematical philosophy*. London: George Allen & Unwin.

Rynasiewicz, R. (2014). Newton's views on space, time, and motion. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Summer 2014 ed.). http://plato.stanford.edu/archives/sum2014/entries/newton-stm/. Accessed 07 April 2016.

Schutz, B. F. (2003). *Gravity from the ground up*. Cambridge: Cambridge University.

Schutz, B. F. (2009). *A first course in general relativity* (2nd ed.). Cambridge: Cambridge University.

Silk, J. (2001). *The big bang* (3rd ed.). New York: W.H. Freeman and Company.

Zermelo, E. (1908). Untersuchungen über die Grundlagen der Mengenlehre. I. *Mathematische Annalen, 65*, 261–281. http://eudml.org/doc/158344. Accessed 19 May 2015.

Chapter 6
Craig's *Kalām* Cosmological Argument

6.1 Introduction

After being overlooked for several centuries, the *kalām* cosmological argument, based on the impossibility of an infinite temporal regress of events, was revived in Stuart Hackett's book *The Resurrection of Theism* (1957). William Lane Craig, one of Hackett's students, entitled this version of the argument the '*kalām* cosmological argument' in view of 'the substantive contribution made by its medieval Muslim proponents' (Craig 2013:7). By formulating a modern defence of the *kalām* cosmological argument, Craig brought the argument into prominence in his book *The Kalām Cosmological Argument* (1979). As Quentin Smith observes, Craig's defence of the *kalām* cosmological argument has gained remarkable attention in recent years:

> A count of the articles in the philosophy journals shows that more articles have been published about Craig's defense of the *Kalām* argument than have been published about any other philosopher's contemporary formulation of an argument for God's existence. . . . The fact that theists and atheists alike 'cannot leave Craig's *Kalām* argument alone' suggests that it may be an argument of unusual philosophical interest or else has an attractive core of plausibility that keeps philosophers turning back to it and examining it once again (Smith 2007:183).

In light of the fact that Craig is the foremost advocate of the *kalām* cosmological argument, this chapter will offer an analysis of his formulation and defence of the argument.[1]

[1] In view of the fact that Craig presents his long-running defence of the *kalām* cosmological argument in numerous publications, I shall treat several of his works as a coherent whole, rather than focusing on just one of his publications in my exposition of his *kalām* cosmological argument. The works on which I shall draw include those of Craig (1979, 2008, 2013) although I shall focus primarily on Craig and James D. Sinclair's article entitled 'The *Kalām* Cosmological Argument'

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_6

6.2 Synopsis of Craig's *Kalām* Cosmological Argument

Following al-Ghazālī, Craig (1979:63) represents the *kalām* cosmological argument as the following syllogism:

1. Everything that begins to exist has a cause of its existence.
2. The universe began to exist.
3. Therefore, the universe has a cause of its existence.

The key terms in the argument may be defined as follows. First, *universe* refers to all space, time (or spacetime), matter, and energy. This includes any notion of a multiverse. Second, *begins to exist* may be defined as follows: *x* begins to exist if and only if *x* exists at some time *t* and there is no time *t** prior to *t* at which *x* exists and no state of affairs in the actual world in which *x* exists timelessly.[2] Third, *cause* refers to what Aristotle termed an efficient cause—the primary source of the caused entity—and which may be anything besides the caused entity (Craig and Sinclair 2012:195). For example, an artisan and his sculpting ability may be the efficient cause of a sculpture.[3]

Finally, Craig (in Craig and Sinclair 2012:115–116, 124, 183–184) stresses that the *kalām* cosmological argument presupposes the dynamic theory of time, also known as the A-theory of time.[4] In terms of the A-theory the past, present, and future are objectively distinct with things coming into being and going out of existence as time passes. Every event has a beginning and an end. Thus, it is not possible for temporally sequential events to exist simultaneously—an event cannot exist simultaneously with the event immediately prior to it. For example, the event representing a clock's minute hand moving from the first numbered dial on the clock face to the second numbered dial cannot exist simultaneously with the event representing the same hand moving from the second dial to the third dial.

The A-theory of time is in contrast to the B-theory (or static theory) of time, which affirms that the universe is a tenseless, four-dimensional, spacetime block,

---

that is published in *The Blackwell Companion to Natural Theology* (2012). Although Craig and Sinclair co-authored the article, I shall credit Craig with the philosophical section of the article because, according to Craig (in Craig and Harris 2008), he wrote the philosophical section of the article while Sinclair wrote the scientific section on the cosmological evidence in favour of a beginning of the universe.

[2]Craig's more technical definition of *begins to exist* is as follows: '*x* comes into being at *t* iff (i) *x* exists at *t*, and the actual world includes no state of affairs in which *x* exists timelessly, (ii) *t* is either the first time at which *x* exists or is separated from any $t' < t$ at which *x* existed by an interval during which *x* does not exist, and (iii) *x*'s existing at *t* is a tensed fact' (Craig and Sinclair 2012:184).

[3]See Aristotle's *Physics* 2.3 and *Metaphysics* 5.2, in which he presents his four well known causes, namely, material cause, formal cause, efficient cause and final cause.

[4]John M.E. McTaggart (1908) distinguishes between two theories of time that he arbitrarily terms the 'A-series' and the 'B-series'. The former theory affirms that there exists a present moment in the series of time while the latter theory denies such a present moment. Similar, non-descriptive names, such as 'A-theory' and 'B-theory', have since been used to differentiate between these two theories. For a brief introduction to McTaggart's views regarding time see McDaniel (2010).

and that the flow of time is merely a mind-dependent illusion. According to the B-theory of time nothing actually comes into being because every event exists simultaneously in the spacetime block (I discuss the distinction between the A-theory and B-theory in more detail in Chap. 8). Thus, since many proponents of the *kalām* cosmological argument assume that things come into existence, they find it difficult to align the *kalām* cosmological argument with the B-theory of time.[5]

Craig offers three reasons in support of the first premise, namely, (1) it is a metaphysical principle that something cannot begin to exist uncaused, (2) it is inexplicable why only universes would not need a cause, and (3) this premise is constantly confirmed in our experience. Premise two is supported by four arguments, two of which are philosophical, namely, (1) the argument based on the impossibility of the existence of an actual infinite and (2) the argument based on the impossibility of the formation of an actual infinite by successive addition; and two of which are scientific, namely, (3) the argument based on the expansion of the universe and (4) the argument based on thermodynamics. Finally, through a conceptual analysis of the argument's conclusion, Craig shows that the cause of the universe must possess various God-like properties. Thus, Craig's argument may be outlined as follows:

1. Everything that begins to exist has a cause of its existence because:
   - (a) It is a metaphysical principle that something cannot begin to exist uncaused.
   - (b) It is inexplicable why only universes would not need a cause.
   - (c) We have experiential confirmation that something cannot begin to exist uncaused.
2. The universe began to exist:
   - (a) The existence of an actual infinite is impossible:
     - (i) An actual infinite cannot exist.
     - (ii) An infinite temporal regress of events is an actual infinite.
     - (iii) Therefore, an infinite temporal regress of events cannot exist.
   - (b) The formation of an actual infinite by successive addition is impossible:
     - (i) A collection formed by successive addition cannot be an actual infinite.
     - (ii) The temporal series of events is a collection formed by successive addition.
     - (iii) Therefore, the temporal series of events cannot be an actual infinite.
   - (c) The expansion of the universe supports a cosmic beginning.
   - (d) The thermodynamic properties of the universe support a cosmic beginning.
3. Therefore, the universe has a cause of its existence.
4. If the universe has a cause of its existence, that cause is God because a conceptual analysis of the cause of the universe illustrates that this cause must have the essential properties traditionally ascribed to God.

[5] For a defence of the A-theory of time, see Craig (2000).

5. Therefore, God caused the universe.
6. Therefore, God exists.

I shall now explore each supporting argument in more depth.

6.3 First Premise: Everything That Begins to Exist Has a Cause of Its Existence

One may expect premise (2) to be the only controversial premise in the *kalām* cosmological argument because premise (1) appears to be obvious. However, premise (1) has also come under tremendous attack. For this reason Craig supports the first premise for the following three reasons (Craig and Sinclair 2012:182–190). First, according to Craig, it is a metaphysical principle that something cannot come into being from nothing. In this context the term 'nothing' is not used as is in the doctrine of creation *ex nihilo*, where nothing means no object or material substance apart from God's being, instead, it simply means 'not anything'. It seems, therefore, metaphysically absurd that something could come into existence uncaused out of absolutely nothing.

Second, Craig argues that if something could come into being from nothing, it becomes inexplicable why just anything, such as microwaves and cows, do not merely pop into existence uncaused. What is special about a universe that it is able to come into existence from nothing? Craig remarks: 'There cannot be anything about nothingness that favors universes, for nothingness does not have any properties' (Craig and Sinclair 2012:186). Thus, it remains plausible that every object that begins to exist, including a universe, requires a cause for its existence.

Craig's third argument is that if premise (1) were false, we would constantly be observing objects spontaneously coming into being uncaused out of nothing. For example, rocks, horses, people and planets would be popping into existence all around us. However, premise (1) is constantly confirmed by our experience as we do not, and never have, observed things beginning to exist without a cause. Craig, therefore, concludes that we have good reason to believe that whatever begins to exist has a cause of its existence.

6.4 Second Premise: The Universe Began to Exist

6.4.1 Argument Based on the Impossibility of an Actual Infinite

Craig formulates the first philosophical argument as follows:

1. An actual infinite cannot exist.

2. An infinite temporal regress of events is an actual infinite.
3. Therefore, an infinite temporal regress of events cannot exist (Craig and Sinclair 2012:103).

This argument is a refined version of Philoponus' argument against an eternal universe. According to Craig, if the universe did not begin to exist, there would be an actually infinite number of past events. However, because an actual infinite is impossible, the universe began to exist.

Craig (in Craig and Sinclair 2012:103–106) defines his key terms as follows. First, he underscores the general distinction between the potential infinite and the actual infinite. As noted in the previous chapter, the *potential infinite* denotes a boundless, quantitative process, such as endless addition, endless division and endless succession. In other words, a potential infinite sequence is a sequence that increases endlessly towards infinity as a limit but never reaches it. It is never complete and is always finite at any given point. On the other hand, the *actual infinite* denotes a boundless, completed totality of infinitely many distinct elements. Mathematicians today define an actually infinite sequence as a sequence that may be placed in one-to-one correspondence with a proper part of itself. Thus, by describing an actual infinite as a 'completed totality' one means that it is an unbounded collection whose members are, nevertheless, present all at once. The fundamental difference, then, between the potential infinite and the actual infinite is that the former is not a completed totality, whereas the latter is. Thus, Craig does not deny the existence of a potential infinite but, rather, he denies the existence of an actual infinite.

Second, with the term 'exist' Craig means 'be instantiated in the mind-independent world' (Craig and Sinclair 2012:105). Craig draws a distinction between mathematical existence and real world existence. The former relates to the legitimacy of mathematical concepts, whereas the latter concerns the mind-independent existence of objects in the real world. Hence, Craig does not wish to deny that the actual infinite is a legitimate concept in contemporary mathematics or that its existence is logically possible but, rather, he wishes to deny the metaphysical possibility of an actual infinite, that is, the possibility of its being actualisable. He writes:

> By 'exist' we mean 'exist in reality', 'have extra-mental existence', 'be instantiated in the real world'. … Cantor's system and set theory are concerned exclusively with the mathematical world, whereas our argument concerns the real world. … What I shall argue is that, while the actual infinite may be a fruitful and consistent concept in the mathematical realm, it cannot be translated from the mathematical world into the real world (Craig 1979:69).

Finally, Craig defines 'event' as any change in the world that has a finite, non-zero duration. Craig asks us to arbitrarily choose some event as our standard, such as a year, so that all the events in the temporal regress of events have the same duration. The temporal regress of events, then, is the series of all past events sorted according to their temporal sequence of *less than*. The issue is, therefore, whether an actually infinite regress of equivalent events, such as years, is metaphysically possible.

Like al-Ghazālī, Craig maintains that the most effective way in which to show that an actual infinite cannot exist in the real world is through thought experiments that illustrate the absurdities that would result if an actual infinite were to be instantiated in reality (Craig 1979:82; Craig and Sinclair 2012:108). I shall mention one such example. Craig (in Craig and Sinclair 2012:108–110) asks us to consider David Hilbert's so-called 'Hilbert's Hotel' thought experiment[6]: Imagine a hotel with an infinite number of rooms, with every room being occupied. Now, suppose that a new guest arrives and asks for a room. 'But of course!' declares the innkeeper, and he moves the guest in room no. 1 into room no. 2, the guest in room no. 2 into room no. 3, and so on. As a result of this displacement, room no. 1 becomes available and so it is given to the new guest. Oddly enough, however, before the guest arrived every room was occupied. Furthermore, although there is one more guest in the hotel, the number of guests in the hotel has not changed, the number has remained infinite!

Suppose further that an infinite number of new guests arrive at the hotel, each asking for a room. 'Of course!' declares the innkeeper, and he moves the guest in room no. 1 into room no. 2, the guest in room no. 2 into room no. 4, the guest in room no. 4 into room no. 6, and so on. Consequently, each guest receives an even numbered room, and all the odd numbered rooms become available, which allows the innkeeper to move every new guest into a vacant room. However, before all the new guests arrived all the rooms were occupied! Once again, the number of guests in the hotel remains identical to the number of guests in the hotel *before* the infinity of new guests arrived.

The situation could become more peculiar if some guests leave the hotel. For example, if the guest in room no. 1 departs, there would still be an infinite number of guests in the hotel. Consequently, infinity minus one equals infinity. Again, if each guest in an odd numbered room departs then, although an infinite number of guests have left, the number of guests in the hotel remains exactly the same, namely, infinity. Thus, infinity minus infinity equals infinity. However, if the guests in room numbers 4 and above (i.e., the guests in room numbers 4, 5, 6, … *ad infinitum*) depart, then there would be three guests only remaining in the hotel—those in room numbers 1, 2, and 3. In that case, infinity minus infinity equals three. However, this results in three inconsistent situations:

1. Infinity minus one equals infinity ($\aleph_0 - 1 = \aleph_0$).
2. Infinity minus infinity equals infinity ($\aleph_0 - \aleph_0 = \aleph_0$).
3. Infinity minus infinity equals three ($\aleph_0 - \aleph_0 = 3$).

This, in turn, illustrates that, when it comes to an actually infinite number of objects in the real world, one may subtract equal quantities from equal quantities and yet reach different results. After discussing Hilbert's Hotel, Craig (in Craig and Sinclair 2012:109) asks, 'Can anyone believe that such a hotel could exist in reality?'

[6]George Gamow (1947:17–18) accredits this thought experiment to David Hilbert (1862–1943), the distinguished mathematician of the nineteenth century.

According to Craig, 'Hilbert's Hotel is absurd. However, if an actual infinite were metaphysically possible, then such a hotel would be metaphysically possible. It follows that the real existence of an actual infinite is not metaphysically possible' (Craig and Sinclair 2012:110). Thus, Craig concludes that an actual infinite cannot exist in reality.

Finally, Craig maintains that the second premise is obvious because 'if there has been a sequence composed of an infinite number of events stretching back into the past, then the set of all events in the series would be an actually infinite set' (Craig and Sinclair 2012:115). Thus, an infinite temporal regress of events cannot exist and the universe began to exist.

6.4.2 Argument Based on the Impossibility of the Formation of an Actual Infinite by Successive Addition

Craig's second philosophical argument that supports premise (2) is formulated as follows:

1. A collection formed by successive addition cannot be an actual infinite.
2. The temporal series of events is a collection formed by successive addition.
3. Therefore, the temporal series of events cannot be an actual infinite (Craig and Sinclair 2012:117).

This argument does not deny the existence of an actual infinity but, rather, it denies that it is possible to create an actual infinite collection by adding one member after another at a later time. Craig maintains that this appears obvious as, for any finite collection c, c will remain finite once a new member has been added (Craig 1979:103–104; Craig and Sinclair 2012:117–118). However, the process of adding another member to a collection cannot be completed and this will hold true even if there is an infinite amount of time in which to perform the process. Craig illustrates this as follows:

> Suppose we meet a man who claims to have been counting down from infinity and who is now finishing: …, −3, −2, −1, 0. We could ask, why did he not finish counting yesterday or the day before? By then an infinite time had already elapsed, so that he has had ample time to finish. Thus, at no point in the infinite past should we ever find the man finishing his countdown, for by that point he should already be done! … But … this contradicts the hypothesis that he has been counting from eternity (Craig and Sinclair 2012:122).

Therefore, according to Craig, to form an actual infinite by never beginning yet arriving at an end is just as impossible as to begin at some point and then try to arrive at infinity. Since the collection of past events is formed by successively adding one event after another in time (given the A-theory of time), Craig concludes that the past must be finite.

6.4.3 *Scientific Arguments in Favour of a Finite Universe*

Craig argues that, apart from philosophical arguments, the second premise may be supported by two remarkable scientific confirmations, namely, the expansion of the universe and the thermodynamic properties of the universe (see Craig 1979:110–140; Craig 2008:125–150). Because I will investigate in Chap. 9 whether modern cosmology supports premise (2), I will simply discuss Craig's *method* of argument at this point.

According to Craig's first scientific argument, the expansion of the universe supports a cosmic beginning. Craig begins by showing how Einstein's General Theory of Relativity (GR), both Friedmann and Lemaître's formulations of GR, and Hubble's discovery all support the view that the universe is expanding. Having done this, Craig argues that the Standard Hot Big Bang Theory (or Standard Model) and the Borde-Guth-Vilenkin theorem both strongly suggest that the universe had an absolute beginning a finite time ago. Craig then evaluates the various other cosmological theories, such as the steady state model, oscillating models, vacuum fluctuation models, chaotic inflation models, quantum gravity models, and string cosmological models, and concludes that they all fail 'to avoid the absolute beginning of the universe predicted by the Standard Model' (Craig 2008:140). Since the Standard Model is the most verified model, Craig concludes that the expansion of the universe is strong evidence for a cosmic beginning.

According to Craig's second scientific argument, the thermodynamic properties of the universe support a cosmic beginning. Entropy is the measure of disorder in a closed system—the lower the entropy, the higher the order. According to the Second Law of Thermodynamics, the entropy in a closed system always increases. For example, the gas molecules in a vacuum sealed bottle will spread out evenly throughout the bottle as time passes. In other words, the molecules will never gather into one corner of the bottle and remain there. Now, it is well known that the universe started in a state of very low entropy and that, although the universe is moving towards a state of thermodynamic equilibrium, it is not yet in such a state. Thus, Craig argues:

> [I]f, given sufficient time, the universe will suffer heat death, then why, if it has existed forever, is it not now in a state of heat death? If in a finite amount of time the universe will inevitably come to equilibrium, from which no significant further change is physically possible, then it should already be at equilibrium by now, if it has existed for infinite time (Craig 2008:141).

Craig evaluates oscillating models, the baby universe theory, and the inflationary multiverse theory and maintains that they all fail to avoid the thermodynamic problem. Thus, since the universe is not now in equilibrium, Craig (2008:150) concludes that '[t]hermodynamics implies that the universe had a beginning'.

6.5 Conclusion: The Universe Has a Cause of Its Existence

Based on the conclusion that the universe has a cause, Craig (in Craig and Sinclair 2012:191–194) conducts a conceptual analysis to show that this ultra mundane cause of the universe must possess the following theologically significant properties. Craig argues as follows. First, the cause must, itself, be *uncaused* because, as the philosophical arguments for premise (2) show, there can be no infinite regress of causes. Furthermore, Occam's Razor instructs us to postulate causes only if necessary and, thus, we are justified in preferring one First Cause over a plurality of uncaused causes.[7] Second, the cause must be *beginningless* because an uncaused entity does not begin to exist. Third, the cause must be *changeless* because an infinite regress of changes is impossible while, fourth, this changeless cause must be *immaterial* because any material object is subject to constant change on both the molecular and atomic levels. Fifth, this cause must be *timeless* without the universe because this First Cause causes time itself to come into existence and, sixth, this cause must be unimaginably *powerful* because it brought all spacetime, matter and energy into being.

Finally, Craig argues that this cause must be *personal* (i.e. be a person) for at least three reasons. (1) There are two types of causal explanation only, namely, *scientific explanations* concerning physical laws and *personal explanations* concerning agents and their volitions. However, the origin of the universe cannot be a scientific explanation since there were no scientific laws before the universe. Accordingly, the cause of the universe may be explained only in terms of a personal agent and this personal agent's volition. (2) Two types of things only may be described as uncaused, beginningless, immaterial, timeless and spaceless, namely, an abstract object (such as a number) and an unembodied mind. However, abstract objects do not stand in any causal relations and, thus, cannot be the cause of anything. Therefore, this First Cause must be an unembodied mind. (3) Only 'personal, free agency can account for the origin of a first temporal effect from a changeless cause' (Craig and Sinclair 2012:193). A changeless and eternally existing object cannot cause a first event unless this object has the free will to do so and, thus, the cause of the universe must be a free, personal agent.

Based on these properties of the First Cause, Craig concludes:

> An uncaused, personal Creator of the universe exists who, sans the universe, is beginningless, changeless, immaterial, timeless, spaceless, and enormously powerful. … This, as Thomas Aquinas was wont to remark, is what everybody means by 'God' (Craig and Sinclair 2012:194).

[7] Occam's razor is accredited to William of Occam (c. 1285–1349) and it is the principle that an explanation of a thing should not include more assumptions than are necessary.

6.6 Craig's Unique Contribution

Although Craig's *kalām* cosmological argument is not totally unique, he advances the *kalām* cosmological argument in at least two distinct ways. First, he takes modern set theory into account in his defence of the impossibility of an actual infinite, ensuring that the *kalām* cosmological argument is in line with contemporary mathematics. Second, unlike his predecessors, Craig presents scientific arguments together with the philosophical arguments in support of a beginning of the universe. As a result, Craig has helped foster interaction between philosophers and physicists regarding the origin of the universe. We may also note that, as with Philoponus' arguments against an eternal universe, if we take Craig's arguments in support of premise (2) as a cumulative case (and Craig appears to present these arguments in a cumulative case fashion), then his *kalām* cosmological argument does not permit the possibility of an actual infinite. In the next chapter I shall evaluate whether the proponents of the *kalām* cosmological argument should argue against the possibility of an actual infinite.

References

Craig, W. L. (1979). *The kalām cosmological argument*. London: Macmillan.

Craig, W. L. (2000). *The tensed theory of time: A critical examination*. Dordrecht: Kluwer Academic.

Craig, W. L. (2008). *Reasonable faith: Christian truth and apologetics* (3rd ed.). Wheaton: Crossway Books.

Craig, W. L. (2013). The kalam argument. In J. P. Moreland, C. Meister, & K. A. Sweis (Eds.), *Debating Christian theism* (pp. 7–19). Oxford: Oxford University Press.

Craig, W. L., & Harris, K. (2008). Blackwell companion book. http://www.rfmedia.org/RF_audio_video/RF_podcast/Blackwell_Companion_Book.mp3. Accessed 27 Dec 2014.

Craig, W. L., & Sinclair, J. D. (2012). The Kalam cosmological argument. In W. L. Craig, & J. P. Moreland (Eds.), *The Blackwell companion to natural theology* (pp. 101–201). Oxford: Wiley-Blackwell.

Gamow, G. (1947). *One two three . . . infinity*. New York: The Viking Press.

Hackett, S. (1957). *The resurrection of theism: Prolegomena to Christian apology*. Chicago: Moody Press.

McDaniel, K. (2010). John M. E. McTaggart. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Fall 2010 ed.). http://plato.stanford.edu/archives/fall2010/entries/mctaggart/. Accessed 15 Apr 2013.

McTaggart, J. E. (1908). The unreality of time. *Mind, 17*, 457–474.

Smith, Q. (2007). Kalam cosmological arguments for atheism. In M. Martin (Ed.), *The Cambridge companion to atheism* (pp. 182–198). New York: Cambridge University Press.

Part II
A Defence of the *Kalām* Cosmological Argument

Chapter 7
Problems with the Infinity Argument

7.1 Introduction

Before defending the *kalām* cosmological argument, I will first investigate whether the proponents of the argument should argue against the existence of an actual infinite? Let us refer to the argument that denies the possibility of an actual infinite in order to show that the universe (or at least past time) must have had a beginning as the 'Infinity Argument'. Our question, then, is whether the Infinity Argument is a good argument in support of theism. The previous chapters revealed that three of the most important proponents of the *kalām* cosmological argument, namely, John Philoponus, al-Ghazālī, and William Lane Craig, use the Infinity Argument as proof that the universe began to exist. Therefore, it is not surprising that a few scholars associate the *kalām* cosmological argument with the Infinity Argument. For example, William L. Rowe defines the *kalām* cosmological argument as the type of cosmological argument that maintains 'it is *impossible* for an *actual infinite* to exist' (Rowe 2007:33 [original emphasis]). Bruce Reichenbach defines the argument in a similar fashion: '[T]he *kalām* argument … holds that an infinite temporal regress is impossible because an actual infinite is impossible' (Reichenbach 2013).

However, whether it is possible for an actual infinite to exist is controversial. For example, Graham Oppy (2006:143–144) maintains that it is possible to perform a supertask—an actually infinite sequence of operations accomplished in a finite duration of time. Hence, Oppy is of the opinion that actual infinities may exist. As does Oppy, Wes Morriston (2013:23–26) has problems with the Infinity Argument. According to Morriston, theists should affirm that the series of future events is actually infinite. If the future is endless and if God has determined each future event, then God must have determined an actually infinite number of events. Accordingly, Morriston maintains that proponents of the Infinity Argument are not 'entitled to conclude that no actual infinite whatever is possible' (Morriston 2013:23). John Byl raises another important objection to the Infinity Argument. According to Byl

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_7

(1996:78–79), if God is omniscient, then God's knowledge encompasses the endless future and, thus, an actual infinite exists in God's mind. Therefore, Byl believes omniscience entails an actual infinite. Douglas Groothuis (2011:222) also has doubt about prohibiting the actual infinite, for he claims that 'set theory poses a genuine problem' for the Infinity Argument. According to set theory, argues Groothuis, the actual infinite is a logically coherent entity, and whatever is logically coherent in the abstract may be instantiated in reality.

In this chapter I advance the concerns of the above mentioned scholars by arguing that the Infinity Argument is inconclusive because it depends on controversial metaphysical positions.[1] I show that the Infinity Argument is, first, incompatible with Platonism, second, incompatible with the standard definition of omniscience and, third, relies on a controversial metaphysical intuition. I will begin by offering a brief recapitulation of the Infinity Argument.

7.2 The Infinity Argument

As mentioned above, the Infinity Argument attempts to show that the universe had a beginning because (1) an actual infinite cannot exist and (2) an endless regress of past events is an actual infinite. In this context, the term '*x* exists' does not mean that *x* has mathematical existence or that *x* is a figment of our imagination but, rather, it means that *x* exists ontologically or is part of the real world. Accordingly, we may formulate the Infinity Argument as follows:

1. An actual infinite cannot exist.
2. If the regress of events is beginningless, it is an actual infinite.
3. Therefore, the regress of events is not beginningless.

This argument denies the existence of an actual infinite but not the existence of a potential infinite. You may recall that the crucial difference between the actual infinite and the potential infinite is that the latter is not a completed totality whereas the former is. In defence of (1), many proponents of the *kalām* cosmological argument, most notably Craig, use the Hilbert's Hotel thought experiment to show that certain alleged absurdities would result if an actual infinite were metaphysically possible (see Craig and Sinclair 2012:108–110). Furthermore, as Craig (in Craig and Sinclair 2012:155) notes, (2) seems to be obviously true because 'if there has been a sequence composed of an infinite number of events stretching back into the past, then the set of all events in the series would be an actually infinite set'. Accordingly, the Infinity Argument concludes that an actually infinite temporal regress of events cannot exist and, thus, the universe had a beginning.

[1] This chapter advances the argument presented in Erasmus and Verhoef (2015).

7.3 The Infinity Argument and Platonism

7.3.1 What Is Platonism?

Platonism, also termed realism, refers to the view that abstract objects exist.[2] Abstract objects are unusually difficult to define. There is agreement, however, that abstract objects should be distinguished from concrete objects, and that every object that exists is either abstract or concrete.[3] But, how do abstract objects differ from concrete objects? J. P. Moreland (2003:376) presents the following definition of Platonism and abstract objects:

> Platonism entails a commitment to the existence of abstract objects, where 'abstract object' is straightforwardly ontological. In this sense, an entity is abstract just in case (a) it is not a person, and (b) it exists outside space and time in that it has no spatial or temporal location or duration. So understood, an abstract object is an immutable, necessary being.

Thus, an abstract object, according to Moreland, is any object that is not a person and is neither spatially nor temporally located or extended. For example, numbers, universals (such as properties; e.g. the property of *being green*), mathematical truths, and propositions (i.e. the content of sentences that are either true or false) are abstract objects. However, there are two problems with this definition of an abstract object. First, it implies that moments, events, and time itself are abstract objects. Something is temporally located if it exists at some moment, but a moment does not exist *at* some moment. Something is temporally extended if it exists at or over some event, but an event does not exist *at* some event. In addition, since time just is the sequence of events, time does not exist *at* some moment or event. However, as Joshua Hoffman and Gary S. Rosenkrantz (2003:47) note, philosophers agree that space, places, moments, events, and time are concrete objects.

Second, Moreland's definition implies that all abstract objects are timeless and this is controversial. Many philosophers believe that the truth value of a proposition is permanent; thus, propositions are timeless. Other philosophers argue to the contrary, namely, that the truth value of a proposition that is stated in tensed terms may change; thus, some propositions are temporal because they undergo intrinsic change. For example, the sentence 'Socrates is married to Xanthippe' expresses a proposition that was true during the fifth century BC when Socrates was married to Xanthippe, but became false once Socrates had died. Therefore, Moreland's definition does not offer a sufficient condition for being an abstract object.

How else may one explain what an abstract object is? Paul Copan and William Lane Craig (2004:168–170) offer a slightly different definition to that of Moreland. According to Copan and Craig, abstract objects are characterised by the following

[2]It should be noted that Platonism, as the view that abstract objects exist, is a contemporary view that does not necessarily reflect the beliefs of Plato (Balaguer 2014). Furthermore, I shall use the terms 'Platonism' and 'realism' synonymously.

[3]I use the term 'object' as the broadest count noun, synonymous with 'entity', 'item', and 'thing'.

three features. First, abstract objects are causally powerless and devoid of any causal relations. The number twelve, for example, does not cause bad weather; and bad weather does not cause an intrinsic change in the number twelve. Furthermore, 'causal impotence seems to be an essential feature of abstract objects' (Copan and Craig 2004:168). Thus, Copan and Craig maintain that there is no possible world in which abstract objects can affect something.

Second, abstract objects do not occupy space and are, thus, immaterial and space-less. If an abstract object were material or spatially extended, it could stand in causal relations with other material objects. Thus, because an abstract object is causally effete, it must be immaterial and space-less. Finally, Copan and Craig assert that, according to Platonism, most (if not all) abstract objects have necessary existence. If no universe at all existed, certain abstract objects would still exist, such as numbers, propositions, and properties. For example, both the proposition that 'no universe at all exists' and the property of *being a universe* would exist without the universe. Therefore, certain abstract objects exist in all possible worlds and, thus, exist necessarily.

In short, Copan and Craig define an abstract object as an object that is causally powerless, immaterial, and space-less, adding that most abstract objects exist necessarily. This definition, however, faces two problems. First, it does not account for space, places, moments, events, or time. According to Copan and Craig's definition, space and time are abstract because they are causally powerless, immaterial, and space-less.

Second, it does not seem that all abstract objects are causally powerless. Copan and Craig suggest that some abstract objects are mutable and temporal. As an example, they claim that the proposition that *George W. Bush is the president of the United States* intrinsically changed from being false to being true at Bush's inauguration in 2001 (Copan and Craig 2004:169). After offering a similar example regarding properties, they conclude, 'While all abstract objects are causally impotent and immaterial, some of them have potentialities and are arguably even mutable and temporal in their being' (Copan and Craig 2004:170).

The problem, however, is that a proposition that undergoes an intrinsic change enters a causal relation. For example, Bush's inauguration in 2001 caused the proposition that *George W. Bush is the president of the United States* to become true. If it were not for the event, the proposition would have remained false. Thus, an event may affect a proposition, and this is a causal relation. However, if causal inability is an essential attribute of abstract objects, as Copan and Craig argue, then propositions cannot undergo intrinsic change and so they must be timeless. It would, thus, appear that Copan and Craig are inconsistent because they claim that some abstract objects are mutable and temporal and yet their definition of abstract objects implies that all abstract objects are timeless and immutable.

Nevertheless, it seems 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 builds a time machine. 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 (such as that of David Lewis), 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.

It may be that Copan and Craig mean that, although an abstract object may be affected by something, it is causally inefficacious within the realm of concrete objects, that is to say, abstract objects cannot enter into causal relations with concrete objects. However, one could challenge this claim 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. Hence, Copan and Craig's definition of abstract objects is inadequate.

Despite the problems with the attempts to define abstract objects discussed above, I believe that, by adjusting these definitions slightly, we may achieve an adequate abstract-concrete distinction. I suggest that, for any object x, x is abstract iff it satisfies none of the following seven conditions, and x is concrete iff it satisfies at least one of the following seven conditions:

1. It is a person (whether physical, such as a human, or non-physical such as a soul, spirit, or God).
2. It is spatially extended.
3. It is a place.
4. It is space itself.
5. It is a time (i.e. a temporal instance, moment, or duration such as an event).
6. It is time itself.
7. It can bring something into existence.

This account of the abstract-concrete distinction avoids the problems discussed above. First, although space and places are space-less, they are concrete objects. Similarly, moments, events, and time are space-less and timeless and, yet, they are

concrete objects. Second, despite the fact that some propositions are mutable, they are abstract objects. Finally, even if an abstract object can stand in causal relations, it cannot bring something into existence, whereas some concrete objects can bring something into existence. In none of the cases discussed above do abstract objects bring something into existence. By '*a* brings *b* into existence at time *t*' I mean that (i) *a* causes *b* to come into existence at time *t*, (ii) *b* is temporally finite and 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 inability to bring something into existence is a necessary (although not sufficient) property of an abstract object.

Examples of abstract objects, thus, include a number, a universal, a property, a mathematical truth, and a proposition. Examples of concrete objects include a dog, a tree, a person, a mind, God, a body, an event, a space, a time, and the universe. Thus, Platonism is the view that *such* abstract objects exist.

7.3.2 Is the Infinity Argument Incompatible with Platonism?

The Infinity Argument denies the existence of an actually infinite number of objects, regardless of whether they are abstract or concrete. However, it is not at all clear how, according to Platonism, a finite number of abstract objects only exists. The following argument appears to show that Platonism entails an actual infinite:

1. The set of natural numbers $\mathbb{N}$ is infinite.
2. If numbers exist necessarily, the members of $\mathbb{N}$ are simultaneously present and so $\mathbb{N}$ is a completed totality.
3. Numbers exist necessarily.
4. Therefore, $\mathbb{N}$ is a completed totality.
5. Any infinite set that is a completed totality is *actually* infinite.
6. Therefore, $\mathbb{N}$ is actually infinite.
7. Therefore, an actual infinite exists.

Thus, by affirming the existence of numbers, the Platonist inadvertently affirms the existence of an actual infinite. Of course, the Platonist may deny premise (3) and argue that numbers are simply contingent beings. However, Chris Swoyer (1996:260) points out that most philosophers identify numbers with properties or necessary entities and this, in turn, requires 'an infinite collection of necessarily existing properties'. Most Platonists, therefore, believe that numbers exist necessarily and this, in turn, entails the existence of an actual infinite.

However, if Platonism entails an actual infinite, it would seem that an advocate of the Infinity Argument cannot be a Platonist. In response to this problem, the

Platonist may claim that the Infinity Argument concerns the concrete infinite only, with the 'concrete infinite' being distinguished from the 'abstract infinite'. The former denotes an actually infinite set of concrete objects, while the latter denotes an actually infinite set of abstract objects. Therefore, the Platonist may argue that a concrete infinite does not exist or is impossible while an abstract infinite exists or is possible.

For example, Moreland (2003), who endorses both Platonism and the Infinity Argument, rejects the concrete infinite only and not the abstract infinite. Moreland claims that an actually infinite number of concrete objects cannot exist in the real world, even though there exists an actually infinite number of abstract objects. Therefore, Moreland (2003:380) suggests that, instead of claiming that 'An actually infinite number of things cannot exist', proponents of the *kalām* cosmological argument should rather claim that 'An actual infinite number of finite, contingent entities that (1) can be added to or subtracted from a set and (2) are spatially (or spatio-temporally or temporally) extended cannot exist'. Moreland (2003:380) explains further:

> An abstract object cannot be added to or subtracted from anything, so they are not proper candidates for members of sets included in thought-experiments employed against the existence of actual infinite collections. Further, abstract objects are neither spatially (or temporally) located or extended, so there is no need to find room for them next to each other or at some other location. And [this reformulated statement] allows one to accept [the] claim that the denial that a whole is greater than any of its proper parts generates 'all sorts of absurdities … when one tries to translate that theory to reality'.

Therefore, according to Moreland, the reformulated statement has the benefit of allowing the abstract realm to be infinite, while denying an actually infinite number of past events.

However, Moreland's suggestion is untenable. According to Moreland, absurdities (such as those illustrated by Hilbert's Hotel, or al-Ghazālī's infinite celestial revolutions thought experiment) would result if an actual infinite were instantiated in the real world, but no such absurdities would result within the realm of abstract objects. But it is difficult to justify why the realm of abstract objects is exempt from such absurdities. What, exactly, makes abstract objects improper 'candidates for members of sets included in thought-experiments employed against the existence of actual infinite collections?' Indeed, it seems that abstract objects may be elements of sets or collections in a thought experiment employed against the actual infinite. Consider, for example, the following thought experiment.

Suppose Jones and Smith possess identical knowledge. All that Jones and Smith know is the following actually infinite series of mathematical equations: $1 + 1 = 2$, $1 + 2 = 3$, $1 + 3 = 4$ and so on *ad infinitum*. Now suppose that Smith forgets every second mathematical equation in the series and no longer knows that $1 + 2 = 3$, $1 + 4 = 5$, $1 + 6 = 7$ and so on *ad infinitum*. Nevertheless, Smith still knows an actually infinite number of propositions. Hence, Jones knows an infinite number of propositions that Smith does not know, yet they both know *exactly* the same amount of propositions. Therefore, infinity minus infinity equals infinity. But suppose that Smith forgets all but the first three equations he previously

knew and now knows three propositions only. Consequently, infinity minus infinity equals three. However, according to the advocates of the Infinity Argument, this is absurd because how can infinity minus infinity equals infinity, yet infinity minus infinity equals three? This thought experiment illustrates that the abstract infinite is not exempt from the apparent absurdities because one may subtract equal amounts of abstract objects from equal amounts but reach different results.

The illustration could become even more bizarre. For, suppose that Jones somehow becomes omniscient, acquiring knowledge of all true propositions (which we will assume amounts to an actual infinite). In this case, Jones knows an actually infinite number of propositions, which is the exact same number of propositions he knew before he was omniscient. Thus, a non-omniscient person may know the identical number of propositions that an omniscient person knows!

The underlying reasoning in this thought experiment, i.e. that subtracting from the actual infinite results in genuine absurdities, parallels the thought experiments used in the Infinity Argument. However, I shall not try to examine whether this underlying reasoning successfully shows the impossibility of an actual infinite. Nevertheless, if we assume that it does, then the thought experiment about infinite knowledge discussed above successfully shows that absurdities would result if the abstract infinite were to exist. Accordingly, the Platonist proponent of the Infinity Argument faces a problem as the argument invalidates the view that an actually infinite number of abstract objects exist. Therefore, the Platonist who wishes to maintain that the Infinity Argument is sound may choose one of at least four options:

(A1) Affirm Platonism and declare (i) that a concrete infinite is impossible, (ii) that an abstract infinite is possible, and (iii) that this will eventually be proved.
(A2) Affirm Platonism and try to show that the realm of abstract objects is free from the absurdities concerning infinity.
(A3) Affirm Platonism and assert that there exist only a finite and not an actually infinite number of abstract objects.
(A4) Reject Platonism.

The first choice is undesirable because the Platonist must, at least, show why the above thought experiment about infinite knowledge fails. Without any arguments in favour of the possibility of an abstract infinite, it remains more plausible that the existence of the abstract infinite is as impossible as the concrete infinite. The second choice may be warranted if the Platonist could show that the realm of abstract objects is impervious to the seeming metaphysical absurdities associated with an actual infinity. However, it is unclear how one could achieve this. The third choice requires abstract objects to be contingent and not necessary entities, and this the Platonist will probably criticise as scarcely credible, arguing that a world without abstract objects is incomprehensible. However, as noted above, if numbers exist necessarily, the series of natural numbers would be actually infinite. Therefore, it appears that the fourth choice is the best choice for the proponents of the Infinity Argument and this, of course, implies that Platonism is incompatible with the Infinity Argument. We thus have good reason to believe that it is not possible for a theist to advocate both Platonism and the Infinity Argument.

7.4 The Infinity Argument and Omniscience

7.4.1 What Is Omniscience?

Omniscience is the attribute of being all-knowing. According to theism, God alone is omniscient; God's knowledge is perfect and no other being has the capacity to surpass His knowledge. The Jewish and Christian scriptures describe at least four features of God's knowledge. First, God knows everything that has occurred and is occurring throughout the universe. As Proverbs 15:3 states, 'The eyes of the Lord are in every place, keeping watch on the evil and the good'. Second, God knows our inner thoughts (Psalm 44:21; 1 Chronicles 28:9). For example, in Jeremiah 17:10, God declares, 'I the Lord search the heart and test the mind, to give every man according to his ways, according to the fruit of his deeds'. Third, God has foreknowledge of the entire future (Psalm 139:1–6; Acts 2:23; Romans 8:29; 11:2; 1 Peter 1:2). In fact, in the book of Isaiah God's foreknowledge is used to distinguish Him from the pagan gods (Isaiah 41:21–24), for only God makes known 'the end from the beginning and from ancient times things not yet done' (Isaiah 46:10). Thus, God knows each and every future event that will occur. Finally, God's knowledge is unsurpassable because He alone knows everything (Romans 11:33–36; Job 21:22; Psalm 147:5). Therefore, a theological description of omniscience may state that omniscience is the property of knowing every event and thought that has, is, and will occur.

Analytic philosophers offer a more technical definition of omniscience. In the philosophy of religion, the standard definition of omniscience states that omniscience is knowledge of all true propositions, where a proposition is the content of a sentence. Accordingly, for any person *S*, *S* is omniscient iff, for every proposition *p*, if *p* is true, then *S* knows *p*. Several philosophers believe this standard definition of omniscience to be problematic and, thus, they suggest variations of the standard definition.

For example, Hoffman and Rosenkrantz (2002:112) claim that the standard definition of omniscience faces the problem of indexicals, according to which each person has 'first-person' knowledge that is not available to any other person. Thus, a person cannot know an indexical or perspectival proposition that someone else asserts. For example, if Smith declares 'I am hungry', then only Smith can grasp this proposition, and no one else is able to believe or know this proposition (of course, others may know the proposition that *Smith is hungry* but, according to the problem of indexicals, this proposition is different to the proposition expressed by Smith. Smith alone can experience the first-person knowledge that *he* is hungry). Thus, Hoffman and Rosenkrantz (2002:124) redefine the standard definition of omniscience in terms of knowledge of any true proposition *p*, where either *p* can be grasped by different persons, or *p* can be grasped by *S* alone. Nevertheless, for the purposes of this study, we need not concern ourselves with all the issues associated with the standard definition of omniscience, and we shall accept the standard definition.

7.4.2 *Is the Infinity Argument Incompatible with God's Omniscience?*

An important objection to the Infinity Argument states that omniscience entails an actual infinite. More precisely, this objection claims that if God is omniscient, His knowledge must encompass an endless sequence of future events or abstract objects at once. However, the elements of an endless sequence may be known simultaneously only if the sequence is actually infinite. Therefore, either an actual infinite exists in God's knowledge, or God is not omniscient. This objection may be formulated in greater detail as follows:

(B1) If God is omniscient, He knows an actually infinite number of truths.
(B2) If God knows an actually infinite number of truths, an actual infinite exists.
(B3) Therefore, if God is omniscient, an actual infinite exists.
(B4) Therefore, if an actual infinite is impossible, God cannot be omniscient.
(B5) Therefore, the proponents of the Infinity Argument face the following dilemma: either an actual infinite cannot exist or God cannot be omniscient.

Premises (B2) to (B5) appear to be uncontroversial. (B2) claims that knowledge encompassing an actually infinite number of things entails an actual infinite because such knowledge implies that there exists an actually infinite number of things (such as propositions or truth values). Premises (B3) to (B5) follow from the previous premises. Thus, the controversial premise is (B1). Let us, therefore, examine two reasons put forward by the critics of the Infinity Argument to support (B1).

First, if God has foreknowledge and the future is endless, then God's knowledge of all future events must be actually infinite. Not all theists affirm that God has foreknowledge or that the future is endless. However, the scriptures mentioned above (i.e. Psalm 139:1–6; Acts 2:23; Romans 8:29; 11:2; 1 Peter 1:2; Isaiah 41:21–24; 46:10) clearly imply that God knows the future. Furthermore, an endless future is supported by three scriptural teachings, namely, (i) that all believers will receive physical, resurrected bodies,[4] (ii) that God will create a new physical earth,[5] and (iii) that the new earth is the eternal destination of believers.[6] Therefore, because a physical body and physical earth require the presence of time, and because believers will live forever, the future must be endless, making up at least a potentially infinite sequence of events. Thus, God knows the elements of an endless sequence of future events all at once.

However, by knowing all the elements of an endless sequence of future events at once, God's knowledge comprises a completed totality of infinitely many distinct truths. God must, therefore, know an actually infinite number of things. This

[4]Daniel 12:2, Luke 13:28–29, Matthew 5:29; 10:28, John 5:28–29, Philippians 3:21, 1 Corinthians 15, Romans 8:11.

[5]Isaiah 65:17, 2 Peter 3:13, Revelation 21:1.

[6]Revelations 22:1–5.

conclusion, as John Byl (1996:78–79) contends below, is inconsistent with the Infinity Argument:

> Let us suppose for the sake of the argument that [the] proof against the actual infinite were valid. It would seem that such a ban would have some awkward theological consequences. … If the future is indeed endless, then to an omniscient God it exists as a definite actual infinity, rather than as an indefinite potential infinity … [implying that] God has an infinite stock of memories or thoughts. … [However, if the] argument against an actual infinity is valid it implies that God's knowledge encompasses only a finite number of future events. This leads to the conclusion that either the future is finite, and there is a last event, or God's knowledge of the future is incomplete.

According to Byl, by prohibiting the actual infinite, the Infinity Argument backfires on the theist, who believes the future is endless, by posing a threat to God's omniscience and foreknowledge.

A theist may argue that omniscience excludes foreknowledge (as an advocate of open theism argues) and so God does not know an infinite sequence of future events. However, even in this case, the theist still faces the second argument in favour of (B1) and which states that if God is omniscient, He knows every mathematical truth, of which there is an actual infinite (Morriston 2002:156–160). For example, Wes Morriston declares, 'Since the number of mathematical truths (to say nothing of all the other eternal truths concerning properties and propositions and the like) is clearly infinite, it follows—does it not?—that an *actual* infinity is present in God's knowledge' (Morriston 2002:157 [original emphasis]). Consequently, God knows that $1 + 2 = 3$, $2 + 3 = 5$, $3 + 4 = 7$, … and so on *ad infinitum* and, thus, God knows an actually infinite number of mathematical truths.

It is not possible to assert that abstract objects do not exist and, thus, this second argument fails. For, although a mathematical truth or proposition is an abstract object, the argument does not require that abstract objects exist. A person may know, for example, that $1 + 2 = 3$ without asserting that this equation exists as an abstract object. In such a case, one's *thought* or *knowledge about* the equation exists, yet the equation itself does not exist. Hence, even if abstract objects do not exist, God's knowledge of an actually infinite number of mathematical truths would exist. The problem, then, is that, if omniscience entails an actual infinite, omniscience is incompatible with the Infinity Argument, and, thus, either an actual infinite does not (or cannot) exist or God is not (or cannot be) omniscient.

Is there a way out of this dilemma? As far as I am able to tell, the only way in which the proponents of the Infinity Argument may avoid the dilemma is to show that omniscience does not entail actually infinite knowledge. Craig (in Craig and Smith 1993:94) attempts to do this by suggesting that God's knowledge is non-propositional in nature. Craig's view of God's knowledge is similar to Aquinas' understanding that God has one simple object or representation through which He knows many things (*Summa Contra Gentiles*, 1.51–53). According to Craig, God's knowledge is simple because it lacks diversity—there is no distinction between God's knowledge and its object. Thus, God has one simple intuition of all reality, and this simple intuition may be broken down into propositions endlessly:

> Finite creatures break up the whole of what God knows into propositions which they know. But the fact that God's simple intuition can be broken down into a potentially infinite number of propositions does not entail that what God knows is an actually infinite number of propositions (in Craig and Smith 1993:94).

Hence, Craig maintains that because we, as human beings, use propositions to understand the world, we are forced to describe God's knowledge in terms of propositional knowledge. However, this fact does not commit us to thinking that God's knowledge of all reality is propositional in nature. In other words, God's knowledge is simple and has no divided structure or parts. Furthermore, according to Craig, propositions do not exist, let alone an actually infinite number of them. Our propositional representation of God's knowledge, then, simply helps us to understand God's non-propositional knowledge. Therefore, God's omniscience does not entail actually infinite knowledge.

Craig's argument, however, has four problems. First, if God's knowledge is non-propositional, then our propositional representation of God's knowledge is, technically, incorrect. When we claim, for example, that God knows that *the earth is round*, what we are claiming is incorrect because this is an attempt to describe in propositional terms and from the human perspective God's non-propositional knowledge. But how could such a feeble attempt be correct? Of course, Craig (and most theists) would insist that our propositional representation of God's knowledge is correct; God really does know that *the earth is round*. Unfortunately, we are offered no reason for how this can be the case if God's knowledge is non-propositional. Nevertheless, if we can *accurately* represent God's knowledge using propositions, then it becomes unclear why God's knowledge does not have a propositional structure. If our propositional representation of God's knowledge is accurate, then there is no reason to think that God lacks propositional knowledge; and if God lacks propositional knowledge, there is no reason to think that we can accurately represent God's knowledge using propositions. Thus, if God's knowledge can be represented as propositional knowledge, then we have good reason to think that God's knowledge *is* propositional.

Second, it is difficult to reconcile the view of God's simple intuition with the Christian doctrine of the Trinity, a doctrine that Craig affirms. According to Christianity, *God* is identical to *the Trinity*: God is one being, three persons (i.e. the Father, the Son, and the Holy Spirit). Now, if God's knowledge is simply one undivided intuition of all reality, then the three divine persons share the exact same intuition, that is, they have identical knowledge. However, this cannot be, since each member of the Trinity knows things (or has first-person knowledge) that the other members do not know (or have). For example, the Father alone knows that *I am the Father*, the Son alone knows that *I am the Son*, and the Holy Spirit alone knows that *I am the Holy Spirit*. Hence, since the divine persons do not have identical knowledge, God's knowledge must have parts or a divided structure. Perhaps, then, God's knowledge has three parts only, with each part itself being an undivided intuition and, thus, God's knowledge does not comprise an actually infinite number of parts or knowledge items. It is clear, however, that certain parts of each divine person's knowledge are the same. For example, the divine persons

have the exact same knowledge about the universe, since they all know that *the universe exists*, that *grass is green*, that *the earth is round*, etc. But if certain parts of the divine persons' knowledge are the same, while other parts are not, then each divine person's knowledge has a divided structure. It would, therefore, appear that the Trinity cannot have one simple, undivided intuition of all reality.

Third, God's undivided intuition is inconsistent with God's changing knowledge of tensed facts. In his discussion about God's relationship to time, Craig (2001a, chapter 4; 2001b:97–109) argues persuasively that, if the tense theory of time is true, then God, being omniscient, must know tense facts, such as 'It is raining in Cape Town at the moment' or 'It is now t_1'. As Craig notes, a being who knows tense facts is greater than a being who does not know tense facts and, since God is a maximally great being, He must know tense facts. Furthermore, Craig correctly notes that knowledge of tense facts is changing knowledge: '[A]ny being which *does* know tensed facts cannot be timeless, for his knowledge must be in constant flux, as the tensed facts known by him change' (Craig 2001b:99 [original emphasis]). Thus, since God knows tensed facts, His knowledge is constantly changing. For example, at time t_1 God knows that 'it is now t_1 and not t_2', and at t_2 God knows that 'it is now t_2 and not t_1'. However, the fact that God's knowledge changes as time elapses entails that God's knowledge has a divided structure, since God's knowledge (or part of His knowledge) at t_1 is different to His knowledge at t_2, which is different to His knowledge at t_3, and so on. Thus, God's knowledge or intuition must have a divided structure. It appears, therefore, that Craig's belief that God has an undivided intuition is inconsistent with his belief that God knows tensed facts.

Finally, why is it not possible for God's knowledge to be broken down into propositions that amount to an actual infinite as opposed to a potential infinite? If we are able to express God's knowledge using propositions, as Craig claims, then God can also express His knowledge using propositions. One way for God to do this is to bring into existence a being *S* who has propositional knowledge of all the events that will occur after the present moment. *S*'s propositional knowledge would then encompass God's foreknowledge and, thus, *S* would know an actually infinite number of things. Thus, the fundamental issue is not whether God's knowledge *is* propositional but whether God's knowledge (or a being's foreknowledge of the endless future) *can be* propositional, and the latter case seems possible.

In light of these four reasons, Craig's suggestion does not completely resolve the problem posed by God's omniscience. There is, however, another solution, albeit an unconventional one. One may avoid the conclusion that omniscience entails actually infinite knowledge by showing that omniscience is, in fact, the ability to identify the truth value of any proposition by consciously thinking about the proposition:

(C) God is omniscient iff, for any proposition *p*, (i) God can comprehend *p* and (ii) if God consciously thinks about *p*, then God will immediately identify the truth value of *p*.

According to (C), for God to know any true proposition *p* means that, if God thinks about *p*, God will accept *p* as true. This is similar to human knowledge. For example, if a person accepts the proposition that *Socrates was married to*

Xanthippe as true if he or she consciously thinks about it, we then declare that he or she knows this proposition. Likewise, God knows that *Socrates was married to Xanthippe* because, if God consciously thinks about this proposition, God will accept it as true. However, unlike human beings, God's knowledge is not based on discursive reasoning, which involves formulating conclusions by inference from premises. Instead, God immediately knows the truth value of a proposition when considering it.

As noted above, because the Infinity Argument is incompatible with Platonism, the proponents of the Infinity Argument must deny the existence of abstract objects. Consequently, the proponents of the Infinity Argument must view abstract objects as being similar to fictional characters that one may think about although they do not exist. For example, one may talk about the fictional detective Sherlock Holmes even though 'Sherlock Holmes' refers to nothing more than an idea in the mind. In that case, God may construct mental images denoting such fictional propositions, mathematical equations, numbers, or future events without these objects existing independently of God's conscious thought. An actual infinite may be present in God's mind only if God consciously thinks about an actually infinite number of things all at once.

Now, if we affirm both that abstract objects do not exist and that (C) accurately describes God's knowledge, then it is possible that God is consciously entertaining only a finite number of ideas at any moment (or in some timeless state). Moreover, if God is temporal, His cognitive state may change endlessly, allowing God to have a potentially infinite number of thoughts. Consequently, according to (C), God's knowledge is not actually infinite but potentially infinite, for God may endlessly construct mental ideas of fictional propositions without necessitating an actual infinite.

This solution has the benefit of defining omniscience in such a way that it does not entail an actual infinite. However, it faces at least three problems.[7] First, one must explain why God is, at any moment or in some timeless state, entertaining those thoughts that He is entertaining and not entertaining other thoughts? Why

[7] Andrew Ter Ern Loke (2016) raises another objection to (C), namely, that it requires God's knowledge to be occurrent. If one's knowledge of a true proposition *p* is *occurrent*, then one knows *p* only while one is consciously thinking about *p*. However, if one's knowledge of *p* is *dispositional*, then although one need not constantly think about *p* to know *p*, one must have consciously thought about *p* at least once. So, for example, the proposition that 'I am thinking about the nature of omniscience' can only be known occurrently, while the proposition that 'the earth is round' can be known dispositionally. However, *pace* Loke, (C) does not imply that God's knowledge is occurrent. Rather, (C) removes the limitations of occurrent and dispositional knowledge. According to (C), for God to know some proposition *p*, God must neither constantly think about *p* nor have thought about *p* before but, rather, God must have the ability to identify the truth value of *p*. To be sure, (C) is an unusual account of omniscience–but no more unusual than the account of an undivided intuition of all reality–because it is very unlike the accounts of human knowledge discussed by epistemologists. However, we should expect the nature of God's knowledge to differ from the nature of human knowledge and, thus, (C) is an account of omniscience worth exploring. For a more detailed response to Loke, see Erasmus (2017).

would God be eternally thinking about, for example, the truth of $2 + 1 = 3$ but not the truth of $2 + 2 = 4$? Or, before His creative decree, if God were thinking about only some of the potentially infinite possible worlds He could create, how did God then decide which world to create?

In response, one may claim that God's divine nature entails that He refrain from entertaining unnecessary thoughts while entertaining those thoughts that are best for Him to entertain. Furthermore, because God does not use discursive reasoning with which to judge the truth value of a proposition, God immediately knows whether a proposition is true simply by considering the proposition. Thus, God does not *decide* between various alternatives but, instead, He is instantly aware of the best alternative without having to consider all the alternatives. Therefore, God need not compare every possible world with its entire future to decide which world to actualise. Instead, through His divine intuition, God would be eternally aware that it is good for Him to actualise this world. Of course, if God had compared every possible world to decide which world to actualise, He would have reached the same conclusion, which was to actualise this world. Nevertheless, the central point is that God is always aware of which action is best to perform without having to consider each of the actions He could perform. Likewise, God is always aware of the fact that He does not need to entertain thoughts other than those thoughts He is entertaining.

Second, one must explain why this solution does not render God extremely ignorant. If God is not consciously entertaining every idea He could entertain, God appears to be ignorant in the sense that there is an endless series of propositions of which He is consciously unaware. In response, one may highlight that, according to (C), for God to know the truth value of some proposition p does not mean that God is currently thinking about p, nor does it mean that God has thought about p before but, rather, that God will identify the truth value of p simply by considering p.[8] Therefore, God knows *everything*, and this fact does not render God extremely ignorant in any negative sense. Moreover, God's act of entertaining only some of the ideas He could entertain is not necessarily an imperfection. Someone who is able to immediately identify the truth value of any proposition appears to be greater than someone who lacks this ability. Similarly, someone who is entertaining only those ideas that are the best to entertain appears to be greater than someone who is not able to control his or her mental state and is engulfed in an infinite number of unnecessary thoughts. It is, therefore, perhaps a perfection, and not an imperfection for God to be aware that it is unnecessary for Him to think about an actually infinite number of things all at once.

Finally, this solution requires that one defend an unusual view of God's relationship to time. One must affirm that God is timeless without creation because, if God exists in a temporal state only and if past time is finite, both God and time began to exist. However, one must also affirm that, subsequent to creation, God is

[8] According to (C), for any proposition p, if God can immediately identify the truth value of p, then, whether God has thought about p before makes no difference to God's knowing p, for it is God's divine nature, not His previous considerations of p, that enable Him to see whether p is true or not.

temporal because, if God is timeless, His cognitive state cannot change and, thus, His knowledge is static and finite, not dynamic and potentially infinite. Hence, this solution implies that God is atemporal without creation and temporal subsequent to creation. If this solution is to be accepted, a view of God's eternity similar to the view above should be defended.

In light of these three problems, I believe that most theists would not endorse this solution to the problem posed by God's infinite knowledge. It is far simpler to understand omniscience in terms of the standard definition (i.e. for any person *S*, *S* is omniscient iff for every proposition *p*, if *p* is true, then *S* knows *p*) while affirming that an actual infinite may be present in the mind or knowledge of God. I submit, therefore, that the Infinity Argument is incompatible with the standard definition of omniscience.

7.5 The Infinity Argument and Metaphysical Intuitions

A final problem in respect of the Infinity Argument is that it does not rely on pure logical or mathematical modality but, rather, it relies on our intuitions about what is metaphysically possible and impossible. Craig and Sinclair (2012:106) acknowledge this:

> The fact that the [Infinity Argument] is framed in terms of metaphysical modality also has an important epistemic consequence. Since metaphysical modality is so much woollier a notion than strict logical modality, there may not be the sort of clean, decisive markers of what is possible or impossible that consistency in first-order logic affords for strict logical modality. Arguments for metaphysical possibility or impossibility typically rely upon intuitions and conceivability arguments, which are obviously much less certain guides than strict logical consistency or inconsistency.

As we have seen, the Infinity Argument hinges on the metaphysical intuition that an actual infinite is impossible because, if an actually infinite number of objects could exist in the real world, then an 'equal' quantity could be subtracted from an 'equal' quantity and yet produce different results. The problem, however, is that this intuition concerns finite quantities and not infinite quantities. In fact, many mathematicians and philosophers do not share this intuition, claiming that finite sets behave in a very different way to infinite sets. Unlike in the case of finite sets, subtraction with infinite sets is not well-defined and, thus, it leads to different answers based on which members of the set are 'subtracted' or taken away. However, this is not a logical contradiction. As James East (2013:433) argues,

> If actual infinite collections were to exist, then they would naturally have properties that were not shared by finite collections. … The story of Hilbert's Hotel simply highlights … such [a] property that distinguishes actual infinite collections from finite ones: just knowing that an infinite subcollection has been removed from an infinite collection of objects does not allow one to determine how many objects remain. But this property itself does not entail that actual infinite collections are impossible.

However, since the actual infinite is not logically impossible, and since we should not expect out intuitions about finite sets to apply to infinite sets, it is unclear why the Infinity Argument demonstrates a real metaphysical impossibility. Accordingly, the Infinity Argument is not the strongest argument in favour of the premise of a beginning of time, for it will convince only those who share the argument's metaphysical intuitions.

7.6 Conclusion

I have discussed three problems with the Infinity Argument. First, the argument is incompatible with Platonism and, thus, (i) it will not convince those Platonists who believe that they have good arguments for Platonism and (ii), if the Infinity Argument is to succeed, its proponents must take on the difficult task of arguing against Platonism. Second, the Infinity Argument is incompatible with the standard definition of omniscience and this, in turn, forces the proponents of the Infinity Argument to creatively redefine omniscience, which could be undesirable from a theological perspective. Finally, the argument relies on an apparent metaphysical intuition about the actual infinite that is both obscure and controversial. Therefore, I suggest that, regardless of whether the Infinity Argument is sound, the proponents of the *kalām* cosmological argument would profit from replacing the Infinity Argument with an argument that does not deny the possibility of any actual infinite whatsoever but simply denies the possibility of an actually infinite *regress of past events*. In the next chapter I defend three such arguments.

References

Balaguer, M. (2014). Platonism in metaphysics. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Spring 2014 ed.). http://plato.stanford.edu/archives/spr2014/entries/platonism/. Accessed 20 May 2015.

Byl, J. (1996). On the kalam cosmological argument. In J. van der Meer (Ed.), *Facets of faith and science* (Interpreting God's action in the world, Vol. 4, pp. 75–90). Lanham: University Press of America.

Copan, P., & Craig, W. L. (2004). *Creation out of nothing: A biblical, philosophical, and scientific exploration*. Grand Rapids: Apollos/Baker Academic.

Craig, W. L. (2001a). *God, time, and eternity: The coherence of theism II: Eternity*. Dordrecht: Kluwer Academic.

Craig, W. L. (2001b). *Time and eternity: Exploring God's relationship to time*. Wheaton: Crossway Books.

Craig, W. L., & Sinclair, J. D. (2012). The kalam cosmological argument. In W. L. Craig & J. P. Moreland (Eds.), *The Blackwell companion to natural theology* (pp. 101–201). Oxford: Wiley-Blackwell.

Craig, W. L., & Smith, Q. (1993). *Theism, atheism, and big bang cosmology*. Oxford: Clarendon Press.

East, J. (2013). Infinity minus infinity. *Faith and Philosophy, 30*(4), 429–433.

Erasmus, J. (2017). Loke on the infinite god objection. In *Sophia*. http://link.springer.com/10.1007/s11841-017-0606-9. Accessed 15 Aug 2017.

Erasmus, J., & Verhoef A. H. (2015). The kalām cosmological argument and the infinite God objection. *Sophia, 54*(4), 411–427.

Groothuis, D. (2011). *Christian apologetics: A comprehensive case for biblical faith*. Downers Grove: IVP Academic.

Hoffman, J., & Rosenkrantz, G. S. (2002). *The divine attributes*. Oxford: Blackwell Publishers.

Hoffman, J., & Rosenkrantz G. S. (2003). Platonistic theories of universals. In M. J. Loux, & D. W. Zimmerman (Eds.), *The Oxford handbook of metaphysics* (pp. 46–74). Oxford: Oxford University Press.

Loke, A. T. E. (2016). On the infinite God objection: A reply to Jacobus Erasmus and Anné Hendrik Verhoef. *Sophia, 55*(2), 263–272.

Moreland, J. P. (2003). A response to a platonistic and to a set-theoretic objection to the kalam cosmological argument. *Religious Studies, 39*, 373–390.

Morriston, W. (2002). Craig on the actual infinite. *Religious Studies, 38*, 147–166.

Morriston, W. (2013). Doubts about the kalam argument. In J. P. Moreland, C. Meister, & K. A. Sweis (Eds.), *Debating Christian theism* (pp. 20–32). Oxford: Oxford University Press.

Oppy, G. (2006). *Arguing about gods*. New York: Cambridge University Press.

Reichenbach, B. (2013). Cosmological argument. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Spring ed.). http://plato.stanford.edu/archives/spr2013/entries/cosmological-argument/. Accessed May 11, 2015.

Rowe, W. L. (2007). *Philosophy of religion: An introduction* (4th ed.). Belmont: Wadsworth.

Swoyer, C. (1996). Theories of properties: From plenitude to paucity. *Noûs, 30*(Supplement: philosophical perspectives, 10, metaphysics, 1996), 243–264.

Chapter 8
Philosophical Arguments for a Beginning

8.1 Introduction

The previous chapters explored three of the most important versions of the *kalām* cosmological argument. The chapters also discussed several problems with the Infinity Argument, which is perhaps the most common argument used by the proponents of the *kalām* cosmological argument. In the rest of the book I defend a version of the *kalām* cosmological argument that does not rely on the Infinity Argument. I symbolise this version of the *kalām* cosmological argument as follows:

1. The universe came into existence.
2. If the universe came into existence, then God brought it into existence.
3. Therefore, God brought the universe into existence.

In this chapter I defend premise 1 by, first, defining the two key terms 'universe' and 'came into existence' and, second, offering three philosophical arguments in favour of premise 1. Then, in the following chapter I evaluate whether modern cosmology gives us reason to doubt the truth of premise 1. Finally, in Chap. 10 I present a defence of premise 2.

8.2 The Key Terms in Premise 1

8.2.1 'Universe'

I will use the term 'universe' to denote all space, time (or spacetime), matter, and material objects. But what exactly are space, time, matter, and a material object? There are two different views of space and time (or spacetime), namely, substantivalism and relationism. Those who hold to these two views usually regard

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_8

space and time as united in a four-dimensional continuum known as spacetime. However, I shall define space and time separately in order to provide a better understanding of the nature of each than may otherwise have been the case.

Substantivalism holds that space is a substance that is able to exist by itself, independent of material objects. Space is the container in which material objects can exist and move—an invisible substance that forms the 'empty spaces' between objects. On the other hand, relationism denies that space is an entity that may exist without material objects. Instead, space is seen as a relation because it denotes the relations between material objects. In order to remain neutral on the nature of space, I shall define space as the three dimensional extent—whether a substance or relation—in which all matter and material objects exist and move.[1]

Time is a more difficult concept to define than space and we must first understand what we mean by an 'event' before we define 'time'. An event is any change in the world and, because change requires time, any event endures for some non-zero duration. Now, as in the case of space, substantivalism views time as an entity that may exist with no change. In this sense, time is 'the thing that makes change possible' and it is distinct from any event or sequence of events (Fiocco 2014:89). Relationism, however, states that no time exists without change; time is the set of temporal relations between things and, thus, it just is the sequence of all events ordered by the relation *earlier than*. Once again, I shall remain neutral on the debate as to whether time is an entity or relation because my argument is concerned solely with the sequence of events. Hence, for the sake of simplicity, I shall use the term 'time' synonymously with 'the temporal sequence of all events ordered by the relation *earlier than*'.

The term 'matter' is used in various ways. Sometimes 'matter' is defined as all atoms and, at other times, the term stands for all elementary particles (including all electrons, photons and quarks). Another common phrase is 'matter and energy' but this, unfortunately, suggests that energy is a physical entity that may exist without matter. However, energy is a *property* of matter—i.e. the property of being able to perform work, such as causing motion—that comes in various forms, such as rest mass energy (as described by $E = mc^2$) or kinetic energy. It is also common for energy to be associated with light or photons although a photon carries energy and is not energy itself. Therefore, to avoid confusion, by 'matter' I shall mean all entities that exist within space and time (or spacetime) and that form the fundamental

[1]There is, however, a good reason to favour substantivalism over relationism with regard to space: relationism is consistent with Special Relativity (SR) but it is inconsistent with General Relativity (GR), whereas substantivalism is consistent with both SR and GR (Maudlin 1993). Tim Maudlin (1993:199) notes that the geometrical structure of spacetime is given a priori in SR but not in GR. In GR the spacetime structure needs to be resolved to allow prediction. However, there is insufficient information in the collection of all relations between objects alone to resolve the geometry of the embedding spacetime in GR. Therefore, as Dean Zimmerman (2011:180) remarks, 'The relationalist needs a "plenum" of entities—a field of some kind—upon which to hang GR's web of spatiotemporal relations; and the best candidate for this field is very hard to distinguish from the kind of entity substantivalists have always wanted'.

building blocks of the natural world. In this sense, matter includes all elementary particles, fields and any other physical entities as yet unknown. A material object, then, is any object composed of matter. Therefore, the term 'universe' refers to all matter and material objects that exist within space and time (or spacetime) as well as space and time themselves.

8.2.2 'Came into Existence'

I will use the phrases 'came/come into existence', 'began/begins to exist', and 'had/has a beginning' synonymously. But, what does it mean for something to *come into existence*? To answer this question I must first say something about the different theories of time. As noted above (Sect. 6.2), there are two broad classes of theories of time: the A-theory (or the *tense* or *dynamic* theory) and the B-theory (or the *tenseless* or *static* theory). These non-descriptive names ('A-theory' and 'B-theory') are derived from John E. McTaggart's influential article, *The Unreality of Time* (1908). In this article, McTaggart distinguishes between two series of positions in time, which he arbitrarily terms the 'A-series' and the 'B-series'. Objects in the former are ordered according to the 'A-properties' of *being past*, *being present,* and *being future*, while objects in the later are ordered according to the 'B-relations' of *being earlier than*, *being simultaneous with*, and *being later than*. Thus, the A-series locates objects by tenses, while the B-series locates objects by dates. The A- and B-theories are characterised by their different interpretations of these properties and relations.

The most widely accepted version of the B-theory denies the reality of the A-series and states that the A-properties in sentences may be reduced to B-relations. For example, the sentence 'the year 1999 is in the past' spoken in the year 2017, in fact, means that 'the year 1999 is earlier than the year 2017'. Consequently, most B-theorists hold to *eternalism*, the view that there is no ontological distinction between the past, present, and future and that all times are equally real. The A-theory, on the other hand, states that the past, present, and future are distinct in some ontological, objective or mind-independent way. All times are not equally real because the present is (somehow) ontologically privileged. The most popular version of the A-theory is *presentism*, according to which only present objects (i.e. objects that are both temporal and present right now, where a *temporal object* is an object that cannot exist timelessly but must exist *at* some time) exist and no past or future temporal objects form part of the ontological inventory.

Naturally, then, eternalists and presentists disagree about the nature of temporal becoming. These philosophers distinguish between two senses of 'existence', namely, *present existence* and *ontological existence*. Something exists in the former sense if it is temporally located in the present or at the 'now', and it exists in the latter sense if it may be captured by an unrestricted ontological quantifier. According to the eternalist, ontological existence does not imply present existence, whereas the presentist claims that it does. For example, if 'exists_1' means 'is

present' and 'exists$_2$' means 'exists ontologically', then the eternalist would deny that *Socrates exists*$_1$ and affirm that *Socrates exists*$_2$, while the presentist would deny both propositions.

It is now possible to see why many proponents of the *kalām* cosmological argument presuppose the A-theory. Unlike the other types of cosmological arguments, many versions of the *kalām* cosmological argument—including the version that I will defend—attempt to show that the universe is contingent by showing that the universe came into being. Anything that comes into existence is clearly contingent (as opposed to eternal and necessary) for its non-existence is possible. However, only on the A-theory is it possible for the universe to really come into existence because, according to the B-theory, the universe exists as an eternal spacetime block with every event in the universe being equally real. Thus, I will hereafter presuppose the truth of the A-theory. Let us now analyse the notion of temporal becoming (i.e. of what it means for something to 'come into existence') according to the A-theory.

A common account of temporal becoming states that an object x comes into being at time t if and only if there is an earlier time at which x did not exist (see, for example, Grünbaum 1989:389–390). Let '$C(x,\ t)$' mean 'x comes into existence at time t', let '$E(x,\ t)$' mean 'x exists at time t', and let '$x\ <\ y$' mean 'time x is earlier than time y'. Accordingly, this account of temporal becoming may be expressed as follows:

$$\forall x, t \left\{ C(x,t) \equiv E(x,t) \wedge \exists t^* \left[\left(t^* < t \right) \wedge \neg E\left(x, t^* \right) \right] \right\} \tag{8.1}$$

The phrase 'at time t' is ambiguous because it could mean that t is either an instant, a duration, or time itself. However, something cannot come into existence at 'time itself' but, instead, something comes into existence only at some instant or over some duration. Therefore, to avoid this ambiguity, let I denote the attribute of *being an instant or a duration*. Accordingly, our account of temporal becoming should be adjusted as follows:

$$\forall x, t \left\{ C(x,t) \equiv It \wedge E(x,t) \wedge \exists t^* \left[It^* \wedge \left(t^* < t \right) \wedge \neg E\left(x, t^* \right) \right] \right\} \tag{8.2}$$

Equation (8.2) correctly captures the idea that something cannot come into existence if it already exists. However, since (8.2) implies that something cannot come into existence unless time already exists, and since there is no time prior to the universe, (8.2) implies that the universe cannot come into existence. Thus, it is more accurate to say that some object x comes into existence iff x exists at some time that is *not* preceded by an earlier time at which x existed:

$$\forall x, t \left\{ C(x,t) \equiv It \wedge E(x,t) \wedge \neg \exists t^* \left[It^* \wedge \left(t^* < t \right) \wedge E\left(x, t^* \right) \right] \right\} \tag{8.3}$$

This account allows something to come into existence at t whether or not there was an earlier time $t^*\ <\ t$. However, there are two problems with (8.3). First, (8.3) does not accurately capture the notion of temporal becoming in terms of the A-theory because it is compatible with the B-theory, that is to say, the B-theorist may

understand temporal becoming in terms of (8.3). Recall the two different senses of 'existence': exist_1 (which means 'is present') and exist_2 (which means 'exist ontologically'). Now, the B-theorist may understand temporal becoming, not in the strict ontological sense, but simply as becoming present. Thus, the B-theorist may claim that, according to (8.3), a past finite universe came into existence_1 or became present even though it exists_2 eternally (since events exist_2 even if they are not present). Second, (8.3) implies that God came into existence. If God exists and created the universe a finite time ago, then time is finite and there is no past-infinite sequence of congruent time intervals or events at which God exists. Thus, according to (8.3), since God exists at t_0 (the first event in time) and there is no time prior to t_0, God came into existence. This conclusion is obviously unacceptable for the theist. Hence, to avoid the above mentioned problems, we will add to our analysis of temporal becoming the clause that, if x came into being, then x has not, does not, and cannot exist timelessly, that is to say, x cannot exist unless x is present. Let 'Ex' mean 'x exists' and let 'Fx' mean 'x is present', then:

$$\forall x, t \left\{ C(x,t) \equiv It \wedge (Ex \supset Fx) \wedge E(x,t) \wedge \neg \exists t^* \left[It^* \wedge \left(t^* < t \right) \wedge E\left(x, t^* \right) \right] \right\} \tag{8.4}$$

It is important to note that, although the new clause $Ex \supset Fx$ is compatible with x existing at the first moment in time, it does not imply that x can exist only if some past time exists. Thus, since this new clause restricts temporal becoming to entities that cannot exist without being present, it allows for God's existing timelessly without the universe and bringing the universe into being *ex nihilo*. Equation (8.4) is, I believe, a plausible account of the temporal becoming of temporal objects. However, (8.4) does not account for time itself coming into being. Time cannot come into existence at some instant or duration for time just is the temporal sequence of all instants, durations, or events. Therefore, we must distinguish between the coming into existence of *a temporal object* and the coming into existence of *time*. The nature of time differs greatly from the nature of a temporal object, which is an object (such as space, matter, and a material object) that exists at some time, and thus we should expect to have different accounts of temporal becoming for these two types of objects. Fortunately, we may define 'time (or an event) comes into existence' simply as 'time (or the event) comprises a finite sequence of congruent temporal intervals'. In other words, to say that time came into existence is to say that time had a beginning or a very first event, moment, or interval. We may now define the universe's coming into being as follows:

> The universe came into existence $=_{\text{.def}}$ Time comprises a finite sequence of congruent temporal intervals, and all space, matter, and material objects came into existence in terms of (8.4).

Hereafter, I will use 'the universe came into existence' in *this* sense. It is important to note that, in order to show that the universe came into existence, one merely has to show that time had a beginning, since the universe cannot exist in a timeless, unchanging state. I will now defend the first premise, namely, that the universe came into existence.

8.3 The Argument Based on Traversing Infinite Time

Our first argument against an eternal universe is based on Philoponus' argument about the impossibility of traversing the actual infinite. I will formulate the argument as follows:

1. If the universe did not come into existence, then the present event could not occur.
2. The present event is occurring.
3. Therefore, the universe came into existence.

What is the basis for thinking that the present event could not occur if the universe had no beginning? Well, a beginningless universe entails that the regress of past events has no beginning (or first event) and ends at a particular moment (which is the last event in the sequence). Let us call this regress the *beginningless past*. As Claude Gratton (2010:26) notes, the property of *being beginningless* causes the beginningless past to be actually infinite, and not merely potentially infinite. For, if the past were beginningless, an actually infinite number of events *have already occurred* prior to the last event in the sequence and, thus, a one-to-one correspondence exists between each event that has occurred and each member in the set of natural numbers. The beginningless past, then, is the temporal regress of events that (i) has no beginning, (ii) has an end, and (iii) is actually infinite.

Now, time has the following indisputable feature: for any event e in the temporal sequence of events, if e occurs then all the events prior to e, if any, must have occurred. Hence, if we define an event as one day (i.e. twenty-four hours), then, if today is occurring, yesterday must have occurred, and if yesterday occurred, the day prior to yesterday occurred, and so on *ad infinitum*. Thus, if time is beginningless, then, if today is occurring, an actually infinite number of days have occurred and infinite time has been traversed. The problem, however, is that an actually infinite sequence of congruent events (i.e. events of identical duration) cannot be traversed. To traverse a sequence means to go through the sequence completely and one member at a time. If a sequence has been traversed, each of its members has been singled out at a unique time. Thus, a traversed sequence is a completed totality. Accordingly, for any temporal sequence of events S, S has been traversed iff all the events in S have occurred one after another.

How, then, can an actually infinite sequence of congruent events be traversed if such a sequence is essentially an endless process? Consider, for example, someone trying to count through all the natural numbers one per second (i.e. 1, 2, 3, . . .). Can the person count through the entire collection of numbers one per second? Clearly not, for no matter how many numbers the person has counted, there will always be an infinite number of numbers still to be counted (i.e. for any number n that one counts, there will always be another number $n + 1$ yet to be counted). Therefore, it is impossible to traverse an actually infinite sequence of congruent events and, thus, if the universe did not come into existence, the present event could not occur.

There are five important objections to the above argument. First, Graham Oppy (2006a:143) objects that an actually infinite sequence of events can be traversed (or

formed by successive addition) because a supertask is clearly possible. A *supertask* is an actually infinite sequence of progressively shorter operations accomplished in a finite duration of time. To illustrate the possibility of a supertask, Oppy asks us to suppose that a ball is bouncing at one minute to twelve o'clock, and that both the time lapse between each bounce and the height of each bounce is halved with each bounce. Accordingly, the ball hits the floor at one minute to twelve, then at half a minute to twelve, then at quarter a minute to twelve, and so on until the ball stops bouncing at twelve. The ball, according to Oppy, has then completed an actually infinite sequence of bounces between one minute to twelve and twelve, thus accomplishing a supertask. Oppy concludes that 'In this example, we have a process—the bouncing of the ball—that plainly does form an actual infinite by successive addition. Consequently, … there are perfectly ordinary processes that involve formation of an actual infinite by successive addition in not obviously impossible worlds' (Oppy 2006a:143). Thus, according to Oppy, if a supertask may be traversed, then an actually infinite regress of past events may be traversed.

Oppy's argument is a *non sequitur* as the conclusion that an infinite past can be traversed does not follow from the claim that a supertask is possible. An actually infinite sequence of past events is not a supertask as it is a sequence of equal intervals that amount to an infinite duration, not progressively shorter intervals that amount to a finite duration. Oppy's argument, if successful, merely shows that a supertask is possible and not that an infinite past is possible. Therefore, one may grant the possibility of a supertask without conceding that an actually infinite sequence of *congruent* events can be traversed.

Second, Oppy (2006b:61) objects that, if a person never stops counting, then that person *does* count to infinity. In other words, given an infinite amount of time, an actually infinite sequence of events can be traversed if whatever is going through the sequence never stops trying to go through the sequence. But why think this? Oppy's answer is as follows: 'One counts to infinity just in case, for each finite number *N*, one counts past *N*. But unless one stops counting, one will eventually reach any given finite *N*' (Oppy 2006b:61). However, the problem with this argument is that it confuses *counting endlessly* with *having traversed an endless sequence*, the former representing a potential infinite and the later representing an actual infinite. The difference is that the process of counting endlessly is never complete and there will always be numbers that have not yet been counted, whereas having traversed an endless sequence means that one has already gone through each member in the sequence one at a time and no more numbers need to be counted. Accordingly, even if a person never stops counting, there will always be an endless sequence of numbers the person has not yet counted (because, for any given finite number n, even if the person eventually counts n, he or she still has to count all the numbers after n, such as $n + 1$, $n + 2$, and so on *ad infinitum*). Therefore, it is false that, if a person never stops counting, he or she will eventually traverse an actually infinite sequence.

Third, Stephen Puryear (2014, 2016) argues that we do not need to view time as a sequence of multiple discrete events. Instead, time may be viewed simply as one long, infinite event. In this case, one event only had to occur, namely, time itself.

This argument has two problems. In the first place, an event is any change from one state to another state. Hence, an event has a beginning and an end. This implies that time cannot be an infinite (beginningless) event. Moreover, if time is simply one undivided event, then what is constantly being added to time? Events? More time? Indeed, when tomorrow occurs, then time (as it is understood by Puryear) has *changed* into a longer event, but this change is itself an event. Thus, it is highly implausible that time itself is one infinite event; it is far more plausible that time is a sequence of events. In the second place, it is irrelevant whether time is one entity or comprises multiple entities or events, since we are arguing, essentially, that any duration that can be conceptually divided into discrete congruent events cannot be beginningless (because if such a duration is beginningless, it cannot be traversed). In addition, since time can be conceptually divided into discrete congruent events, time cannot be beginningless.

Fourth, Richard Sorabji (2006:221–222) objects that a beginningless sequence does not face the same difficulties as an endless sequence. The crucial difference between these two sequences, says Sorabji, is that, if the former has been traversed, it has only one terminus (i.e. a finish, which would be the present moment), whereas if the latter has been traversed, it has two termini (i.e. a start, which would be the present moment, and a finish, which would be some future moment). 'And [having two termini] is what prevents the future series of traversed years from being more than finite' (Sorabji 2006:222). Therefore, Sorabji concludes that, because a traversed sequence of past events has only one terminus, it can be traversed. Sorabji's objection is, however, not acceptable. What causes the impossibility of traversing an endless sequence of congruent events is not that it will have two termini once it has been traversed, but rather that it is actually infinite. Having two termini is neither a sufficient nor a necessary condition for being actually infinite, since a sequence is actually infinite iff it may be placed into a one-to-one correspondence with a proper part of itself. Hence, a sequence may be actually infinite whether it has one, two, or no termini. Therefore, since the set of each event in a beginningless past may be placed into a one-to-one correspondence with a proper part of itself, a beginningless sequence of past events is actually infinite and, thus, cannot be traversed.

Finally, several critics, such as Paul Draper (2011:174) and Wes Morriston (2013:26–27), try avoid the difficulties associated with traversing infinite time by insisting that, if the past is beginningless, an actually infinite sequence of events has *always* been traversed. For example, Morriston retorts,

> Well, yes, before the present event occurred, the event immediately prior to it must have occurred; and before it occurred, the one immediately prior to it must have occurred. … But it's hard to see what the problem is supposed to be, since on the hypothesis of a beginningless past each of those infinitely many events *has* occurred. When the present arrives, all of its (infinitely many) predecessors are past (Morriston 2013:27 [original emphasis]).

Thus, the objection is that, for any past event e, if the regress of events is beginningless, then e can occur because all events prior to e have occurred.

This objection is circular because it presupposes that an actually infinite sequence of events *has been* traversed to try to show that an actually infinite sequence of events *can be* traversed. Hence, the objection amounts to saying that an actually infinite past can be traversed if it has been traversed! But this response fails to refute the intuitive notion that an actually infinite sequence of congruent events can never be completed (or traversed). It is important to remember that we are dealing with a sequence of *congruent* events, whose members do not come into being or occur all at once, but occur one at a time with equal duration. In addition, because the set of events that must occur before the present event can occur is actually infinite, the process of events occurring before the present moment never ends. Therefore, the present moment can never be reached.

Furthermore, if an infinite temporal sequence that has a beginning cannot be traversed, then an infinite temporal sequence that has no beginning, but reaches an end, cannot be traversed. To illustrate this, suppose that the universe is eternal. Suppose also that Jones, who is immortal, has been video recording himself non-stop from eternity past. Now, suppose that Jones wishes to watch his entire life in reverse. Accordingly, he stops recording himself, plugs the video recorder into a television, and starts watching, in reverse and at normal speed, his recorded life beginning from the last recorded moment. Can Jones watch the entire recording of his life in reverse? Clearly not, for the same reasons offered above. However, if Jones is not able to watch the entire recording of his life, how could he record his entire life? If the one action is impossible, so is the other. Thus, the impossibility of traversing an infinite past stems from the properties of *being actually infinite* and *being congruent*, and has nothing to do with *being infinite in one direction only*.

Therefore, any actually infinite sequence of congruent events cannot be traversed and, thus, if the universe had no beginning, the present event could not occur. However, the present event is occurring—it has been reached. This is obvious. If we define an event as any year, then the current year is busy happening or, if we define an event as any day, then today is busy occurring. Consequently, the universe came into existence.

8.4 The Argument Based on Ungrounded Causal Chains

Our second argument is inspired by Laureano Luna's (2009a, 2009b, 2014) argument against ungrounded causal chains.[2] Our argument stems from the fact that time, or the temporal sequence of events, may be regarded as a causal chain of events in which each event, except the first (if it exists), is caused by or depends on prior events. However, if there is no first event, and if nothing outside the chain determines the events in the chain, then no event could have occurred. The argument may be stated as follows:

[2]I am indebted to Laureano Luna for his helpful suggestions in respect of the argument in this section.

(B1) Every causal chain has a first cause or a transcendent cause.
(B2) Time is a causal chain.
(B3) Therefore, time has a first cause or a transcendent cause.

This argument does not deny the possibility that the universe is eternal but, instead, it shows that the only way the universe can be eternal is if a transcendent (and, hence, supernatural) cause of the universe exists. Thus, if naturalism is true and no transcendent/supernatural entity exists, then time, or the universe, must have had a beginning. Thus, if this argument were to succeed, it would be of great value to the proponents of the *kalām* cosmological argument. Let us now defend the argument's premises.

8.4.1 Every Causal Chain Has a First Cause or a Transcendent Cause

Our key definitions are as follows. A *strict chain* is an ordered pair $(Q, <)$, where Q is a set with at least two members and $<$ is a strict total order on Q. Let '$C(x, y)$' mean 'x causes y', then a *causal law* L is a relation $R_L \subseteq Q \times Q$ in a non-empty set Q such that L is in effect in Q iff

$$\forall x, y \in Q\,[R_L(x, y) \supset C(x, y)]\,.$$

Accordingly, a *causal chain* $S = (Q, <)$ is a strict chain in which each member of Q, except the first member, if it exists, is caused by all $<$-prior members of Q, according to some causal law L:

$$\forall x, y \in Q\,[x < y \supset R_L(x, y)]\,.$$

We say that a causal chain S is *ungrounded* iff S lacks a first cause (or first item):

$$\forall x \in Q\,[\exists y \in Q\,(y < x)]\,,$$

And we say that S is *grounded* iff S has a first cause:

$$\exists x \in Q\,[\neg\exists y \in Q\,(y < x)]\,.$$

Now, the contents of a grounded causal chain are clearly determined by both its first cause and its causal law. However, can the contents of an ungrounded causal chain be determined *solely* by the chain's causal law? The answer is no—the causal law *together with* either a first cause or an external entity is what determines the contents of the chain. Intuitively, it is easy to see this because a causal law is not an object that causes the existence of other objects but, rather, it is merely a relation

that determines the causal relationship between objects. Without a first (or external) cause, a causal law simply results in an infinite regress of causal conditionals:

$$\begin{gathered}\ldots \\ p \supset q \\ q \supset r \\ r \supset s \\ \ldots\end{gathered}$$

However, since a conditional does not, by itself, entail its consequent (e.g. the conditional that 'if Jones throws the stone at the window, then the window will break' does not, by itself, entail that 'the window will break'), the infinite regress of conditionals, by itself, entails no consequent and without any consequent, there is no causal chain.

We may argue more formally in favour of this intuition as follows. Let S be a causal chain, let L be the causal law ruling S, let 'Ex' mean 'x exists or occurs', and let

$$P_Q = \{Ex | x \in Q\}.$$

L brings about a logical relation R_L between the members of P_Q such that

$$\forall x, y \left[L(x, y) \equiv R_L(Ex, Ey)\right].$$

R_L is a conditional relation that involves counterfactuals and, thus, it is stronger than the relation of material implication. However, R_L is not stronger than the relation of strict or necessary implication because causal laws could be contingent. We say that a relation R_1 is stronger than a relation R_2 iff

$$\forall x, y \left[R_2(x, y) \vDash R_1(x, y)\right],$$

where '$P \vDash Q$' means 'Q is a logical consequence of P'.

Now, we wish to determine whether R_L entails, by itself, its consequents (or each Ex in P_Q). (For simplicity, I will hereafter use the phrase 'self-entails' to mean 'entails, by itself'). We say that a relation R self-entails its consequents iff

$$\forall x, y \left[R(x, y) \vDash y\right].$$

Fortunately, in order to evaluate whether R_L self-entails its consequents, we simply need to evaluate whether the existence of some other relation R_S between the members of P_Q that is stronger than R_L self-entails each Ex in P_Q. This strategy is justified by the fact that, if L has certain causal powers, it has them analytically and, thus, with logical necessity, since L would not be L if it had different causal powers. Thus, if L self-entails the contents of Q, then R_S must self-entail each Ex in P_Q.

The stronger relation we choose is the strongest possible relation of implication, which is entailment (or logical consequence) or logically valid material implication (the difference being solely that the former holds between a set of propositions and a proposition while the latter holds between propositions. We may ignore this difference WLOG). We symbolise this relation by '$\vDash$'. Relation $\vDash$ is at least as strong as strict implication because '$\Box\,(p \supset q)$' states that q is true at all possible worlds at which p is true, whereas '$p \vDash q$' states that q is true in all logically possible states of affairs in which p is true, which includes all possible worlds. Therefore, relation $\vDash$ is at least as strong as R_L.

However, not even relation $\vDash$ self-entails the truth of its consequents:

$$\neg\forall x, y\,[(x \vDash y) \vDash y]\,.$$

To see that this is true, consider the case

$$(p \supset q) \vDash \neg\,(p \wedge \neg q)\,,$$

which is true regardless of the truth value of p and q. For example, let p be true and q be false, then the consequent is false even though the relation $\vDash$ holds. Hence, even if $\vDash$ holds between all propositions related by R_L, this would not self-entail any consequent of R_L. However, since $\vDash$ is stronger than R_L, by transitivity of $\vDash$, it follows that R_L also does not self-entail any of its consequents in P_Q. L being in effect in Q is the same as R_L holding between the corresponding members of P_Q. Therefore, L cannot cause, by itself, the existence or occurrence of any member of Q and, thus, a causal law cannot, by itself, determine the contents of its causal chain.

Therefore, any causal chain's content is determined by its causal law together with its first cause (if it exists) or a transcendent entity. The only way to escape this conclusion is to affirm that a causal law's content can be determined by its causal law *and chance*, that is to say, the chain can exist inexplicably and without sufficient reason. However, this move is inconsistent with even a weak version of the principle of sufficient reason (PSR) and, since I defend such a principle in Chap. 10, I do not find this move viable. Therefore, we may conclude that any causal chain must have a first cause/item or a transcendent cause.

8.4.2 Time Is a Causal Chain

It is clear that time has a causal structure, since each event causes its subsequent event and is determined by prior events, if there are any. Thus, in light of time's causal structure, we may define *time* as a causal chain $T = (Q_T, <_T)$, where Q_T is a set of events and $<_T$ is the order of temporal precedence. Each member of Q_T, except the first member, if it exists, is caused by all $<_T$-prior members of Q_T, according to some causal law L:

$$\forall x, y \in Q_T \left[x <_T y \supset R_L (x, y) \right].$$

The events in Q_T do not need to be of equal length or duration. Indeed, we could regard them as left-open time intervals (i.e. sets of temporal instants of the form $(x,\ y]$, where instant x is excluded and instant y is included) that shorten toward the past:

$$\ldots\ (-3.5,\ -3],\quad (-3,\ -2],\quad (-2,\ 0]$$

In this case, time is ungrounded (because the chain excludes a first instant), even though a finite amount of time has passed when measured in fixed units (such as an hour). If time is grounded, then the chain must have a closed first interval that includes the very first instant. Either way, it is clear that time is a causal chain.

8.4.3 Time Has a First Cause or a Transcendent Cause

It follows from (B1) and (B2) that time must have a first cause/event or a transcendent cause (or both). The only way that the universe can be eternal is if a transcendent entity, such as God, causes the events in time. If naturalism is true and no supernatural entities exist, then time (and the universe) must have had a beginning. As we have seen, the problem is essentially about determination, since a causal law's being in effect cannot, by itself, determine a specific causal chain. Therefore, we have good reason to believe that the universe either came into existence, has a transcendent cause, or both.

8.5 The Argument Based on the Paradoxes of Beginningless Time

Our final philosophical argument for a beginning of the universe stems from the determinate property of time, namely, that past events determine subsequent events and that the past is unchangeable. This argument is similar to our previous argument, for it ultimately shows that an ungrounded causal chain is paradoxical. I shall offer two thought experiments, which I shall call the 'gong peal paradox' and the 'persistent liar paradox', to illustrate the impossible situations that would result from beginningless time. Let us begin with the gong peal paradox.

8.5.1 The Gong Peal Paradox

This paradox is based on Luna's (2009a:304) gong peal paradox, which is based on José A. Benardete's (1964:259) gong peal thought experiment. The gong peal

paradox is as follows. Suppose that the universe had no beginning and that past time is infinite. Suppose further that Jones, who is immortal and has lived through the entire past, rings a gong peal every day at noon (which he has always been doing). Furthermore, suppose that the following is true:

(M) The gong peal is so loud that anyone who rings it is struck deaf permanently upon hearing the peal if and only if that person was not previously deafened by the peal.

(M) implies that Jones can become deaf only by hearing the peal.

Now, for any past day *d*, Jones must already have been deaf prior to ringing the gong peal on *d*. Why? Because Jones' act of ringing the gong peal on the day immediately prior to *d* ensures that Jones would be deaf on *d* (if Jones were not deaf before ringing the gong peal on the previous day, he would have become deaf upon hearing the peal that day). Therefore, Jones has been deaf throughout the entire past. However, if Jones were deaf before he rings the gong peal on any past day, no day exists on which he became deaf by hearing the peal. But Jones can become deaf only by hearing the peal. We are thus led to the following three inconsistent states:

1. Jones is deaf.
2. Jones can become deaf only by hearing the gong peal.
3. Jones has never heard the gong peal.

In view of the fact that these three states are inconsistent, the entire situation is logically impossible. But what produced this entire situation? The intuitive answer is the *beginningless-ness* of the temporal regress of past events (or that time is an *ungrounded* causal chain in which each event is determined by prior events). If time had a beginning, the contradiction would vanish because Jones would become deaf on the first day.

One might object that the paradox would not result if time were beginningless and Jones rings the peal on a *finite* number of days only. More precisely, it is the following two incompatible states that result in the impossible situation above:

(C1) For every day in time, a person *S* rings a gong peal that is so loud that *S* is struck deaf permanently upon hearing the peal iff *S* was not previously deafened by the peal.
(C2) Time is beginningless.

The objection, then, is that one may affirm (C2) while denying the possibility of (C1). The problem with this objection, however, is that (C1) is obviously possible if time were finite and, therefore, if (C2) is true, then something must render (C1) impossible. But what could this something be? Stephen Yablo (2000) voices an unusual criticism of Benardete's God-wall paradox (Benardete 1964:259–260), which is similar to the gong peal paradox. According to Yablo, denying an infinite regress is not the only solution to these Benardete-type paradoxes. Another way out of these paradoxes, claims Yablo, is to argue that *logic* prevents one of the seemingly possible situations in the thought experiment from happening. Adapted for the gong peal paradox, Yablo's solution is that logic renders (C1) impossible when (C2) is

true. In other words, if time is beginningless, then, although Jones intends to ring the peal every day at noon, logic prevents him from doing this an actually infinite number of times; logic permits Jones to ring the peal a finite number of times only, thereby causing Jones to become deaf by hearing the peal during his first ring.

Unfortunately, Yablo's solution treats logic as a causal force. However, as Luna (2009b:95) points out, logic is not a causal force that could step in and stop Jones from ringing the peal on certain days. Indeed, if logic could stop Jones from ringing the peal, on which days would it stop him? There is simply no logical necessity that Jones cannot ring the peal on certain days. Thus, there is no reason to think that something would render (C1) impossible if (C2) were true. Therefore, since (C1) is clearly possible and since (C2) is the questionable proposition of the two, we are justified in thinking that (C2) is impossible: beginningless time leads to impossibilities and so is itself impossible.

8.5.2 The Persistent Liar Paradox

The persistent liar paradox is my version of Yablo's paradox. More precisely, the paradox is founded on Luna's (2009b:91–92) Yabloesque thinkers paradox, which is based on Roy A. Sorensen's (1998b) queue paradox that is, in turn, a version of Stephen Yablo's (1993) liar-like paradox. However, unlike Yablo's paradox, the persistent liar paradox is formulated in temporal terms in order to illustrate a consequence of beginningless time. The persistent liar paradox is as follows.

Suppose that the universe had no beginning. Suppose further that every minute Jones, who is immortal and has lived through the entire past, declares the following proposition:

(N) 'None of the previous statements that I have made, if any, are true.'

This is the only statement Jones makes and, when he makes it, he is evaluating all his previous statements only, and not his current statement. This last point is important because it implies that the regress of Jones' statements is not circular (i.e. it does not involve self-reference) but, instead, comprises an infinite number of distinct statements at distinct times. Furthermore, (N) must express an objective truth. In view of the fact that the past has occurred, the law of the excluded middle applies to (N). In other words, since (N) concerns the objective past, each time Jones declares (N), he is expressing a proposition that is either objectively true or objectively false—(N) does not express a subjective proposition, such as 'I like ice-cream'. Therefore, for any past minute m, Jones is making an objective statement at m that is either true or false.

Now, for any past minute m, is Jones' statement at m true or false? His statement is neither true nor false. Consider, for example, the two minutes, m_1 and m_2, where m_2 is the minute immediately prior to m_1. If Jones' statement at m_1 is true, then his statement at m_2 is false, which entails, in turn, that at least one of his statements prior to m_2 is true, which entails that his statement at m_1 is false. Thus, if Jones'

statement at m_1 is true, this statement is false! Similarly, if Jones' statement at m_1 is false, then, for some $k > 1$, m_k is true, which entails, as noted above, that m_k is false, which entails that m_1 is false. Thus, if Jones' statement at m_1 is false, this statement is true!

However, if none of Jones' statements are true or false, then none of his statements express objective truths about the past. This, in turn, leads to the following contradiction: For any past minute m,

(D1) Jones' statement at m expresses an objective proposition that has a distinct truth-value, and
(D2) Jones' statement at m does not express an objective proposition that has a distinct truth-value.

As noted above, given the determinate property of time, (D1) must be true because any well-defined statement about the past has a distinct truth-value and (N) is a well-defined statement about the past. Furthermore, if the sequence of past events is beginningless, then, as we have seen, (D2) must be true. However, (D1) and (D2) contradict one another, so the entire situation is logically impossible. Intuitively, the entire situation results from *beginningless time* (or that time is an ungrounded causal chain). If time had a beginning, then Jones' first statement would be true and all his later statements would be false and, hence, the contradiction disappears. As with the gong peal paradox, one can escape the persistent liar paradox only by denying that time is beginningless, for if time is beginningless, then nothing (not even logic) can prevent a person from declaring (N) every minute (or day, year, etc.). Hence, if time is beginningless, then it is possible that both (D1) and (D2) are true. It is, however, impossible for both (D1) and (D2) to be true and, therefore, time had a beginning.

Yishai Cohen (2015:181–185) argues that, if successful, these Benardete-type paradoxes, such as the persistent liar paradox, not only show that time had a beginning but they also show that time must have an end.[3] To illustrate this, Cohen constructs the following thought experiment (which I will call 'Cohen's paradox'): Suppose that time had a beginning, that the future is endless, and that an actually infinite number of Grim Reapers exist. Furthermore, imagine that, for each time t, a unique Reaper is assigned either (i) to swing its scythe at t iff no Reaper swings its scythe at some time after t, or (ii) not to swing its scythe at t iff some Reaper swings its scythe at some time after t. Now, if the first Reaper swings its scythe at t_1, then the second Reaper does not swing its scythe and this, in turn, entails that some Reaper swings its scythe after t_2. In that case, a contradiction results because it is true and false that some Reaper swings its scythe after t_1. Similarly, a contradiction results if the first Reaper does not swing its scythe at t_1. Cohen concludes, therefore, that an endless future is as impossible as a beginningless past, a conclusion that most theists reject.

[3]For a more detailed response to Cohen's objections to the *kalām* cosmological argument, see Erasmus (2016).

What should we think of Cohen's paradox? Unlike the gong peal paradox and persistent liar paradox, Cohen's paradox rests on the following two assumptions:

(E1) God can predetermine an endless future.
(E2) God can actualise an ungrounded causal chain.

Cohen assumes (E1) in order to argue that the future is completely determined, and he assumes (E2) in order to argue that each Reaper will necessarily swing his scythe iff none of the infinitely many future Reapers swing their scythes. Cohen claims that (E1) must be denied in order to escape his paradox. It turns out, however, that Cohen's paradox may be escaped by denying (E2) while affirming (E1). This is clearly seen by the fact that the logic underpinning Cohen's paradox entails that the same paradox will result *even if* (E1) is false but (E2) is true.

For example, suppose that time had a beginning and has an end. Hence, the predetermined sequence of future events is finite. Suppose further that space is inhabited only by an actually infinite row of successive Grim Reapers such that (i) there is a first Reaper but no last Reaper, (ii) each Reaper is located at a unique spatial point, and (iii) all the Reapers are facing the same direction. Now, imagine God has predetermined that, at noon tomorrow, each Reaper will swing its scythe iff no Reaper in front of it swings its scythe. Consequently, the same contradiction as above will result at noon tomorrow, since regardless of whether the first Reaper swings its scythe, it is both true and false that some Reaper in front of the first Reaper swings its scythe. However, the contradiction disappears if (E2) is false.

Therefore, to escape Cohen's paradox, the theist need not deny (E1) but, rather, he or she must simply deny (E2). If (E1) is true and (E2) is false, then no paradox results because it is impossible for God to predetermine either a paradoxical future or a paradoxical sequence of Grim Reapers. This conclusion will trouble very few theists. Moreover, since an endless past—unlike an endless future—is an ungrounded causal chain in which each event is caused by a prior event(s), and since the gong peal paradox and persistent liar paradox exclude assumptions (E1) and (E2), one may escape these paradoxes only by denying the possibility of beginningless time.

Another objection that may be raised is that the above thought experiments are too implausible. For example, perhaps it is impossible for Jones (or any human being) to exist through an eternal past because no human being is immortal or else, given human imperfection, one may object that it is impossible for Jones to perform an infinitely repetitive task. A sickness, for example, may render Jones out of action for several days or else ringing a gong peal repetitively may render Jones emotionally unstable and unable to finish the infinite task. Thus, the objection is that the thought experiments are overly far-fetched.

However, this objection fails to appreciate the nature of a thought experiment. A thought experiment is an imaginary scenario that is used to test which of a few supposedly possible propositions are, in fact, possible. The 'possibility' in mind is not merely a practical possibility, but a logical or metaphysical possibility. As Sorensen remarks,

> 'Impossible' has to be relativized to the proper background constraints. It is a practical impossibility for all the oxygen molecules to segregate to one corner of the room, thereby suffocating me. But it is physically possible. An attack on a thought experiment that shows the supposition to be logically impossible is sure to be successful. But the choice of a weaker impossibility courts the danger of too weak a response (Sorensen 1998a:278).

As Sorensen notes, it is not sufficient for the critic to assert that the thought experiment is too far-fetched but, he or she must also show that the practical impossibilities are also logically impossible. Thus, it may be *practically* impossible for Jones to be immortal or to perform an infinitely repetitive task, but it is not *logically* or *metaphysically* impossible. As long as it is logically or metaphysically possible for Jones to be immortal or to perform an infinitely repetitive task, our thought experiments achieve their goal. Accordingly, the gong peal paradox and the persistent liar paradox provide strong justification for the view that beginningless time, or an eternal universe, leads to logical impossibilities and so is itself logically impossible.

8.6 Conclusion

The proponents of the *kalām* cosmological argument have at their disposal at least three strong philosophical arguments in support of the premise that the universe came into existence, namely, (i) that it is impossible to traverse past-infinite time, (ii) that a causal chain (such as time) must have a first or external cause, and (iii) that beginningless time, or an eternal universe, leads to impossibilities. These three arguments are not beset by the same difficulties as the Infinity Argument, for they do not rely on a controversial metaphysical intuition about the actual infinite and, in addition, they are compatible with Platonism, the standard definition of omniscience, and set theory. Therefore, advocates of the *kalām* cosmological argument would profit from replacing the Infinity Argument with these three arguments. In the next chapter, I evaluate whether science or, more precisely, certain eternal modern cosmological models, are able to justify one's belief that the universe is eternal and did not come into existence.

References

Benardete, J. A. (1964). *Infinity: An essay in metaphysics*. Oxford: Clarendon Press.

Cohen, Y. (2015). Endless future: A persistent thorn in the *kalām* cosmological argument. *Philosophical Papers, 44*(2), 165–187.

Draper, P. (2011). A critique of the kalām cosmological argument. In L. P. Pojman, & M. C. Rea (Eds.), *Philosophy of religion: An anthology* (6th ed., pp. 172–178). Andover: Wadsworth Cengage Learning.

Erasmus, J. (2016). Cohen on the *kalam* cosmological argument. *Prolegomena 15*(1), 43–54. http://hrcak.srce.hr/164909. Accessed 31 Dec 2016.

Fiocco, M. O. (2014). Becoming: Temporal, absolute, and atemporal. In L. N. Oaklander (Ed.), *Debates in the metaphysics of time* (pp. 87–107). New York: Bloomsbury Academic.
Gratton, C. (2010). *Infinite regress arguments*. Dordrecht: Springer.
Grünbaum, A. (1989). The pseudo-problem of creation in physical cosmology. *Philosophy of Science, 56*(3), 373–394.
Luna, L. (2009a). Ungrounded causal chains and beginningless time. *Logic and Logical Philosophy, 18*, 297–307. http://apcz.pl/czasopisma/index.php/LLP/article/view/LLP.2009.014/995. Accessed 11 Apr 2015.
Luna, L. (2009b). Yablo's paradox and beginningless time. *Disputatio, 3*(26), 89–96. http://www.disputatio.com/wp-content/uploads/2009/05/026-3.pdf. Accessed 13 Apr 2015.
Luna, L. (2014). No successful infinite regress. *Logic and Logical Philosophy, 23*, 189–201.
Maudlin, T. (1993). Buckets of water and waves of space: Why spacetime is probably a substance. *Philosophy of science, 60*, 183–203.
McTaggart, J. E. (1908). The unreality of time. *Mind, 17*, 457–474.
Morriston, W. (2013). Doubts about the kalam argument. In J. P. Moreland, C. Meister, & K. A. Sweis (Eds.), *Debating Christian theism* (pp. 20–32). Oxford: Oxford University Press.
Oppy, G. (2006a). *Arguing about Gods*. New York: Cambridge University Press.
Oppy, G. (2006b). *Philosophical perspectives on infinity*. New York: Cambridge University Press.
Puryear, S. (2014). Finitism and the beginning of the universe. *Australasian Journal of Philosophy, 92*(4), 619–629.
Puryear, S. (2016). Finitism, divisibilty, and the beginning of the universe: Replies to Loke and Dumsday. *Australasian Journal of Philosophy, 94*(4), 808–813.
Sorabji, R. (2006). *Time, creation, and the continuum: Theories in antiquity and the early middle ages*. Chicago: University of Chicago Press.
Sorensen, R. A. (1998a). *Thought experiments*. New York: Oxford University Press.
Sorensen, R. A. (1998b). Yablo's paradox and kindred infinite liars. *Mind, 107*(425), 137–156.
Yablo, S. (1993). Paradox without self-reference. *Analysis, 53*(4), 251–252.
Yablo, S. (2000). A reply to new Zeno. *Analysis, 60*(2), 148–151.
Zimmerman, D. (2011). Presentism and the space-time manifold. In C. Callender (Ed.), *The Oxford handbook of philosophy of time* (pp. 163–244). Oxford: Oxford University Press.

Chapter 9
Can Cosmology Justify Belief in an Eternal Universe?

9.1 Introduction

Most physicists and cosmologists who believe that the universe is, or could be, eternal justify this belief by the fact that one may, conceivably, construct an eternal cosmological model. (For the sake of simplicity, in this chapter I will use the phrase 'eternal universe' to mean 'past infinite/eternal or autonomous (i.e. self-caused or self-contained) universe', and I will use the phrase 'eternal cosmological model' to mean a cosmological model or theory that entails that the universe is eternal). For example, in his debate with William Lane Craig, the prominent cosmologist, Sean Carroll, remarks,

> [I]f you want to know whether something is possible in cosmology or physics, you ask, 'Can I build a model?' Can I build a model where the universe had a beginning, but did not have a cause? The answer is Yes. It's been done. … You might also ask, 'Could the universe be eternal?' without having a beginning at all. Again, the answer is: yes, just build a model. … So, whether or not the universe can be eternal does not come down to a conversation about abstract principles. It comes down to a conversation about building models and seeing which one provides the best account for what we see the universe to be doing (Stewart 2016:40–41).

In order to justify his belief that the universe could be eternal, Carroll argues that one could simply build an eternal cosmological model, regardless of whether 'it's very likely to be a correct description of reality' (Stewart 2016:41). But is this correct? Suppose the three philosophical arguments in favour of an absolute beginning discussed in the previous chapter have convinced you that the universe came into existence (in this chapter I will use the phrase 'the philosophical arguments' to denote these three philosophical arguments). Assume that you see no sound objections to these philosophical arguments. Hence, you believe that, on the basis of the philosophical arguments, the universe came into existence. Now, suppose that there exist several eternal cosmological models. What should you think

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_9

about the apparent conflict between the conclusions of the philosophical arguments and the eternal cosmological models? Does modern cosmology—cosmology as it is currently practised—provide you with grounds to doubt the soundness of the philosophical arguments? Or, suppose you are well versed in the eternal cosmological models, but only faintly aware of the philosophical arguments. Now, if you believe, solely on the grounds of some eternal cosmological model, that the universe is or can be eternal, is your belief justified? More precisely: Can an eternal cosmological model, by itself, justify belief in the possibility of an eternal universe?

This question is often overlooked and, yet, it is important. If an eternal cosmological model cannot, by itself, justify belief in the possibility of an eternal universe, then advocates of the *kalām* cosmological argument are justified in believing that the philosophical arguments successfully establish an absolute beginning, and critics of the argument are not able to claim that modern cosmology successfully establishes, by itself, that the universe is or can be eternal. However, if the opposite is true and an eternal cosmological model can justify belief in an eternal universe, then the fact that several cosmological models include an eternal universe poses a threat to the *kalām* cosmological argument.

In this chapter I argue that the answer to the above question is negative. First, I argue that, if one does not engage with the philosophical arguments and if one does not include in the pool of explanatory options the hypothesis of an absolute beginning when evaluating which hypothesis best explains the discoveries of modern cosmology, then one's belief in the possibility of an eternal universe cannot be justified solely by the fact that there exist several eternal cosmological models. I then argue, second, that, even if an eternal cosmological model can justify this belief, no such model is currently successful, and the hypothesis that the universe had a beginning is, at present, the best explanation of the discoveries of cosmology. It should be noted that I am not trying to argue that cosmology adds support for the view that the universe had a beginning (although this certainly appears to be the case). Instead, I wish to propel scientists (and critics of theism) to engage with the philosophical arguments in favour of a beginning of the universe. I wish to show that the scientist can no longer justify his or her belief in an eternal universe by appealing solely to (the shifting sands of) modern cosmology.

9.2 Can A Cosmology Model Justify Belief in an Eternal Universe?

How a model or theory justifies one's belief is, of course, controversial. Nevertheless, a simple and plausible account of how 'theory x can justify, by itself, belief in y' is as follows. For any person S, scientific theory T, and proposition P, T can justify, by itself, S's belief in P iff the following four conditions are met:

(A1) *T* entails *P* because, if *T* is a true description of reality, then *P* must be true.
(A2) *T* satisfies the requirements of a sound or good scientific theory, such as internal consistency, simplicity, explanatory power, testability, etc.
(A3) The methodology behind *T* does not presuppose *P*, that is to say, the methodology behind *T* includes not-*P* in the pool of live or explanatory options.
(A4) *S* has responsibly searched for important theories or arguments in favour of not-*P*, but found none.[1]

Now, there are at least two reasons why an eternal cosmological model cannot justify, by itself and in the sense just described, a person's belief in the possibility of an eternal universe. These reasons are as follows.

(1) *Eternal cosmological models are shaped by methodological naturalism*. Methodological naturalism (MN) is the predominant scientific attitude that states that science should restrict itself to the natural realm and proceed as if no supernatural realm exists. According to Victor J. Stenger (2012:26), 'The scientific community in general goes along with the notion that science has nothing to say about the supernatural because the methods of science as they are currently practised exclude supernatural causes.' Likewise, Eugenie C. Scott (2009:56), the Executive Director of the National Center for Science Education, remarks, 'Twentieth- and twenty-first-century scientists limit themselves to explaining natural phenomena using only natural causes … [and so] scientists do not consider supernatural explanations scientific.' This 'rule of science', states Scott, distinguishes MN.

MN should not be confused with *philosophical naturalism* (PN), which denies the existence of a supernatural realm. PN entails atheism whereas MN does not. Thus, one may be a methodological naturalist without being a philosophical naturalist. However, although MN does not presuppose PN, science directed by MN is identical to science directed by PN. Del Ratzsch makes this point well:

> It is evident that whether or not there is a nonnatural realm, the methods science would employ and the results science would obtain presupposing philosophical naturalism would be *identical* to those it would obtain employing methodological naturalism of this sort. There is thus no *scientific* reason for insisting on philosophical as opposed to this methodological naturalism—whatever the *philosophical* rewards might be (Ratzsch 2010:73 [original emphasis]).

As Ratzsch notes, any scientific theory produced through MN would be consistent with atheism. It is, thus, clear that MN is characterised by the following three important features.

First, it places constraints on the pool of live or explanatory options for any scientific explanation or theory. The *pool of live or explanatory options* is the set of explanations from which the scientist chooses the best explanation for some phenomenon. If science proceeds in accordance with MN, then the pool of options

[1] Such a search forms part of the justification for belief in *P*. Hence, to state that *T* may justify 'by itself' belief in *P* is not to say that *T* is the only justification for belief in *P* but, rather, it means that *T* is the only theory or argument that forms part of the justification for belief in *P*.

includes explanations in terms of natural laws or causes only. For example, suppose I have a headache and I wish to know its cause. According to MN, I must choose the best explanation from a pool of natural explanations, such as lack of sleep, stress, poor posture, etc. Any supernatural explanation is not an option. I cannot, for example, state that my headache is caused by some demon trying to make my life difficult. Hence, any scientific theory is based on a pool of explanatory options that excludes supernatural explanations.

Second, if a scientific theory is refuted, then MN insists that the theory be replaced by some other natural theory only (Ratzsch 2010:73). Supernatural theories, no matter how powerful they may be in the explanatory sense, are dismissed from the beginning. If I initially thought my headache was caused by poor posture but later discovered that I have perfect posture, I cannot replace my initial theory with the demon theory and I must consider alternative natural theories only.

Finally, if a specific event cannot be explained by known natural laws or causes, MN concludes that, for the time being, the event is unexplainable but non-supernatural. Loren Haarsma (2010:161) notes that a scientist, whether he or she adheres to MN, will reach one of at least five different conclusions when confronted with a scientifically unexplainable event: (i) An unknown natural law is responsible, (ii) a supernatural event occurred, (iii) natural but super-human intellect or technology is responsible, (iv) an improbable event simply occurred, or (v) in view of the fact that many universes exist, it is unsurprising that the event occurred in our universe. The second of these five is the only conclusion that invokes the supernatural and, thus, the scientist who is directed by MN will avoid (ii) and conclude that some natural explanation, such as (i), (iii), (iv), or (v), exists. Therefore, according to MN, there is some natural explanation for events that, at the time, cannot be explained by science and the reason why these events are 'unexplainable' is that there is a gap in our scientific knowledge.

In view of the fact that cosmology is a science, cosmology is dominated and directed by MN. The comments of several important physicists confirm this. For example, Arthur S. Eddington (1931:450), the prominent British physicist, declares, 'the notion of a beginning of the present order of Nature is repugnant to me'. Likewise, Fred Hoyle, the famous astronomer who coined the term 'big bang', states: '[I]t is against the spirit of scientific enquiry to regard observable effects as arising from "causes unknown to science", and this in principle is what creation-in-the-past implies' (Hoyle 1948:372). Similarly, Walther Nernst, the German physicist, claims, 'To deny the infinite duration of time would be to betray the very foundations of science' (Nernst cited by Vilenkin 2006:177). Alexander Vilenkin (2006:177) notes that, because it would appear that an absolute beginning implies a Creator, 'the natural instinct of most scientists has been to reject the idea of a cosmic beginning'. There is little doubt, therefore, that the eternal cosmological models produced by modern cosmology have been shaped by MN.

Now, MN's influence on cosmology means that condition (A3) cannot be satisfied. If the universe had an absolute beginning, then no natural explanation for its beginning exists because the universe (as we are using the term) is all natural reality. Thus, the beginning of the universe has either a transcendent

(or divine) cause or no cause whatsoever. However, this conclusion does not accord well with MN. According to MN, any event may be explained by a prior (or simultaneous) natural event or physical state and this, in turn, implies that either the temporal regress of natural events or states is infinite or the universe is autonomous. Therefore, cosmologists directed by MN will do their utmost to avoid theories that entail an absolute beginning *ex nihilo*. Indeed, even if all the current scientific evidence pointed towards an absolute beginning, we should expect the majority of scientists to assume that an unknown natural law or physical state is responsible for this 'unexplainable' event. Therefore, it is safe to say that the methodology behind today's eternal cosmological models excludes as a live option the hypothesis that the universe had an absolute beginning. *This* is the sense in which MN 'presupposes' an eternal or autonomous universe.

There is, however, nothing wrong with the methodology of a theory presupposing (in the sense described above) certain beliefs. However, if this is the case, then the theory does not support the presupposed belief. For example, my belief that God exists cannot be supported by Trinity Monotheism, which is a theological theory of the Trinity. The reason for this is because the methodology underpinning Trinity Monotheism prepossesses the existence of God. Trinity Monotheism may support my belief that, *if God exists*, He exists as one tri-personal being, but the theory cannot support my belief that God exists. Similarly, if the methodology behind natural theology excludes as a live option the hypothesis that God does not exist, then natural theology cannot, by itself, justify belief in God's existence (fortunately, natural theology's methodology treats God's non-existence as a possibility and, thus, it encourages an examination of the arguments against God's existence). Hence, because MN presupposes that the initial singularity (the initial singularity or big bang is discussed in more detail below) or the existence of the universe has a natural explanation, it is difficult to understand how an eternal cosmological model may support one's belief in the possibility of an eternal universe.

(2) *Philosophy is a reliable means to truth*. Sound philosophical arguments may reveal true propositions about reality. This appears obvious because philosophy (especially as practised in the analytic tradition) is based on logical reasoning which is itself a reliable means to truth. For example, the deductive argument: 'All non-divine human beings are mortal; Socrates is a non-divine human being; therefore, Socrates is mortal', is a philosophical argument that tells us about the true nature of Socrates. Clearly, any philosophical argument that is logically valid and has true premises is a reliable means to truth.

However, many scientists dismiss philosophical arguments as useless speculation. These scientists believe that philosophy cannot lead us to truth because science is the only or best way to reach a true understanding of reality. No philosophical argument can tell us whether the universe really had a beginning. As Joseph Silk (2001:5), the notable physicist from the University of Oxford, remarks, '[M]ost physicists … [believe] that the ultimate questions about the origin of the universe must be answerable by physics rather than by philosophy'. The stock example of this attitude is displayed by Stephen Hawking and Leonard Mlodinow:

> What is the nature of reality? Where did all this come from? Did the universe need a creator? … Traditionally these are questions for philosophy, but philosophy is dead. Philosophy has not kept up with modern developments in science, particularly physics. Scientists have become the bearers of the torch of discovery in our quest for knowledge (Hawking and Mlodinow 2010:13).

Hawking and Mlodinow appear to be endorsing *scientism*, which is the popular ideology that views science as the foremost means with which to reach reliable truth. Scientism comes in two forms, namely, strong scientism and weak scientism. The former maintains that no non-scientific discipline (such as philosophy or theology) is able to uncover truths about reality and that science alone is the paradigm of truth and rationality. On the other hand, according to the latter, although non-scientific disciplines may lead to truth, science is the most reliable means to, and final arbiter of, truth. Both forms of scientism stipulate that any philosophical argument that conflicts with science must be dismissed as irrelevant. Thus, if scientism (in either form) is true, then philosophy is not a reliable means to truth.

Is scientism plausible? The answer is no. First, strong scientism is self-refuting because it is itself a philosophical belief that cannot be determined to be true by science (Polkinghorne 2011:23; Moreland and Craig 2003:347–348). The proposition that *only scientific propositions are true* is not a scientific proposition (i.e. a proposition that has been well-established by scientific methods) and, thus, this proposition falsifies itself. Accordingly, strong scientism fails to meet its own requirements.

Second, many true beliefs are produced through non-scientific methods (Moreland and Craig 2003:349–350). For example, the propositions that *the external world is real*, that *murder is wrong*, and that *I am busy thinking about scientism* are not scientific propositions and yet one is rationally justified in believing them to be true. The domain of science does not deal with logical truths, ethical truths, aesthetic truths, or self-evident truths. Furthermore, one may believe certain non-scientific propositions (such as those just cited) with greater certainty than one believes other scientific propositions (e.g., 'The universe underwent a period of rapid expansion or inflation during its primordial evolution'). Although many scientific beliefs will probably be renounced or revised in the next century this is not the case with the non-scientific beliefs just cited. Therefore, the existence of true, non-scientific beliefs undermines scientism (in either form).

Now, since strong philosophical arguments against a past eternal universe exist—as shown in Chap. 8—and philosophy is a reliable means to truth, condition (A4) cannot be satisfied. Nobody can responsibly search for important theories or philosophical arguments in favour of a cosmic beginning and find none. A quick search through the literature on arguments in favour of an absolute beginning reveals a vast number of important books and articles written on the topic. Indeed, most of the arguments used by the proponents of the cosmological argument are

accessible to the public through the internet.[2] Therefore, anyone who has the means to study modern cosmological theories will, through a responsible search, find several important philosophical arguments against an eternal or autonomous universe.

But, why does this matter? Why should an individual search for important reasons in favour of an absolute beginning before an eternal cosmological model may justify his or her belief in an eternal or autonomous universe? The reason is that one has an intellectual duty to evaluate the most important evidence for and against some proposition *P* before one believes *P*. If one finds evidence in favour of *P* and finds no evidence against *P*, then the justification for belief in *P* increases. However, if one finds important evidence both for and against *P*, then, to increase the justification for one's belief in *P*, one must show why the evidence against *P* is unsuccessful. Thus, because there exist strong and important philosophical arguments in favour of an absolute beginning, it is essential that one shows why these arguments fail before an eternal cosmological model may justify one's belief in the possibility of an eternal universe.

Therefore, an eternal cosmological model cannot, by itself, justify belief in the possibility of an eternal universe, at least not while eternal cosmological models are shaped by methodological naturalism, philosophy is a reliable means to truth, and strong philosophical arguments against an eternal universe exist. But, what if an eternal cosmological model can, by itself, justify belief in the possibility of an eternal universe? Suppose that there are no philosophical arguments for a beginning and that the hypothesis of an absolute beginning is included in the pool of explanatory options. In this case, would the hypothesis of an eternal universe turn out to be *the best explanation* of the discoveries of modern cosmology? In other words, are there any eternal cosmological models or hypotheses with sufficient empirical support to justify one's belief in the possibility of an eternal universe? In the rest of this chapter we will address this question by evaluating which hypothesis, including the absolute beginning hypothesis, best explains the discoveries of cosmology.

9.3 Inference to the Best Explanation

Inference to the best explanation (IBE), which is sometimes called *abduction*, is a type of reasoning in which one tries to find a hypothesis that best explains a set of given facts or pieces of evidence.[3] This method of inference is common in both professional and everyday reasoning, such as when medical doctors try to diagnose

[2] See for example http://www.reasonablefaith.org and http://en.wikipedia.org/wiki/Cosmological_argument

[3] For an account of IBE see Lipton (2004).

a patient's symptoms. A classic example of IBE in science is Charles Darwin's *On the Origin of Species* (1859). After discussing several facts about animals, Darwin writes,

> I cannot believe that a false theory would explain, as it seems to me that the theory of natural selection does explain, the several large classes of facts above specified (Darwin 2008:353).

According to Darwin, evolution through natural selection *best explains* a certain set of facts or phenomena. There are many more examples of how scientists and philosophers engage in IBE (see Thagard 1978; Lipton 2004; Douven 2011) and, for this reason, Ernan McMullin (1992) calls it 'the inference that makes science'.

IBE involves three steps (Cf. Lipton 2004:149). The first step involves gathering a set E of accepted facts, truths, or phenomena (for the sake of simplicity, I will hereafter use these three terms synonymously) that are to be explained. These facts may be expressed as propositions, such as the proposition that *the earth is round* or the proposition that *he was murdered with a knife*. Importantly, these facts may be truths about widely accepted scientific theories, such as the fact that *Einstein's General Theory of Relativity describes gravity in terms of the curvature of spacetime*. Moreover, since facts are sometimes disputed, the facts in E must be shown to be extremely plausible or, at least, widely accepted by those knowledgeable about the topic.

The second step is to gather or generate a set H of hypotheses that could, potentially, explain E. These hypotheses should either rival each other or be mutually exclusive, i.e. the acceptance of one should imply the rejection of the others. If two consistent hypotheses H_1 and H_2 are offered together to explain E (i.e. H_1 explains the facts in E that H_2 does not, and vice versa), then H_1 and H_2 should not be two independent hypotheses in H but, rather, the conjunction of H_1 and H_2 should form a single hypothesis in H.

The third and final step in IBE involves determining which hypothesis in H best explains the facts in E. This is done by assessing the extent to which each hypothesis in H complies with some criteria or set of virtues. The best hypothesis is then the one that is most compliant. There is disagreement about the criteria which should be used to determine the best explanation, but commonly accepted criteria include the following (Thagard 1978; Moreland and Craig 2003:62; Lipton 2004:122; Nola and Sankey 2007:37–45):

1. *Consistency*: The best hypothesis should be more consistent with our existing knowledge and other accepted theories than the rival hypotheses are, it should be internally consistent, and it should be without internal logical contradictions.
2. *Explanatory scope and power*: The best hypothesis should explain more of the facts in E, and explain them better than do the rival hypotheses.
3. *Simplicity*: The best hypothesis should involve fewer assumptions than the rival hypotheses.
4. *Refutability*: The best hypothesis should have the potential to be falsified by some imaginary scenario.

By using these criteria, one is able to determine the best explanation of some set of facts. Of course, if new hypotheses or theories become available after a hypothesis

has already been chosen as the best explanation, then one must include these new hypotheses in H and re-evaluate H against the criteria being used. I will hereafter understand IBE, then, as the process that uses the above criteria to determine which hypothesis in some set of rival hypotheses best explains some set of accepted or plausible facts.

9.4 Scientific Facts Requiring an Explanation

Over the past several decades, physicists and cosmologists have made tremendous progress in discovering more about the universe. Many of these discoveries call for an explanation. We will discuss five such discoveries, all of which will form the set of facts in our IBE process.

9.4.1 The Universe Is Expanding

Before the twentieth century, it was widely believed that the universe is in an eternal, steady state. However, as discussed in Chap. 5, when Einstein applied his unprecedented gravitational theory, *General Relativity* (GR), to the universe in 1917, he found that GR entails an expanding or contracting universe, since the spacetime curvature that material objects create cause them to be drawn together. However, because Einstein assumed that the universe is static, he added an unnecessary hypothetical term, the *cosmological constant* or Λ, to his equations to counterbalance the gravity created by the uniform distribution of matter. Several years later, Alexander Friedmann and Georges Lemaître separately devised solutions to GR that depict an expanding universe. Lemaître also found out that, since Einstein's initial model was unstable, it is extremely unlikely that the model entailed an *eternally* static universe. In 1929, Edwin Hubble's discovery that the galaxies are receding from each other provided reliable proof that the universe is expanding. Hubble's discovery shocked many but, today, 'there is little doubt that we live in an expanding universe' (Harrison 2000:291). As Andrew Liddle (2015:117) remarks, 'The expansion of the Universe is a long-established fact.'

The fact that the universe is expanding does not mean that it is expanding in empty space or that the galaxies are moving further apart from each other through space. Rather, it means that *space itself* is expanding. Moreover, even though we observe distant galaxies in all directions receding from us, we are not at the centre of the universe, for an observer at any galaxy will observe the same thing. To better understand this expansion, we may use the common analogy in which space is compared to the surface of a balloon, and galaxies are compared to buttons stuck to the surface of the balloon. As the balloon (space) expands, the buttons (galaxies) move further away from each other. This analogy is not perfect but it does provide us with an indiction of how space can be stretched like a rubber sheet. The expansion of

the universe may be described, more precisely, as the fact that the distance between any two fundamental observers at rest with respect to the cosmic fluid (i.e. all matter spread smoothly throughout the universe) increases with time (Francis et al. 2007:3).

Furthermore, it was widely believed that the expansion rate of the universe was decelerating or slowing down as the gravity attraction between objects opposed the expansion. However, recent observations have shown that the expansion of the present universe is accelerating or speeding up (see Wolschin 2010; Schrabback et al. 2010). Perhaps the most important evidence for this acceleration comes from observations of Type Ia Supernovae (SNe Ia), which are violent explosions of unstable, white dwarf stars. SNe Ia serve as excellent 'standard candles', which are astrophysical objects with a uniform intrinsic brightness that enable us to determine the distances to extra-galactic objects. In 1998, a team of astrophysicists discovered that many SNe Ia appeared dimmer than predicted because they had receded from Earth more than they should have done if the universe's expansion rate were not accelerating (Riess et al. 1998). This indicated that the rate at which the universe is expanding is increasing over time.

Other strong, independent evidence for an accelerated expansion comes from cosmic microwave background anisotropies, galaxy clusters, baryon acoustic oscillations, and strong gravitational lensing (for references, see Schrabback et al. 2010:1). Thus, Mark Sullivan (2010:60) declares, 'This "cosmic acceleration" has been confirmed with a wide variety of different astrophysical observations, and the data indicating this acceleration are now not seriously in question'. Thus, even despite the fact that the cause of this acceleration is a mystery (although it is linked to the presence of dark energy), we have good observational grounds for thinking that the acceleration is occurring.

9.4.2 The Universe Is Filled with Cosmic Microwave Background Radiation

In 1963, Arno Penzias and Robert Wilson discovered (by chance) a peculiar radio signal that was uniform in all directions. Puzzled by this signal, Penzias and Wilson contacted the physicist Robert Dicke at Princeton University, who immediately realised that they had discovered the radiation that was predicted to result from the big bang. Several decades earlier, scientists (including Dicke, George Gamow, Ralph Alpher, and Robert Herman) had argued that some elements were created in the first few minutes of the big bang through nucleosynthesis, a process requiring enormous temperatures. It was further predicted that, as the universe expanded and cooled, there would remain a cosmic microwave background radiation (CMB) with a temperature of approximately 5 kelvin. It was this radiation that Penzias and Wilson detected, at a temperature of about 3.5 kelvin. Further observations from the *Cosmic Background Explorer* (COBE) satellite in the 1990s have confirmed the existence of the CMB.

9.4.3 *At the Planck Time, the Universe Was Extremely Hot and Dense*

GR and the expansion of space imply that, as one extrapolates back in time, the universe becomes denser and denser until one reaches a point at which the density of matter was about 10^{90} kilograms per cubic centimetre, and the entire universe was compressed within an extremely tiny sphere. This point is known as the *Planck time* or *Planck epoch* (named after Max Planck, a founder of quantum mechanics), which is only 10^{-43} seconds after the initial singularity (or time 0), if there were such a singularity. We must not underestimate how small and dense the universe was at this point. At this point, all the matter in the entire observable universe—including the matter that makes up all the planets, stars, and galaxies we are able to see—was compressed within a small sphere with a radius equal to one-hundredth of a centimetre, about the size of a needle's point (Silk 2001:108). Indeed, according to Joseph Silk (2001:108), 'These physical conditions are so extreme that it seems entirely appropriate to regard the Planck time as the moment of creation of the universe'.

Furthermore, the COBE satellite has revealed that the CMB has the precise blackbody spectrum that is expected to have resulted if the universe were in such a hot, dense state. Silk (2001:80) explains,

> As we trace the history of the universe back in time, the temperature of the cosmic blackbody radiation rises. At earlier and earlier times, the radiation becomes hotter and hotter, and the universe denser and denser, until an instant is reached when blackbody radiation can be created. At this time, conditions are such that perfect equilibrium exists between matter and radiation; this is how the blackbody nature of the radiation gets established.

Thus, GR, the expansion of space, and the CMB together confirm that, at the Planck time, the universe was extremely hot and dense. 'Almost all cosmologists now firmly believe', declares Edward Harrison (2000:415), 'that the discovery of the cosmic background radiation establishes beyond all doubt that we live in a big bang universe and … that the early universe was very dense and hot. … [T]he high-density, high-temperature beginning of the universe is a fact as secure as any in cosmology'.

The physical conditions at the Planck time are so drastic that it is not possible for GR to describe the universe at this point. GR is valid up to the Planck time, but it breaks down at this point because the universe is too hot for spacetime to exist as a smooth, connected manifold, the type of manifold that GR describes (Stoeger 2010:160). Thus, the Planck time marks the beginning of classical (i.e. non-quantum) space and time. If a physical reality existed 'prior' to the Planck time, then, in order to describe this reality, we would need a theory of quantum gravity that unifies GR with quantum mechanics. Unfortunately, this challenge has not yet been met.

9.4.4 The Early Universe Was in a Low-Entropy State

Entropy is the measure of disorder in a closed system. The higher the entropy, the higher the disorder. The Second Law of Thermodynamics states that the entropy in a closed system increases but never decreases. For example, the gas molecules in a vacuum sealed bottle will spread out evenly throughout the bottle as time passes. The molecules will never gather into one corner of the bottle and remain there. Once a closed system reaches maximum possible entropy (e.g. when the gas molecules are spread out evenly), then the system is in a state of *thermodynamic equilibrium*.

Now, is the universe at present in equilibrium (i.e. in a state of thermodynamic equilibrium)? Clearly, the *observable* universe is not in such a state as stars are still burning out, the sun is giving off heat, life exists, etc. If the observable universe were in equilibrium, then all its energy would be used up and there would be no stars, light, heat, or life. This is clearly not the case. However, the fact that the observable universe is in disequilibrium implies that the universe, as a whole, is in disequilibrium, for why would certain regions of the universe be in a low-entropy state if the universe itself were in a high-entropy state? The Austrian physicist, Ludwig Boltzmann (1844–1906), postulated that the universe is, in fact, in a state of equilibrium and that the observable universe is simply one of the low-entropy regions (or 'worlds') that would occur by chance every now and then:

> We assume that the whole universe is, and rests for ever, in thermal equilibrium. The probability that one (only one) part of the universe is in a certain state, is the smaller the further this state is from thermal equilibrium; but this probability is greater, the greater is the universe itself. If we assume the universe great enough, we can make the probability of one relatively small part being in any given state (however far from the state of thermal equilibrium), as great as we please. We can also make the probability great that, though the whole universe is in thermal equilibrium, our world is in its present state (Boltzmann 1895:415).

According to Boltzmann, if the universe is old and big—indeed, very, very, old and very, very big—then, although the universe is in equilibrium most of the time, a spontaneous fluctuation (i.e. an accidental rearrangement of matter) occurs very rarely, producing a low-entropy, isolated region, such as the observable universe.

It turns out, however, that Boltzmann's solution is highly implausible. If the universe as a whole is in equilibrium, and if spontaneous fluctuations do occur occasionally, then it is *vastly* more probable that we would be in a much smaller disequilibrium region than the observable universe. Thus, as Huw Price (2004:226–227) notes, Boltzmann's solution entails that 'if we wish to accept that our own region is the product of "natural" evolution from a state of even lower entropy, we must accept that our region is far more improbable than it needs to be, given its present entropy … [and] we should not expect it to be any more extensive *in space* than we already know it to be' (original emphasis). Moreover, Boltzmann's solution faces the so-called 'Boltzmann Brain' problem. A Boltzmann Brain is a hypothetical brain that is formed, not by foetal growth or by natural evolution, but by random atoms coming together by chance (or fluctuation). Such a brain possesses a copy of someone else's memories and, thus, it has the illusion that it is a real

person living in the observable universe. Now, although a Boltzmann Brain is very unlikely, it is vastly more probable that a spontaneous fluctuation would produce a single Boltzmann Brain than a massive low-entropy region similar to the observable universe. Consequently, one should believe that one is a Boltzmann Brain! Andreas Albrecht and Lorenzo Sorbo (2004:5) describe this consequence of Boltzmann's solution as follows:

> From this point of view, it is very surprising that we find the universe around us in such a low entropy state. In fact, the logical conclusion of this line of reasoning is utterly solipsistic. The most likely fluctuation consistent with everything you know is simply your brain (complete with 'memories' of the Hubble Deep fields, WMAP data, etc) fluctuating briefly out of chaos and then immediately equilibrating back into chaos again.

However, since it is absurd to think that one is a Boltzmann Brain, we should conclude that Boltzmann's solution is false. For these reasons, most cosmologists affirm that the universe as a whole is in a low-entropy state.

Now, the fact that the universe is not in a state of equilibrium entails that, as one extrapolates back in time, the entropy of the universe decreases and decreases until one reaches the very early universe, at which point the universe was in an extremely low-entropy state. As the prominent physicist, Roger Penrose (2005:726), declares, 'The fact that [the early universe] must have had an absurdly low entropy is already evident from the mere existence of the Second Law of thermodynamics'. This conclusion is obviously widely accepted in view of the fact that 'most scientists take the view that our universe started off in a low-entropy condition, and that, with the exception of the occasional small-scale local reversal, its entropy has been increasing ever since' (Dainton 2010:49).

9.4.5 Any Universe That Is, on Average, Expanding Had a Classical Beginning

In 2003, the three prominent cosmologists, Arvind Borde, Alan H. Guth, and Alexander Vilenkin, proved a remarkable theorem that states that any universe whose average expansion rate is positive must have had a classical beginning (Borde et al. 2003). More precisely, the Borde-Guth-Vilenkin (BGV) theorem states that, if the average expansion rate is positive along any null or timelike geodesic, then this geodesic must be past-incomplete. A geodesic in this context refers to a spacetime 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. Accordingly, a *past-incomplete* geodesic must terminate (i.e. have a beginning) after a finite amount of time in the past. The BGV theorem shows, then, that, if the universe has, on average, been expanding, then time (as understood in classical physics) must have had a beginning.

An incredible feature of the BGV theorem is its simplicity. The theorem makes no assumptions about either matter or gravity. It merely assumes that the universe's average expansion rate is positive. Vilenkin explains,

> We made no assumptions about the material content of the universe. We did not even assume that gravity is described by Einstein's equations. So, if Einstein's gravity requires some modification, our conclusion will still hold. The only assumption that we made was that the expansion rate of the universe never gets below some nonzero value, no matter how small (Vilenkin 2006:175).

Thus, the BGV theorem depends on the reality of time (or spacetime). Hence, if it turns out that we may define time at the quantum dominated Planck epoch, and if the universe has been expanding during this epoch, then the BGV theorem would imply that even this epoch had a beginning.[4]

With these facts in mind, let us now evaluate which of the most important rival hypotheses best explains the set of facts.

9.5 Evaluating the Rival Hypotheses

The four hypotheses that have been suggested as an explanation of the above facts include the cyclic hypothesis, the quantum creation hypothesis, the multiverse hypothesis, and the beginning hypothesis. Numerous cosmological models have been proposed in the literature, and to evaluate all these models would require an entire book on its own. Thus, in our evaluation of each hypothesis, we will discuss the most prominent and promising cosmological models only. Furthermore, since all four hypotheses may be refuted by other observations and evidence, we will evaluate them against the consistency, explanatory scope and power, and simplicity criteria, and not against the refutability criterion. Let us begin with the cyclic hypothesis.

9.5.1 The Cyclic Hypothesis

According to this hypothesis, the universe goes through an infinite succession of cycles, oscillations, or bounces. Four important models of a cyclic universe have been suggested, namely, the oscillating model, the ekpyrotic model, the deflation

[4] In his personal correspondence with Craig, Vilenkin clarifies this point: 'The question of whether or not the universe had a beginning assumes a classical spacetime, in which the notions of time and causality can be defined. On very small time and length scales, quantum fluctuations in the structure of spacetime could be so large that these classical concepts become totally inapplicable. Then we do not really have a language to describe what is happening, because all our physics concepts are deeply rooted in the concepts of space and time. … But if the fluctuations are not so wild as to invalidate classical spacetime, the BGV theorem is immune to any possible modifications of Einstein's equations which may be caused by quantum effects' (Vilenkin quoted in Craig 2013).

model, and the conformal cyclic cosmology model. The *oscillating model* states that the universe oscillates indefinitely by expanding from a big bang to a maximum size and then contacting back down to a big crunch, similar to an accordion. According to Paul Steinhardt and Neil Turok's *ekpyrotic model*, the volume of the universe is always increasing (or the three-brane that represents our universe is always expanding), since expansion exceeds contraction in each cycle. Paul Frampton and Lauris Baum's *deflation model* postulates that, with each cycle, the universe expands rapidly until it fragments into numerous causally detached patches at the turnaround (i.e. just before the big rip), most of which then deflate (or contract down) to a big bang and then rebound and begin the same cycle. Finally, Roger Penrose has proposed the *conformal cyclic cosmology* (CCC) model, according to which each cycle (or 'aeon' in Penrose's terms) involves a big bang followed by an infinite future expansion that eventually results in the big bang of the next cycle.

These various cyclic models do not necessarily require that an infinite number of past cycles have occurred. They are compatible with there being a finite number of past cycles only. Nevertheless, according to the cyclic hypothesis, the universe is eternal because there have, in fact, been an infinite number of cycles as per one of the cyclic models mentioned above. Let us examine how well this hypothesis complies with the criteria for determining the best explanation as stated above.

(1) *Consistency*. The basic idea behind the cyclic hypothesis appears to be internally consistent and consistent with other accepted scientific theories. However, as Xin Zhang (2009) has shown, the deflation model has an internal problem, namely, the Hubble distance will become infinite at the turnaround and, thus, the universe will not fragment into numerous causally detached patches. Moreover, the oscillating model has an entropy problem (as we will see below), the ekpyroptic model and deflation model rely on undeveloped fields (i.e. phantom bounce cosmology and string theory), and the CCC model is controversial, speculative, and still in the process of being evaluated by the scientific community.[5] Thus, it is unclear whether any of the cyclic models will, in fact, turn out to be internally consistent. Furthermore, as we will see below, even if the cyclic hypothesis is internally consistent, most of the cyclic models are inconsistent with the BGV theorem. Therefore, it is not possible to claim that the cyclic hypothesis satisfies the consistency criterion.

(2) *Explanatory scope and power*. Here we encounter additional problems with the cyclic hypothesis. First, the oscillating model does not explain the low entropy state of the early universe. If there have been an infinite succession of cycles, then our universe would not have an initial low entropy state. In fact, Joseph Silk (2001:380) estimates that there could have only been approximately one hundred of these past cycles. Moreover, the oscillating model fails to explain why the expansion

[5] Rodney Holder (2013:124) declares, 'Penrose's theory is highly contentious among cosmologists … Even Penrose himself is aware that many details of the conformal cyclic model remain to be filled in. Moreover, observations which Penrose argues support his model are disputed, as is the theory itself. One point counting against it is that for the rescaling to work all particles have to lose their mass, whereas, as far as we know, the electron mass is stable'.

of the universe is accelerating. The fact that cosmic expansion is acceleration strongly suggests that the universe will expand forever and never contract down to a big crunch. According to the physicist, Stephen M. Barr (2006:54), 'present data indicate an expansion of the universe that is getting faster and faster, and therefore suggest that the expansion will go on forever rather than reversing and leading to a crunch or bounce'.

Second, if the entropy problem is avoided by the volume of the universe increasing with each cycle, then the universe is, on average, expanding and thus the BGV theorem would apply to it (Mithani and Vilenkin 2012). Hence, the ekpyroptic model, the deflation model, and the CCC model do not explain how the universe could be eternal in light of the BGV theorem (Borde et al. 2003:4; Craig and Sinclair 2012:152). Commenting on the ekpyroptic model, Vilenkin (2015) writes,

> The problem with this scenario is that, on average, the volume of the universe still grows, and thus the BGV theorem can be applied. This leads immediately to the conclusion that a cyclic universe cannot be past-eternal.

Therefore, the cyclic hypothesis has weak explanatory scope because it fails to account for several scientific facts.

(3) *Simplicity*. A cyclic universe appears simple at first sight. However, this impression quickly vanishes once we realise that this hypothesis postulates an *infinite* number of past cycles. As Robert Nola and Howard Sankey (2007:42) note, simplicity may be understood as follows: 'Other things being equal, if theory T_1 postulates more entities … than another theory T_2, then we are to choose T_2 over T_1. This is commonly expressed as a version of Ockham's razor: do not multiply entities beyond necessity'. Note that T_2 is simpler than T_1 regardless of whether T_1 postulates more *types* of entities or more *instances* of one type of entity than T_2. For example, suppose you find a note on your car that reads 'Your back tyre is flat'. The hypothesis that *one stranger wrote this note* is simpler than the hypothesis that *a thousand strangers wrote this note*, even though the latter merely postulates more *instances* of the same type of entity (i.e. stranger). Hence, to assume that the universe has endured an infinite number of cycles is to assume the existence of an infinite number of entities, and this is the antithesis of simplicity.

Therefore, the cyclic hypothesis is not a good hypothesis as it does not satisfy the criteria of consistency, explanatory scope, or simplicity.

9.5.2 The Quantum Creation Hypothesis

This hypothesis states that classical spacetime emerged (in the reductionistic, non-temporal sense) from a quantum state. This quantum state is sometimes referred to, rather misleadingly, as 'nothing' because it is devoid of space and time (or classical spacetime). However, the quantum state or vacuum is not literally nothing but, rather, a physical state of fluctuating virtual (or unobservable) particles (Silk 2001:387; Vilenkin 2006:181). Nevertheless, there are two similar cosmological

proposals that describe this apparent quantum emergent (or 'creation') of the universe. The first is Alexander Vilenkin's (1982; 1984) tunnelling proposal, according to which our classical spacetime came into existence (or tunnelled) out of the quantum vacuum as a quantum fluctuation. The second is James Hartle and Stephen Hawking's (1983) no-boundary proposal, according to which there are no spatio-temporal boundary conditions of the universe. Both these proposals describe the universe as a wave function rather than a classical spacetime. In a sense, one may say that these proposals treat physical reality as a quantum system that transitioned from a state with a vacuum devoid of spacetime to a state with spacetime (Barr 2006:276). Furthermore, in order to remove the initial big bang singularity, these proposals involve a Wick rotation, that is, they introduce Euclidean or 'imaginary' time by using imaginary (complex) numbers, such as the square root of -1, for the time variable in Einstein's gravitational equations. This has the strange consequence of converting time into a spatial dimension as one approaches the Planck epoch. At that epoch, spacetime does not exist and only a four-dimensional space exists. Real time comes into focus only as the size of the universe increases. The quantum creation hypothesis, then, states that either (i) the tunnelling proposal is correct and the quantum vacuum is eternal, or (ii) the no-boundary proposal is correct and the universe is completely autonomous. How well does this hypothesis comply with our above criteria?

(1) *Consistency*. In light of the fact that we do not yet have a quantum theory of gravity, it is unclear whether the tunnelling and no-boundary proposals are internally consistent, or whether they will turn out to be consistent with the (still to be developed) theory of quantum gravity. Indeed, after discussing the original mathematics of the no-boundary proposal, Chris J. Isham (1997:402), one of the leading experts on quantum gravity, remarks, 'It is most unlikely that the [no-boundary] theory is mathematically consistent in the form presented above. Quantum theories of gravity tend to be plagued with ill-defined expressions which are singularly difficult to remove'. As regards the tunnelling proposal, Isham (1997:402) claims that it is 'not so well-developed and … [does not] fit in as well with a general approach to the problem of quantum gravity'. Thus, since it is widely believed that a complete theory of quantum gravity will drastically change our concept of the space/spacetime continuum, the tunnelling and no-boundary proposals will, in all likelihood, prove to be internally inconsistent.

Moreover, the quantum creation hypothesis faces other problems. First, J. Richard Gott and Li-Xin Li (1998) argue that the tunnelling and no-boundary proposals should contain realistic energy levels and, if they did, then they would describe the universe emerging from a classical metastable state. However, since a metastable state is unstable, it cannot be eternal. Second, although the tunnelling and no-boundary proposals are supposed to eliminate the initial singularity, Martin Bojowald and Hugo A. Morales-Técotl (2004:431) show that they, in fact, do not do this, for the wave function does not disappear at the singularity. Indeed, Bojowald and Morales-Técotl call this singular point 'a point of creation'.

Third, as regards the tunnelling proposal, the quantum vacuum cannot be eternal because, if it were timeless, then it would not spontaneously produce a temporal

universe, and if it were temporal, then it would have to be unstable and unable to last for an infinite time. As Anthony Aguirre and John Kehayias (2013:5) declare,

> [I]t is very difficult to devise a system—especially a quantum one—that does nothing 'forever,' then evolves. A truly stationary or periodic quantum state, which would last forever, would never evolve, whereas one with any instability will not endure for an indefinite time'.

Fourth, the no-boundary proposal does not entail that the universe is autonomous or self-explaining but, rather, it simply provides us with a set of equations that help us to calculate a wave-functional that complies with the Wheeler-DeWitt equation (Butterfield and Isham 1999:60) or, as Vilenkin (2006:191) puts it, it leaves us 'with a rather formal prescription for calculating probabilities'. However, as Hawking himself admits, a set of equations does not, by itself, necessitate the existence of the universe. Hawking (1988:174) writes, 'Even if there is only one possible unified theory, it is just a set of rules and equations. What is it that breathes fire into the equations and makes a universe for them to describe? The usual approach of science of constructing a mathematical model cannot answer the questions of why there should be a universe for the model to describe'.

Finally, the realistic interpretation of imaginary time is unjustified. In view of the fact that the moments of time, unlike the points in space, are ordered by the *earlier than* relation, time is metaphysically distinct from space. Moreover, the Wick rotation 'is little more than a convenient mathematical trick' (Isham 1997:399) and imaginary time 'is introduced only for computational convenience' (Vilenkin 2006:182). Consequently, we should not interpret the tunnelling and no-boundary proposals realistically and, thus, the quantum creation hypothesis cannot be a true description of reality. For these reasons, the quantum creation hypothesis does not satisfy the consistency criterion.

(2) *Explanatory scope and power*. The no-boundary proposal predicts that it is vastly more probable that the universe would start with the largest possible size and the smallest amount of vacuum energy (Vilenkin 1998, 2006:191). Moreover, the accelerated expansion of the universe implies that it is highly probable that the present universe is an almost empty de Sitter spacetime, which is clearly not the case (see Page 2007). Thus, the no-boundary proposal explains neither the fact of cosmic acceleration nor the fact that the early universe was extremely hot and dense.

Furthermore, since both the tunnelling and no-boundary proposals rest on the presupposition that the universe may be described solely by quantum mechanics, they fail to address the so-called 'problem of time' (an umbrella term used to classify several related problems). The proposals do not explain the fact that we live in a temporally evolving universe. As George F. R. Ellis, Roy Maartens, and Malcolm A. H. MacCaullum note (2012:516), 'the [tunnelling and no-boundary] solution is static, and so it is difficult to see how it can represent a time-evolving universe'. Furthermore, the proposals do not solve what Svend E. Rugh and Henrik Zinkernagel (2011:421) term 'the cosmic measurement problem', namely, if the

universe was (and still is) fundamentally quantum, then how can there be classical structures now? Rugh and Zinkernagel argue that, since cosmic time depends on classical (non-quantum) structures, a classical spacetime cannot gradually emerge in terms of cosmic time (as implied by the tunnelling and no-boundary proposals). Thus, since quantum cosmology has nothing to say with respect to the measurement problem (Hartle 1991:154), it does not solve the cosmic measurement problem.

The tunnelling and no-boundary proposals also fail to explain which time is consistent with the Wheeler-DeWitt equation. Commenting on the entire quantum creation proposal, Jeremy Butterfield and Chris J. Isham remark:

> [I]t does *not* (and is not intended to) solve the problem of time; nor does it give an account of the emergence of time. That is: even if it overcame all its own problems, it would give us nothing more (nor less!) than a wave-functional of the universe obeying the Wheeler-DeWitt equation. The problem … of finding a time with which to make sense of the Wheeler-DeWitt equation … would still have to be addressed. So would the … issue … of how to get a *classical* spacetime … from this [wave-functional] (Butterfield and Isham 1999:60 [original emphasis]).

Finally, the tunnelling and no-boundary proposals face the reverse problem of time, which Zinkernagel (2006:309) describes as follows:

> [T]he assumption that quantum gravity (or quantum cosmology) is relevant for the study of the very early universe rests on a solid classical (i.e. not described by a quantum operator) notion of time. But if it is conjectured that timeless quantum gravity is *the* fundamental theory—from which classical physics and concepts can be derived—it appears paradoxical that its central field of application (the early universe) is only defined by a concept (classical cosmic time) which is completely alien to the theory.

As Zinkernagel notes, since we must assume a classical concept of time in order to discuss the primary application of quantum gravity, it is unclear what is meant by the assumption that the nature of the universe is, ultimately, quantum or non-classical. The quantum creation hypothesis simply does not address this problem. For these reasons, the quantum creation hypothesis has weak explanatory power and scope.

(3) *Simplicity*. The mathematics of the tunnelling and no-boundary proposals may be simple, but, overall, the proposals are not simple because they rely on several assumptions that many physicists have strong reservations about (Isham 1997:401–402). The quantum creation hypothesis requires us to assume, first, that the entire universe may be described solely by quantum physics, second, that the mathematical representation of the space/spacetime continuum is correct on quantum levels, third, that time may be identified with space and, finally, that the Everett many-worlds interpretation of quantum mechanics is the correct interpretation (Vilenkin 2006:187). These questionable assumptions greatly diminish the simplicity of the quantum creation hypothesis.

We may conclude, therefore, that the quantum creation hypothesis, as with the cyclic hypothesis, is not a good hypothesis because it fails to satisfy the criteria of consistency, explanatory scope and power, and simplicity.

9.5.3 The Multiverse Hypothesis

In the past decade the notion of a multiverse has captivated cosmologists. The general perception of a multiverse is that our observable universe (or spacetime) is not the only universe and that many other universes (or spacetimes) exist. There are several ways in which to envisage a multiverse. For example, inflationary multiverse theories (such as eternal inflation or chaotic inflation) state that an everlasting inflationary spacetime constantly spawns separate spacetimes. A multiverse could also be understood in terms of Everett's many-worlds interpretation of quantum mechanics, according to which the alternative histories of our universe are essentially distinct 'universes' that exist in a different branch of the quantum wave function. One could also understand a cyclic universe (as described above) as a multiverse. Nevertheless, since the inflationary multiverse is the most widely accepted type of multiverse, I will focus on it although most of my comments also apply to the other multiverse proposals. Thus, I will understand the multiverse hypothesis as the claim that an inflationary multiverse exists and that the 'mother' inflationary spacetime is past eternal.

(1) *Consistency*. It is difficult to determine whether the multiverse hypothesis is internally consistent because, as Ellis (2011:43) notes, the multiverse proposal 'is more a concept than a well-defined theory. Most [multiverse] proposals involve a patchwork of different ideas rather than a coherent whole'. As with the quantum creation hypothesis, the internal consistency of the multiverse hypothesis will depend on the final theory of quantum gravity, which many hope will be string theory. However, as Ellis and Silk (2014:322) declare, 'Fundamentally, the multiverse explanation relies on string theory, which is as yet unverified, and on speculative mechanisms for realizing different physics in different sister universes. It is not, in our opinion, robust, let alone testable'. Thus, the multiverse hypothesis is controversial. Furthermore, in their article entitled *Mathematical Issues in Eternal Inflation*, Ikjyot Singh Kohli and Michael C. Haslam (2015) show that the widely accepted scenario of eternal inflation cannot, in fact, be eternal and, thus, it would not produce an infinite number of universes. They conclude that the possibility of an inflationary multiverse 'is still very much an open question that will require much deeper investigation'. Therefore, we currently do not know whether the multiverse hypothesis is internally consistent.

Nevertheless, even if the multiverse hypothesis turns out to be internally consistent, it would still be inconsistent with both the BGV theorem and the fact that we are not living in a simulated reality. First, since an everlasting inflationary spacetime is, on average, expanding, it cannot, according to the BGV theorem, be past eternal (see Spitzer 2010:75–87). Second, by far the majority of people accept that the universe and our experience of the universe are real as opposed to illusions or computer simulations. We are not living in a virtual reality, such as 'the Matrix', but, rather, we are real people living in a real universe. Although this is not a scientific fact, it is an important presupposition of science. If the universe is an illusion or simulated reality, then the laws of physics must be illusory and this, in turn, implies that the

scientific enterprise is futile because there is no reliable truth to be discovered. Indeed, if one denies that the universe is real, then one must deny the validity of all scientific facts (including the facts discussed above). 'Not surprisingly', declares John D. Barrow (2005:210), 'simulated realities are not welcomed into the scientific world-view'. Thus, since the notion of a fake universe is incompatible with science, and since we have no reason or evidence in favour of this notion, we are justified in thinking that the universe is, in fact, real.

However, if the multiverse hypothesis is true, then we should believe that we are in a simulated reality (see Barrow 2005:203–205; Davies 2007:496–497). A multiverse will include many universes in which most of its observers are in a simulated reality, having been produced artificially by a technologically advanced civilisation or a 'Grand Architect'. Since such a universe is vastly more probable than a real, non-simulated universe, if we believe in the multiverse hypothesis, then we should also believe that our universe is not real. As Paul Davies argues,

> For any given 'real' world, there would be a vast, indeed infinite, number of possible virtual worlds. A randomly selected observer would then be overwhelmingly more likely to experience a virtual simulation than the real thing. Thus there is little reason to suppose that *this* world (the one you and I are observing now) is other than a simulated one (Davies 2007:496 [original emphasis]).

Hence, the multiverse hypothesis is inconsistent with the fact that the universe is real. Therefore, consistency is not a feature of the multiverse hypothesis.

(2) *Explanatory scope and power*. Unfortunately, the multiverse hypothesis also faces difficulties in respect of this criterion. First, as noted above, the hypothesis does not explain how the multiverse may be past eternal in light of the BGV theorem. Second, the multiverse hypothesis does not explain the low entropy state of the early universe. Roger Penrose (1991:342–344; 2005:726–731; 2011:126–127) calculates that the odds of the universe starting in such a state are one part in $10^{10(123)}$, where the superscript '10(123)' means '10^{123}'. In other words, for every $10^{10(123)}$ possible universe configurations, only one universe configuration would have the same initial low entropy state as that of our universe. However, Penrose (1991:354) argues that the odds of our entire solar system being created by random collisions of particles is about one part in $10^{10(60)}$. Consequently, since 1 in $10^{10(60)}$ is *vastly* more probable than 1 in $10^{10(123)}$, only an incomprehensibly tiny fraction of universes in the multiverse ensemble would start in such a low entropy state. Hence, if the multiverse hypothesis were true, our universe should be much smaller than it actually is and it would be inexplicable as to why our universe started in such a low entropy state. Consequently, the explanatory scope and power of the multiverse hypothesis is unsatisfactory.

(3) *Simplicity*. A prominent criticism of the multiverse hypothesis is that it is not simple (Davies 1983:173–174; Ellis 2011:43; Holder 2013:136–137; Steinhardt 2014). In order to explain why our universe (or spacetime) started in a low entropy state, the multiverse hypothesis postulates that many, most probably an infinite number of, distinct universes (or spacetimes) exist. However, such an explanation is far from simple. As noted above, simplicity is identified with Occam's razor, which

is the principle that an explanation should not include more assumptions or entities than are necessary. Thus, since the multiverse hypothesis assumes the existence of far more entities than are necessary, it is not a simple hypothesis.

Max Tegmark disagrees. According to Tegmark (2007:123), algorithmic information theory demonstrates that 'an entire ensemble is often much simpler than one of its member'. Tegmark argues:

> The algorithmic information content in a number is, roughly speaking, the length of the shortest computer program that will produce that number as output. For example, consider the set of all integers. Naïvely, you might think that a single number is simpler than the whole set of numbers, but the set can be generated by a trivial computer program, whereas a single number can be hugely long. Therefore, the whole set is actually simpler. … The lesson is that complexity increases when we restrict our attention to one particular element in an ensemble, thereby losing the symmetry and simplicity that were inherent in the totality of all the elements taken together (Tegmark 2007:123).

There are several problems with the above argument. First, no computer program is able to generate as output the set of all integers, since such a program would not only require an infinite amount of both time and processing power, but it would run indefinitely and never complete its task. Second, Tegmark confuses the set S of numbers with the computer program P that generates the set. Clearly, the number of characters in P's code may be less than the number of digits of one of the members of S, but this does not imply that S is simpler than its individual members. When written out, S contains more characters than any one of its members. Third, it is unclear (and Tegmark does not tell us) how algorithmic information theory may be relevant to the multiverse, since the latter comprises physical entities (i.e. entire spacetimes) and not simply characters or digits.

Finally, Tegmark mistakenly understands simplicity in terms of Kolmogorov complexity. The Kolmogorov complexity of an output object, such as a string, is the length of the shortest program code that generates the object. Thus, Tegmark believes that, if the Kolmogorov complexity of some set S is smaller than that of $s \in S$, then S is simpler than s. However, this sense of 'simplicity' is not what the critics of the multiverse have in mind. The mathematical simplicity of the multiverse model is, frankly, not the issue. As noted above, simplicity is the principle that an *explanation* should not involve more entities than are necessary. In Tegmark's example, the computer program is an entity, the programmer is an entity, the computer running the program is an entity, and so on. Hence, an explanation of some computer output that postulates one program, one programmer, and one computer is simpler than an explanation that postulates a thousand of each. However, it is this sense of 'simplicity', which Tegmark has not even begun to address, that the critics have in mind.

We can see, then, that the multiverse hypothesis does not satisfy the simplicity criterion. Indeed, coming back to the example in which you find a note on your car that reads 'Your back tyre is flat', the multiverse hypothesis is akin to the hypothesis that *an infinite number of strangers wrote this note*, since the multiverse hypothesis postulates an infinite (or nearly infinite) number of universes merely to explain our universe. However, as with the cyclic hypothesis, this is the antithesis of simplicity.

In conclusion, the multiverse hypothesis is not a good explanation of the scientific facts, since it is inconsistent, has weak explanatory scope and power, and is far from simple. Therefore, not one of the hypotheses discussed above (cyclic, quantum creation, multiverse) appear to provide good explanations of the facts. Commenting on these hypotheses, Ellis (2007:1213) rightly complains,

> All of these proposals however are strongly speculative, none being based solidly in well-founded and tested physics, and none being in any serious sense supported by observational evidence. They are all vast extrapolations from the known to the unknown. They may or may not be true. One thing is certain: they can't all be true!

The final hypothesis we will evaluate is the beginning hypothesis, which proves to be a better hypothesis than the rival hypotheses.

9.5.4 The Beginning Hypothesis

According to the beginning hypothesis, the Standard Hot Big Bang model (also known as the Friedmann-Lemaître model) is correct in predicting that the universe had an absolute beginning, coming into existence a finite time ago. Based on GR, the Standard Hot Big Bang model predicts that the universe 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 'big bang' or the 'initial singularity' and it represents the beginning of time or classical spacetime. Although the Big Bang Theory is primarily a theory about the evolution of the universe since the big bang, '[a]ll the simple homogeneous cosmological models, described by the Friedmann equation, feature an instant of creation at infinite density' (Liddle and Loveday 2009:28). Hence, I use the phrase 'the Standard Hot Big Bang model' instead of the phrase 'the Big Bang Theory' to emphasise that the beginning hypothesis is concerned, not with the evolution of the universe, but with the prediction that the universe had a beginning.

Although physicists often associate a singularity with the curvature or density of spacetime becoming infinite, this association is misleading. For example, John J. Park (2016) interprets this association as the claim that the initial singularity is a transcendent abstract object that caused the existence of the universe.[6] However, when a physicist states that the initial singularity is a state of infinite spacetime curvature, he or she does not mean that it is an abstract object that has the property of being infinite but, rather, that as one extrapolates back in time, the spacetime curvature tends to infinity, that is to say, the volume of spacetime approaches zero in the limit as its scale factor approaches zero (Heller 2009:24; Craig and Sinclair 2012:129). Moreover, the Standard Hot Big Bang model does not describe the events 'at' the singularity (or 'at' the edge of spacetime), so to speak, because GR breaks down at this limit. As Andrei Linde states,

[6]For a detailed response to Park, see Erasmus (2016).

> 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 1994:48).

A singularity in physics is formally defined, then, in terms of geodesic or path incompleteness (Wald 1984:215; Liddle and Loveday 2009:277; Ellis et al. 2012:145). As noted above, a geodesic is a spacetime path along which a freely falling particle moves, and a geodesic is incomplete if it has a finite, affine length. Accordingly, spacetime is singular if it is time-like or null geodesically incomplete.[7] We may think of the initial singularity as a boundary (or edge) of the universe, where 'boundary' does not refer to some wall or barrier with which an observer may collide but, rather, it signifies that spacetime is inextendible in at least one direction. As an analogy, one could think of the 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 or concrete object. It is important to note that 'it is this property [of geodesic incompleteness] that is proven by the singularity theorems to hold in a wide class of spacetimes' (Wald 1984:216).

The Standard Hot Big Bang model predicts that the universe is past geodesically incomplete and, thus, had an absolute beginning. Ellis (2007:1190) describes such a start to the universe as follows: 'This 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'. The beginning hypothesis, then, makes two important claims. First, it states that, since the universe is geodesically incomplete, it had an absolute beginning. Second, it states that (i) physics (or science) cannot explain why the universe had a beginning or why it began the way it did, for physics began to exist with the universe, and that (ii) these 'why' questions are metaphysical questions that should be answered, not by science, but by philosophy or theology. However, this does not mean that the beginning hypothesis is a religious hypothesis (where 'religious' means presupposing the existence of a supernatural realm, such as one or more deities). The hypothesis is religiously neutral because it does not invoke the supernatural. How well, then, does the beginning hypothesis fare against the criteria?

(1) *Consistency*. The beginning hypothesis is consistent because it involves no logical or internal contradictions, nor does it face any theoretical problems. Some physicists believe, however, that we may not trust the Standard Hot Big Bang model's prediction of an absolute beginning because GR breaks down at the Planck epoch where quantum effects are believed to be dominant. However, the fact that GR may not describe the Planck epoch does not imply that we cannot trust the prediction of a beginning of the universe. The reason for this is that the early quantum gravity

[7] Sometimes a singularity is defined solely as a spacetime boundary where the curvature of spacetime becomes infinite. Robert M. Wald (1984:214–215) shows, however, that spacetime may be singular without the curvature becoming infinite. Hence, it is best to define a singularity in terms of geodesic incompleteness.

epoch cannot be prior to the beginning of time (or classical spacetime), since this would require the existence of time. Rather, classical mechanics/GR and quantum mechanics/gravity describe the *exact same* reality but at different levels. The former describes the universe at a macroscopic level while the latter describes the universe at a microscopic level. Thus, if classical spacetime is not eternal, then neither is the quantum gravity epoch. Moreover, GR cannot be completely reduced to quantum gravity (as the quantum fundamentalist claims) because the existence of classical spacetime must be presupposed before the applicability of quantum gravity may be discussed. As Zinkernagel argues,

> It is sometimes said that since general relativity predicts space-time singularities (the Big Bang and the center of black holes), this theory predicts its own demise as it is unable to describe the vicinity of these singularities (due to quantum gravity effects). … [H]owever, theoretical (and observational) access to either the very early universe or black holes relies firmly on classical theory—namely classical general relativity. This seems to imply that one must *presuppose* classical theories in order to *define* the field of application for quantum gravity. If this is correct then it at least limits the sense in which general relativity can be reduced to quantum gravity (Zinkernagel 2006:307 [original emphasis]).

Therefore, there is nothing incoherent about the claim that the universe came into existence either at an initial singularity or at the Planck epoch (where the quantum gravity epoch simply represents the boundary to the universe). Thus, the beginning hypothesis satisfies the consistency criterion.

(2) *Explanatory scope and power*. The beginning hypothesis demonstrates good explanatory scope and power because it clearly explains (and is consistent with) the expansion of the universe, the Cosmic Microwave Background radiation, the extremely hot and dense early universe, the present low entropy state of the universe, and that any universe that is, on average, expanding had a beginning. However, the Standard Hot Big Bang model does not explain why the universe had a beginning and why it started in such a low entropy state. Nevertheless, the beginning hypothesis does not state that these questions are inexplicable but, rather, that they should be addressed by philosophy or theology instead of science. This, in itself, is an explanation. Thus, even if the beginning hypothesis does not have perfect explanatory power, it has better explanatory scope and power than the above rival hypotheses.

(3) *Simplicity*. Unlike the rival hypothesis, the beginning hypothesis exhibits simplicity because it does not involve *ad hoc* assumptions. The hypothesis does not postulate the existence of an infinite number of distinct spacetimes, or that time may be identified with space, or that quantum fundamentalism is true. Nor does the hypothesis depend on a specific interpretation of quantum mechanics. It does assume, however, that some discipline other than science may address the issue of why the universe began the way it did. However, this assumption is not *ad hoc* because it stems from the widely accepted belief that scientism is implausible and that there are things that science cannot explain. Nevertheless, even if this assumption is *ad hoc*, the beginning hypothesis is still far simpler than the rival hypotheses.

In their book *The Grand Design*, Hawking and Mlodinow (2010:68) declare,

> It is not yet clear whether a model in which time continued back beyond the big bang would be better at explaining present observations because it seems the laws of the evolution of the universe may break down at the big bang. If they do, it would make no sense to create a model that encompasses time before the big bang, because what existed then would have no observable consequences for the present, and so we might as well stick with the idea that the big bang was the creation of the world.

What our discussion above reveals is that, if the beginning hypothesis is included in the pool of explanatory options, then this hypothesis turns out to explain present observations better than do the cyclic, quantum creation and multiverse hypotheses. The obvious corollary of this is that, at present, an eternal cosmological model cannot, by itself, justify one's belief in a past eternal universe. Thus, in the words of Hawking and Mlodinow, 'we might as well stick with the idea that the big bang was the creation of the world'.

9.6 Conclusion

It is difficult to see how the belief in the possibility of an eternal universe may be justified solely by the fact that there exist several eternal cosmological models if one either (i) fails to engage with the philosophical arguments against an eternal universe or (ii) deliberately excludes the hypothesis of an absolute beginning from the pool of explanatory options. However, even if this conclusion is false and an eternal cosmological model may justify one's belief in the possibility of an eternal universe, the hypothesis that the universe had a beginning still turns out as the best explanation of the discoveries of cosmology. Therefore, those who are sincerely seeking to know whether the universe is eternal ought to evaluate the philosophical arguments against an eternal universe. In the next chapter I will defend the second premise of the *kalām* cosmological argument, namely, that if the universe came into existence, then God brought it into existence.

References

Aguirre, A., & Kehayias, J. (2013). Quantum instability of the emergent universe. http://arxiv.org/abs/1306.3232v2. Accessed 22 May 2016.

Albrecht, A., & Sorbo, L. (2004). Can the universe afford inflation? http://arxiv.org/abs/hep-th/0405270v2. Accessed 28 Aug 2016.

Barr, S. M. (2006). *Modern physics and ancient faith*. Notre Dame: University of Notre Dame Press.

Barrow, J. D. (2005). *The infinite book: A short guide to the boundless, timeless, and endless*. New York: Pantheon Books.

Bojowald, M., & Morales-Técotl, H. A. (2004). Cosmological applications of loop quantum gravity. In N. Bretón, J. L. Cervantes-Cota, & M. Salgado (Eds.), *The early universe and observational cosmology* (pp. 421–462). Berlin: Springer.

Boltzmann, L. (1895). On certain questions of the theory of gases. *Nature, 51*(1322), 413–415.
Borde, A., Guth, A. H., & Vilenkin, A. (2003). Inflationary spacetimes are incomplete in past directions. *Physical Review Letters, 90*(15).
Butterfield, J., & Isham, C. J. (1999). On the emergence of time in quantum gravity. https://arxiv.org/abs/gr-qc/9901024. Accessed 09 Sept 2016.
Craig, W. L. (2013). 'Honesty, transparency, full disclosure' and the Borde-Guth-Vilenkin theorem. http://www.reasonablefaith.org/honesty-transparency-full-disclosure-and-bgv-theorem. Accessed 13 May 2016.
Craig, W. L., & Sinclair, J. D. (2012). The Kalam cosmological argument. In W. L. Craig & J. P. Moreland (Eds.), *The Blackwell companion to natural theology* (pp. 101–201). Oxford: Wiley-Blackwell.
Dainton, B. (2010). *Time and space* (2nd ed.). Durham: Acumen.
Darwin, C. (2008). *On the origin of species* (Oxford world's classics, Revised ed.). Oxford: Oxford University Press.
Davies, P. (1983). *God and the new physics*. New York: Simon & Schuster.
Davies, P. (2007). Universes galore: Where will it all end? In B. Carr (Ed.), *Universe or multiverse?* (pp. 487–505). Cambridge: Cambridge University Press.
Douven, I. (2011). Abduction. In E .N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Spring 2011 ed.). http://plato.stanford.edu/archives/spr2011/entries/abduction/. Accessed 29 April 2016.
Eddington, A. S. (1931). The end of the world: From the standpoint of mathematical physics. *Nature, 127*, 447–453.
Ellis, G., & Silk, J. (2014). Scientific method: Defend the integrity of physics. *Nature, 516*, 321–323.
Ellis, G. F. R. (2007). Issues in the philosophy of cosmology. In J. Butterfield & J. Earman (Eds.), *Philosophy of physics: Part B* (pp. 1183–1285). Amsterdam: Elsevier.
Ellis, G. F. R. (2011). Does the multiverse really exist? *Scientific American, 305*(2), 38–43.
Ellis, G. F. R., Maartens, R., & MacCallum, M. A. H. (2012). *Relativistic cosmology*. Cambridge: Cambridge University Press.
Erasmus, J. (2016). Is the big bang the sole cause of the universe? A response to John J. Park. *Acta Analytica, 31*(3), 337–344.
Francis, M. J., Barnes, L. A., James, J. B., & Lewis, G. F. (2007). Expanding space: The root of all evil? http://arXiv.org/abs/0707.0380v1. Accessed 09 May 2016.
Gott, J. R., & Li-Xin, L. (1998). Can the universe create itself? *Physical Review D, 58*(2).
Haarsma, L. (2010). Scientific knowledge does not replace religious knowledge. In M. Y. Stewart (Ed.), *Science and religion in dialogue* (Vol. 1, pp. 153–167). Malden: Wiley-Blackwell.
Harrison, E. R. (2000). *Cosmology: The science of the universe* (2nd ed.). Cambridge: Cambridge University Press.
Hartle, J. B. (1991). The quantum mechanics of cosmology. In S. Coleman, J. B. Hartle, T. Piran, & S. Weinberg (Eds.), *Quantum cosmology and baby universes* (pp. 65–157). Singapore: World Scientific. OCLC: 24771696.
Hartle, J. B., & Hawking, S. W. (1983). Wave function of the universe. *Physical Review D, 28*(12), 2960–2975.
Hawking, S., & Mlodinow, L. (2010). *The grand design*. London: Bantam Books.
Hawking, S. W. (1988). *A brief history of time: From the big bang to black holes*. New York: Bantam Books.
Heller, M. (2009). *Ultimate explanations of the universe*. Heidelberg: Springer.
Holder, R. D. (2013). *Big bang big God: A universe designed for life?* Oxford: Lion Books.
Hoyle, F. (1948). A new model for the expanding universe. *Royal Astronomical Society, 108*, 372–382.
Isham, C. J. (1997). Creation of the universe as a quantum process. In R. J. Russell, W. R. Stoeger, & G. V. Coyne (Eds.), *Physics, philosophy, and theology: A common quest for understanding* (3rd ed.) (pp. 375–408). Vatican City State: Vatican Observatory.

Kohli, I. S., & Haslam, M. C. (2015). Mathematical issues in eternal inflation. *Classical and Quantum Gravity, 32*(7), 1–12.
Liddle, A. (2015). *An introduction to modern cosmology* (3rd ed.). Chichester: John Wiley & Sons.
Liddle, A., & Loveday, J. (2009). *The Oxford companion to cosmology*. Oxford: Oxford University Press.
Linde, A. (1994). The self-reproducing inflationary universe. *Scientific American, 271*(5), 48–55.
Lipton, P. (2004). *Inference to the best explanation* (2nd ed.). London: Routledge.
McMullin, E. (1992). *The inference that makes science* (Number 1992). Milwaukee: Marquette University Press.
Mithani, A., & Vilenkin, A. (2012). Did the universe have a beginning? https://arxiv.org/abs/1204.4658. Accessed 18 May 2016.
Moreland, J. P., & Craig, W. L. (2003). *Philosophical foundations for a Christian worldview*. Downers Grove: InterVarsity Press.
Nola, R., & Sankey, H. (2007). *Theories of scientific method: An introduction*. Stocksfield: Acumen.
Page, D. N. (2007). Susskind's challenge to the Hartle–Hawking no-boundary proposal and possible resolutions. *Journal of Cosmology and Astroparticle Physics, 2007*(1), 1–20.
Park, J. J. (2016). The kalām cosmological argument, the big bang, and atheism. *Acta Analytica, 31*(3), 323–335.
Penrose, R. (1991). *The emperor's new mind: Concerning computers, minds, and the laws of physics*. New York: Penguin Books.
Penrose, R. (2005). *The road to reality: A complete guide to the laws of the universe*. London: Vintage Books.
Penrose, R. (2011). *Cycles of time: An extraordinary new view of the universe*. London: Vintage Books.
Polkinghorne, J. (2011). *Science and religion in quest of truth*. New Haven: Yale University Press.
Price, H. (2004). On the origins of the arrow of time: Why there is still a puzzle about the low-entropy past. In C. Hitchcock (Ed.), *Contemporary debates in philosophy of science* (pp. 219–239). Malden: Blackwell Publishing.
Ratzsch, D. (2010). The alleged demise of religion: Greatly exaggerated reports from the science/religion "wars". In M. Y. Stewart (Ed.), *Science and religion in dialogue* (Vol. 1, pp. 69–84). Malden: Wiley-Blackwell.
Riess, A. G., Filippenko, A. V., Challis, P., Clocchiatti, A., Diercks, A., Garnavich, P. M., Gilliland, R. L., Hogan, C. J., Jha, S., Kirshner, R. P., Leibundgut, B., Phillips, M. M., Reiss, D., Schmidt, B. P., Schommer, R. A., Smith, R. C., Spyromilio, J., Stubbs, C., Suntzeff, N. B., & Tonry, J. (1998). Observational evidence from supernovae for an accelerating universe and a cosmological constant. *The Astronomical Journal, 116*(3), 1009–1038. https://iopscience.iop.org/article/10.1086/300499. Accessed 10 May 2016.
Rugh, S. E., & Zinkernagel, H. (2011). Weyl's principle, cosmic time and quantum fundamentalism. In D. Dieks, W. J. Gonzalez, S. Hartmann, T. Uebel, & M. Weber (Eds.), *Explanation, prediction, and confirmation* (pp. 411–424). Dordrecht: Springer. OCLC: 930736539.
Schrabback, T., Hartlap, J., Joachimi, B., Kilbinger, M., Simon, P., Benabed, K., Bradaā, M., Eifler, T., Erben, T., Fassnacht, C. D., High, F. W., Hilbert, S., Hildebrandt, H., Hoekstra, H., Kuijken, K., Marshall, P. J., Mellier, Y., Morganson, E., Schneider, P., Semboloni, E., Van Waerbeke, L., & Velander, M. (2010). Evidence of the accelerated expansion of the Universe from weak lensing tomography with COSMOS. *Astronomy and Astrophysics, 516*(A63).
Scott, E. C. (2009). *Evolution vs. creationism: An introduction* (2nd ed.). Westport: Greenwood Press.
Silk, J. (2001). *The big bang* (3rd ed.). New York: W.H. Freeman and Company.
Spitzer, R. J. (2010). *New proofs for the existence of God: Contributions of contemporary physics and philosophy*. Grand Rapids: William B. Eerdmans.
Steinhardt, P. J. (2014). What scientific idea is ready for retirement? *Edge*. https://www.edge.org/response-detail/25405. Accessed 19 Sept 2016.

Stenger, V. J. (2012). *God and the folly of faith: The incompatibility of science and religion*. Amherst: Prometheus Books.
Stewart, R. B. (Ed.) (2016). *God and cosmology: William Lane Craig and Sean Carroll in dialogue*. Minneapolis: Fortress Press. OCLC: 946346697.
Stoeger, W. R. (2010). The big bang, quantum cosmology and creatio ex nihilo. In D. B. Burrell, C. Cogliati, J. M. Soskice, & W. R. Stoeger (Eds.), *Creation and the God of Abraham* (pp. 152–175). Cambridge: Cambridge University Press.
Sullivan, M. (2010). Type Ia supernovae and cosmology. In G. Wolschin (Ed.), *Lectures on cosmology: Accelerated expansion of the universe* (Lecture notes in physics, Vol. 800, pp. 59–97). Berlin: Springer.
Tegmark, M. (2007). The multiverse hierarchy. In B. Carr (Ed.), *Universe or multiverse?* (pp. 99–125). Cambridge: Cambridge University Press.
Thagard, P. R. (1978). The best explanation: Criteria for theory choice. *The Journal of Philosophy, 75*(2), 76–92.
Vilenkin, A. (1982). Creation of universes from nothing. *Physics Letters, 117*(1), 25–28.
Vilenkin, A. (1984). Quantum creation of universes. *Physical Review D, 30*(2), 509–511.
Vilenkin, A. (1998). The quantum cosmology debate. http://arXiv.org/abs/gr-qc/9812027v1. Accessed 11 Sept 2016.
Vilenkin, A. (2006). *Many worlds in one: The search for other universes*. New York: Hill and Wang.
Vilenkin, A. (2015). The beginning of the universe. *Inference: International Review of Science, 1*(4). http://inference-review.com/article/the-beginning-of-the-universe. Accessed 18 May 2016.
Wald, R. M. (1984). *General relativity*. Chicago: University of Chicago Press.
Wolschin, G. (Ed.) (2010). *Lectures on cosmology: Accelerated expansion of the universe* (Lecture notes in physics, Vol. 800). Berlin: Springer.
Zhang, X. (2009). Can the universe fragment into many independent causal patches at turnaround in cyclic cosmology? *The European Physical Journal C, 59*(4), 755–759.
Zinkernagel, H. (2006). The philosophy behind quantum gravity. *Theoria, 21*(3), 295–312.

Chapter 10
God as the Explanation of the Universe

10.1 Introduction

Having defended the first premise of the *kalām* cosmological argument, we turn now to the second premise, namely, that if the universe came into existence, then God brought it into existence. We saw above that, in their defence of the *kalām* cosmological argument, al-Ghazālī and William Lane Craig defend the Principle of Causality: Everything that begins to exist has a cause. I find Craig's arguments for this principle convincing. However, it would be superfluous to rehash Craig's arguments at this point. Accordingly, I will defend the second premise of the *kalām* cosmological argument in a unique way with the following argument:

1. If the universe came into existence, then it has a sufficient explanation.
2. If the universe has a sufficient explanation, the explanation is that God brought the universe into existence.
3. If the sufficient explanation of the universe is that God brought the universe into existence, then God brought the universe into existence.
4. Therefore, if the universe came into existence, then God brought it into existence.

Since premise 3 is obvious, we need only to defend the first two premises. In support of premise 1, I argue, first, that every contingent concrete object that exists has a sufficient explanation in an external state of affairs why it exists, and, second, that it is highly unlikely that the universe would come into existence without a sufficient explanation. I then defend premise 2 by offering a conceptual analysis of what an explanation of the universe would involve. Let us begin, then, by defending the Principle of Sufficient Reason.

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5_10

10.2 The Principle of Sufficient Reason

The Principle of Sufficient Reason (PSR) is the philosophical principle that states, very broadly, that everything that exists has a sufficient explanation why it exists. This broad version of the PSR applies to both necessary and contingent things. We say that something is *necessary* iff it exists in every possible world (I use the phrase 'possible world' in the usual sense to denote the way reality could have been, logically speaking). We say that something is *contingent* iff it exists in a possible world but also does not exist in another possible world. Now, the advocates of the PSR believe that a sufficient explanation of a necessary thing is that its very essence is necessary. In other words, the explanation that '*x* is necessary' sufficiently explains why *x* exists in the actual world. The existence of a contingent thing, however, cannot be explained by its essence, since its essence does not imply that it exists in the actual world. Thus, a sufficient explanation of a contingent thing *E* must be in an external state of affairs, that is, a state of affairs that excludes *E*. Accordingly, the PSR may be stated as follows:

(P1) Everything that exists has a sufficient explanation why it exists, either in the necessity of its essence or in an external state of affairs.

There are various versions of the PSR that are weaker than (P1). For example, in his important book on the PSR, Alexander R. Pruss (2006) defends the following version:

(P2) Every contingent thing that exists (or every contingent proposition) has a sufficient explanation why it exists (or why it is true).

(P2) restricts the PSR to contingent things or propositions only. However, the PSR may be further restricted to things that come into existence. As we have seen, in their defence of the *kalām* cosmological argument, al-Ghazālī and William Lane Craig use the Principle of Causality, which is a version of the PSR that may be stated as follows[1]:

(P3) Everything that comes into existence has a cause of its existence.

(P3) restricts the PSR, not to contingent things, but to things that come into existence. Although something that comes into existence is contingent, a contingent thing does not necessarily come into existence. Our analysis of 'comes into existence' in Chap. 8 revealed that, if something comes into existence, then it is a temporal entity and it is temporally finite. Consequently, an eternal universe may be *contingent* because its existence is not necessary and yet it does not *come into existence* because it is temporally infinite. Furthermore, (P3) is restricted to causes and not to explanations. Although a cause is a type of explanation (since a cause explains its effect), an explanation is not necessarily a cause. For example, an

[1] However, Craig sometimes presents the *kalām* cosmological argument in terms of a stronger PSR, such as (P1). See, for example, Craig (1999:737).

explanation for why a certain mathematical equation is correct is not the cause of the equation's correctness.

Now, I will not defend (P3); instead, I will defend a version of the PSR similar to (P2), namely:

(P4) Every contingent concrete object that exists has a sufficient explanation in an external state of affairs why it exists.

My reasons for defending (P4) are as follows. First, the argument based on ungrounded causal chains (see Sect. 8.4) depends on a version of the PSR that is at least as strong as (P4). Unfortunately, since (P3) is weaker than (P4), it is compatible with an ungrounded causal chain (Pruss 2006:41). (P3) requires that each effect in the chain has a cause but it does not require that the chain itself has an explanation. Unlike (P3), however, (P4) requires that a contingent causal chain (such as the temporal regress of events) has an explanation in an external state of affairs. Thus, we require (P4) to support our argument based on ungrounded causal chains. Second, some philosophers have preconceived ideas about causation that are inconsistent with the universe having a cause. One such idea, for example, is that a cause must be temporally prior to its effect, which implies that if the universe had a beginning, it cannot have a cause because nothing is temporally prior to the universe. There are many different accounts of causation and, hence, by referring to 'explanations' instead of 'causes' (P4) remains consistent with these various accounts. Finally, (P4) restricts the PSR to *concrete objects*. As noted above (Sect. 7.3.1), a concrete object is an object that is either a personal being, spatially extended, a place, space itself, a time, time itself, or able to bring something into existence. An abstract object, on the other hand, is an object that meets none of these seven conditions. Since we do not have a good handle on the nature of explanations of abstract objects, and since it is controversial whether abstract objects exist, it is deemed safer to restrict the PSR to concrete objects. In the interests of readability, I will hereafter use 'contingent object' to denote 'contingent concrete object' and I will use 'PSR' to refer to (P4), unless otherwise indicated.

10.2.1 The Argument Based on Explanations of Possibility

Our first argument for the PSR is not a deductive argument but, rather, a type of inductive argument that tries to show that the PSR is more probable than its negation. It is common for the proponents of the PSR to appeal to one's intuition to defend the PSR. One should affirm the PSR, they claim, because it is so self-evident. Although I find this argument convincing, I wish to show that one may defend the PSR by appealing to a stronger intuition, namely, that every contingent object that has *an explanation* has a *sufficient* explanation.[2] Let me explain.

[2]Of course, one may try to discredit any argument that rests on an intuition with the simple remark, 'I do not share that intuition'. What could one say in response to such a remark? Probably very little. One could, perhaps, note that philosophy is not possible without relying on one's intuitions.

Consider the following proposition:

(P5) Every contingent object that exists has an explanation.

Note the major difference between (P5) and (P4), namely, the latter refers to a 'sufficient explanation' while the former merely refers to an 'explanation'. We will discuss this difference shortly. The argument in favour of the PSR or (P4), then, is that (P5) is true and that, intuitively, (P5)'s being true renders the PSR more probable than not, that is to say, $Pr(\text{PSR}|\text{P5}) > 0.5$.

So, why think (P5) is true? Well, the following *reductio ad absurdum* shows that (P5) must be true:

1. Assume that some contingent object E exists without an explanation.
2. E exists because nothing prevents E from existing.
3. However, (2) is an explanation for E's existence.
4. We have reached a contradiction: E's existence both *has* and *does not have* an explanation.
5. Therefore, a contingent object cannot exist without an explanation.

This simple argument shows that the existence of every contingent concrete object is partly explained by the fact that nothing prevents it from existing— if something prevented the object's existence, the object would not exist. However, *the fact that nothing prevents something from existing* is clearly not a *sufficient* explanation of the thing's existence. Thus, we need to distinguish between an *explanation of possibility* and an *explanation of actuality*. An explanation of possibility explains why something *can* exist, whereas an explanation of actuality explains why something *does* exist. The former is a partial (or incomplete or unsatisfactory) explanation of the thing's existence, while the latter is a full (or satisfactory or adequate or good enough) explanation of its existence. Hence, a sufficient explanation for some contingent entity E's existence is not (simply) an explanation of possibility but an explanation of actuality, that is to say, an explanation of E's existence is sufficient only if it involves an explanation of actuality that explains E's existence in a full, satisfactory way.

But now, if every contingent object that exists has an explanation of possibility, why think that it lacks an explanation of actuality? Critics of the PSR have no good response to this question. Intuitively, it seems that:

Every philosophical argument rests on some type of intuition, such as a logical intuition, a modal intuition, or a moral intuition, although it must also be said that some of our intuitions are more fragile than others. Nevertheless, the point is that everyone relies on an intuition at some point, and an argument that rests on an intuition is not necessarily a bad argument.

One may note, furthermore, that the purpose of a philosophical argument is not always to try to *convince* others (including those who do not share one's intuitions). One may use a philosophical argument in an attempt to convince only those who share one's intuitions, or simply to *explain* to others why one believes something. Thus, I readily admit that, what I find intuitively obvious regarding the PSR, some others might not. However, the purpose of this section is (i) to try convince only those who share my intuitions (and not everybody), and (ii) to explain why I affirm the PSR.

(I) If a contingent object's existence has a partial explanation (an explanation of possibility), then it has a sufficient explanation (an explanation of actuality).

Since (I) involves only those objects that already have some sort of explanation, (I) is more self-evident than the PSR (namely, that every contingent object's existence has a sufficient explanation). However, given (P5), one's intuitive justification for (I) is strong enough to commit one to the view that the PSR is true, unless, of course, there are sound arguments against (I) but, as far as I am able to tell, there are no such arguments.

Perhaps the strongest argument one could lodge against (I) is the conceivability argument, which is based on Hume's conceivability principle (see Hume 1960:19–20, 32, 43, 89). In his *A Treatise of Human Nature*, Hume writes:

> 'Tis an establish'd maxim in metaphysics, *That whatever the mind clearly conceives includes the idea of possible existence*, or in other words, *that nothing we imagine is absolutely impossible*. We can form the idea of a golden mountain, and from thence conclude that such a mountain may actually exist. We can form no idea of a mountain without a valley, and therefore regard it as impossible (Hume 1960:32 [original emphasis]).

According to Hume, whatever is conceivable is possible. The argument, then, is that, since we can conceive of some contingent object existing without a sufficient explanation, and since conceivability is a reliable means to discovering possibility, (I) must be false, no matter how intuitive it appears. For example, one may conceive of a golden egg coming into existence without a sufficient explanation and, since this is conceivable, it is surely possible, or so the argument goes.

The conceivability argument, however, has two problems. First, possibility is not the same as conceivability because one may conceive of impossible states of affairs. Consider, for example, the Goldbach Conjecture, which states that every even number greater than two is the sum of two prime numbers. One could easily conceive that the Goldbach Conjecture is true or that it is false. However, if the Goldbach Conjecture is true, it is necessarily true, and if it is false, it is necessarily false (Bradley and Swartz 1979:329–330). Thus, it is possible to conceive of a necessarily false proposition and, therefore, Hume's conceivability principle is false.

Second, given the S5 system of modal logic, Hume's conceivability principle is self-refuting. Let '$\Box$' be the necessity operator, let '$\Diamond$' be the possibility operator, and let P denote Hume's conceivability principle or the proposition that 'Whatever is conceivable is possible'. Now, one could obviously conceive that P is necessarily false, that is, of $\Box\neg P$. Consequently, if P is true, then it follows that it is possible that P is necessarily false: $\Diamond\Box\neg P$. However, from S5 one may prove that, if it is possible that P is necessarily false, then P is necessarily false: $\Diamond\Box\neg P \supset \Box\neg P$. S5 is based on the weak logic known as 'K' (named after Saul Kripke), which includes the following logically true formulas:

(Ka) $\Box(A \wedge B) \supset (\Box A \wedge \Box B)$
(Kb) $(\Box A \wedge \Box B) \supset \Box(A \wedge B)$
(Kc) $\neg\Box A \equiv \Diamond\neg A$
(Kd) $\Box\neg A \equiv \neg \Diamond A$

S5 is characterised by K plus the following axioms:

(T) $\Box A \supset A$
(5) $\Diamond A \supset \Box \Diamond A$

We can now see why, for any proposition ϕ, $\Diamond\Box\phi \supset \Box\phi$ is true in S5: if it is false we arrive at a contradiction. Consider the following proof:

1. $\Diamond\Box\phi \wedge \neg\Box\phi$	Assumption
2. $\neg\Box\phi$	1, Simplification
3. $\Diamond\neg\phi$	2, (Kc)
4. $\Diamond\neg\phi \supset \Box \Diamond \neg\phi$	(5)
5. $\Box \Diamond \neg\phi$	3, 4, *Modus Ponens*
6. $\Box\neg\Box\phi$	5, (Kc)
7. $\Diamond\Box\phi$	1, Simplification
8. $\neg\Box\neg\Box\phi$	7, Def $\Diamond$
9. $\perp$	6, 8
10. $\Diamond\Box\phi \supset \Box\phi$	1–9

Note the contradiction at premise 9 between premises 6 and 8. Thus, given S5, it is true that $\Diamond\Box P \supset \Box P$. Consequently, since one may clearly conceive that Hume's conceivability principle is necessarily false, if the principle is true, then it is necessarily false; and if the principle is false, then it is false; either way, the principle is false. Thus, Hume's conceivability principle is self-refuting given S5. However, if a principle is inconsistent with S5—the most common modal logic used by philosophers—then so much the worse for that principle! Hence, the fact that the conceivability principle is inconsistent with S5 should give the advocates of the principle pause for thought.

One way (perhaps the only way) out of this difficulty for the proponents of the conceivability principle is to deny S5 on the grounds that

(J) $\Diamond\Box\phi \supset \Box\phi$

is counter-intuitive. The problem with this, however, is that (J) is not count-intuitive. (J) states that, if something is possibly necessary, then it is necessary. However, this appears to be correct. If ϕ is possibly necessarily true, then there is a possible world in which ϕ is necessarily true. However, according to the nature of necessity, if ϕ is *necessarily* true in a possible world, then it is true in all possible worlds. Thus, if ϕ is possibly necessarily true, then it is necessarily true. Therefore, (J) is far from counter-intuitive and, consequently, we have good reason to deny Hume's conceivability principle.

In short, I have argued that (P5) is true, namely, that every contingent concrete object that exists has, at the very least, an explanation of possibility in an external state of affairs. Such an explanation of possibility could be, for example, the fact that nothing prevents the object from existing, or that the object is logically and metaphysically possible. Moreover, I have argued that the principle that

(I) every contingent object that has a partial explanation also has a sufficient explanation

is more intuitive and self-evident than the principle that

(P4) every contingent object has a sufficient explanation.

However, since (P5) together with (I) entail (P4), (I) renders (P4) more probable than its negation. Thus, if and until (I) is shown to be false or counter-intuitive, we have strong justification for (P4).

10.2.2 The Argument Based on the Lack of Empirical Evidence

'Absence of evidence is not evidence of absence' is a popular slogan among scientists. This slogan, however, is not true in all situations for absence of evidence *is* sometimes evidence of absence. But when is the latter the case? Consider the following argument form:

1. If p is true, then we will have evidence that p is true.
2. We do not have any evidence that p is true.
3. Therefore, p is false.

Accordingly, we may say that the absence of evidence for some proposition p is evidence that p is false only when premises 1 and 2 are true. For example, if p means 'there is a dog under Jones' desk' and, if we look under Jones' desk and see no dog, then this absence of evidence counts as evidence that p is false. Why? Because if there were a dog under Jones' desk, we would have evidence for this. However, in many situations the above argument is unsound, for premise 1 is simply false. Michael J. Murray (2008:29) provides a good example: Suppose that your doctor accidentally drops a needle on the floor just before injecting you with it. The doctor then picks up the needle, quickly inspects it, and infers that, because he cannot see any germs on the needle, there are no germs on the needle. Would you allow the doctor to continue injecting you with the needle? Certainly not, for *even if* there were germs on the needle, we would not necessarily see any (i.e. we will not have evidence that there are germs on the needle). Thus, absence of evidence is evidence of absence only when it is the case that, were the entity under question present, we would have (more) evidence for its existence.

How is all this relevant to the PSR or (P4)? Well, the absence of evidence that the PSR is false counts as evidence that the PSR is true. Hence, we may argue as follows:

(A1) If the PSR is false, then we will have evidence that the PSR is false.
(A2) We do not have any evidence that the PSR is false.
(A3) Therefore, the PSR is true.

Surely (A1) is true. Given the amount of contingent objects that exist, if these objects can exist without a sufficient explanation, then it is highly unlikely—indeed, implausible—that we would have no empirical evidence for this. Every day we, as humans, experience objects existing (or even coming into existence)—cars, computers, animals, thoughts, soft drinks, books, other humans, and so on—and, thus, if the PSR is false, then we should observe at least one of these objects existing (or coming into existence) with absolutely no sufficient explanation whatsoever. This is not to say, however, that we should experience a situation in which we are unsure either (i) what the explanation of something is or (ii) whether it has an explanation but, rather, that we should experience a situation in which it is clear that something *does not* have a sufficient explanation. This would count as empirical evidence against the PSR. (A1) should, therefore, be uncontroversial.

Graham Oppy (2010, 2015) argues, however, that, even if the Causal Principle (CP) (i.e. everything that begins to exist has a cause) is false, we would not observe objects suddenly coming into existence uncaused out of nothing. According to Oppy, since space is already occupied by objects, and since two objects cannot occupy the same space, one object cannot come into existence uncaused where another object is located. A tiger, for example, cannot pop into existence where a table exists. Interestingly, in his former article, Oppy (2010) appears to affirm that, if the CP is false, then objects may cease to exist (or cease to occupy some location) without a cause. However, he argues that a tiger, for example, can spontaneously come into existence where a table now is *only if* the table ceases to exist (or ceases to occupy some location), in which case the *disappearance* of the table is a cause of the tiger's coming into existence (in his latter article, Oppy (2015) seems to change his mind about the possibility of things disappearing uncaused and, yet, he provides no reason for this change of mind).

Is it possible to modify Oppy's argument in order to refute (A1)? I do not think so. First, Oppy's argument is ineffective in refuting the CP. Since events are concrete objects, the CP applies to events. Hence, an object's ceasing to exist (or ceasing to occupy some location) without a cause just is an event occurring (or coming into existence) without a cause. The proponent of the CP may, thus, argue that, if the CP is false, then we should observe objects spontaneously ceasing to exist (or ceasing to occupy some location) without a cause. Oppy does not address this point. Furthermore, since Oppy thinks an object can come into being uncaused only if there exists an empty space that is the shape of the object, Oppy presupposes substantivalism (the view that space is a substance that is able to exist by itself, independent of material objects). Unfortunately, Oppy does not defend substantivalism, and this weakens his case. Nevertheless, if substantivalism is true and the CP is false, then a space is a thing that can itself come into existence uncaused. Accordingly, we should observe empty spaces, and objects of the related shape, constantly coming into being all around us. Once again, Oppy overlooks this point. Second, since (A1) concerns the PSR and not the CP, Oppy's argument does not address the question of whether a contingent concrete object can exist without a sufficient explanation (regardless of whether the object comes into being or not). Thus, I do not see how Oppy's argument may be modified to refute (A1).

The crucial question, then, is whether (A2) is true? Do we have no empirical evidence that a contingent object can exist without a sufficient explanation? It seems so. The critic of the PSR might claim that quantum mechanics or one's free actions provide empirical evidence against the PSR. However, as we will see next, these two pieces of 'evidence' do not discredit the PSR.

10.2.2.1 Quantum Mechanics

Quantum mechanics is the science dealing with the measurements and behaviour of microscopic particles. It is unfortunate that quantum mechanics is widely thought to be an indeterministic theory. On an indeterministic interpretation of quantum mechanics, certain quantum phenomena, such radioactive decay, can only be given a probabilistic description, that is to say, the theory cannot tell us what *will* happen in a given case but only what the *probability* of a result is. By placing their faith in an indeterministic interpretation of quantum mechanics, some have gone so far as to claim that certain events (including the creation of the universe!) can occur without a cause or reason. For example, in his discussion on how a universe can come into existence out of the quantum vacuum, Alexander Vilenkin (2015) remarks,

> What causes the universe to pop out of nothing? No cause is needed. If you have a radioactive atom, it will decay, and quantum mechanics gives the decay probability in a given interval of time, say, a minute. There is no reason why the atom decayed at this particular moment and not another. The process is completely random. No cause is needed for the quantum creation of the universe.

The objection to the PSR, then, is that the indeterministic nature of quantum mechanics is incompatible with the PSR.

However, there are three reasons why this is not a valid objection. First, it is simply not an established fact that the quantum realm is indeterministic. The deterministic interpretations of quantum mechanics, such as Bohm's interpretation, are to date empirically equivalent to the indeterministic interpretations, and no one knows which interpretation is correct (see Hoefer 2010:section 4.4). Second, an indeterministic interpretation of quantum mechanics does not imply that causality does not hold on the quantum level. As Peter J. Riggs explains,

> We need to be careful not to identify the concept of 'causality' with the doctrine of 'determinism'. . . . A physical theory is deterministic if it predicts the future state of a system uniquely from the specification of the system's present state. In other words, if the equation governing a particular phenomenon together with the relevant boundary conditions provide a unique solution, then the description of the phenomenon is deterministic. Conversely, if the governing equation does not provide a unique solution then the description of the phenomenon is non-deterministic. It does not logically follow that if a phenomenon is not describable by a completely deterministic formalism then the phenomenon is itself uncaused (Riggs 2009:9).

As Riggs notes, the fact that an equation governing a quantum event does not have a unique solution for the later state of the system, given an earlier state, is not the same

as the quantum event lacking a cause. This is made clear by the fact that quantum events follow a consistent pattern. For example, uranium atoms consistently decay into other elements, such as thorium and lead, and they never decay into butterflies or puppies. This shows that quantum events are not causeless but occur within a causal structure governed by the laws of quantum mechanics. Thus, since a cause is a sufficient explanation, indeterministic interpretations of quantum mechanics are not inconsistent with the PSR.

Finally, Pruss (2012:58) correctly observers that quantum events do have explanations, namely, the experimental setup in which they occur, for quantum events cannot occur without the prior experimental setup. To be sure, according to an indeterministic interpretation of quantum mechanics, such an explanation is a probabilistic explanation that does not guarantee the outcome. Nevertheless, a probabilistic explanation may be a sufficient explanation. For example, although smoking increases the probability of, and does not entail, lung cancer, smoking may sufficiently explain lung cancer. Similarly, suppose that Merlin casts a spell with a 0.7 chance of turning the prince into a frog, and suppose that the prince turns into a frog. Then, in this case, Merlin's spell sufficiently explains why the prince turned into a frog, even though the spell merely raised the probability of this event.[3] Thus, although the experimental setup might merely raise the probability of a quantum event, it sufficiently explains the event.

Therefore, one cannot claim at present that the quantum realm offers empirical evidence that a contingent object can exist without a sufficient explanation.

10.2.2.2 Libertarian Free Will

Libertarianism is the view that free will is incompatible with determinism (the thesis that past events necessarily entail subsequent events) and that some of our actions are free. Usually, a libertarian will state that free will requires that

(R1) the agent faces alternative possibilities or open choices, and that
(R2) some of the agent's actions (including the agent's willing something), is ultimately up to the agent.

Without these two requirements free will appears to be impossible. (R1) states that free agents find themselves in situations in which they face open choices, that is to say, two or more options lie before the agent, and it is possible for the agent to choose any of these options. For example, if Jones, driven by his desire to drink a warm drink, faces the decision to drink either coffee or tea and, if Jones can choose to drink coffee and he can also choose to drink tea, then Jones faces an open choice. In this case, Jones' future is open in the sense that nothing predetermines or necessitates that he choose a particular one of these options because, prior to making the choice, both choices are genuine possibilities for Jones. In addition, when Jones

[3]This example was adapted from Schaffer (2000:40).

chooses to drink coffee, he has performed an *open action*, which is an action that the agent could have refrained from performing. (R2) states that a free action is not ultimately determined by external factors, such as the past, the agent's upbringing, or God's fore-ordination, but by the agent himself. The agent is *ultimately responsible* for his or her free actions. Jones' choosing to, say, drink coffee instead of tea is up to Jones if Jones himself—and nothing outside of Jones—ultimately causes Jones to make this choice.

In response to libertarianism, and especially in response to (R1), critics argue that libertarianism faces the *randomness* objection, namely, that libertarian free actions are essentially random and not, in fact, up to the agent. Free actions are similar to quantum fluctuations in terms of an indeterministic interpretation of quantum mechanics, for free actions occur spontaneously and for no reason at all. Thus, the objection is that the PSR is incompatible with libertarian free will, since certain contingent events—people's free actions—occur without sufficient explanations.

There are at least two ways in which the proponents of the PSR may respond to this objection. The first is to simply deny libertarian free will. The divine determinist, such as the Christian Calvinist, who supports the PSR may attempt this response. According to divine determinism, God ultimately determines the actions of every person—our actions are, ultimately, up to God. Thus, the divine determinist already rejects libertarian free will. However, simply denying libertarianism does not help the divine determinist who wishes to affirm the PSR, for even if no human being has free will, the determinst still faces the question as to whether God has free will? If God has free will, then the objection persists: God's free actions seem to occur for no reason at all. On the other hand, rejecting God's freedom is problematic for the theist. In the first place, a being who possesses free will is surely greater than a being who lacks free will. Hence, if God is not free and has no choice but to perform the actions he performs, then God is not a maximally great being. This conclusion should not suit the theist. In the second place, it seems that God *must* have free will because, according to theism, God is the creator of all things outside Himself and, thus, there is nothing *outside* God that may determine His creative act. God's initial creative act must have been free or ultimately 'up to Him'. Consequently, this first response is only an option for the non-theist for whom denying libertarianism has no negative theological implications.

The second response to the randomness objection is to show that free actions are neither inexplicable nor random but do, in fact, occur for reasons. If successful, such a response would undermine the randomness objection. So, is there a plausible account of free will that entails that free actions have explanations? As with most philosophical issues, there are various competing accounts of free will. However, one plausible account of free will that overcomes the randomness objection is offered by Robert Kane (1998, 2002, 2005). According to Kane, a free action is not necessarily an open action but, rather, it is an action for which the agent is, ultimately, responsible. Consequently, Kane reduces (R1) to (R2), and he defines ultimate responsibility as follows:

> The basic idea is this: to be *ultimately responsible* for an action, an agent must be responsible for anything that is a sufficient reason, cause, or motive for the action's occurring. If, for example, a choice issues from, and can be sufficiently explained by, an agent's character and motives (together with background conditions), then to be *ultimately* responsible for the choice, the agent must be in part responsible by virtue of choices or actions performed in the past for having the character and motives he or she now has (Kane 2005:121 [original emphasis]).

Kane notes that a free action is not necessarily an open choice, that is to say, when an agent performs an action, this action may be free or, ultimately, up to the agent even if the agent could not have done otherwise. For example, a father might treat his child with love because he has a loving character, and the father's character makes it impossible for him to hate his child. In this case, although the father's character determines that he love his child, the father is still, ultimately, responsible for how he treats his child. The reason for this is that the father is ultimately responsible for the open actions he performed in the past that formed his loving character.

Kane calls open actions that form one's will or character 'will-setting' actions. More precisely, a will-setting action is a voluntary, intentional, and rational open action that occurs when an agent decides between competing choices and, only at the moment of decision, does the agent determine which choice he or she desires more. For example, suppose that Sally's mother asks her who took a cookie out the cookie jar. Knowing that she did it, Sally faces a genuine inner struggle about whether she should tell her mother the truth and be reprimanded, or blame it on her brother and stay out of trouble. She is unsure which option she desires more. Nevertheless, Sally eventually decides to be honest with her mother and, at that moment, her will becomes set and her character is formed. Sally has performed a will-setting action.

In line with Kane, we may say, then, that an agent's action is *free* iff the agent is ultimately responsible for the action, and an agent is *ultimately responsible* for an action iff the action is either a will-setting action or sufficiently explained by the agent's character and motives. An agent has *free will*, then, iff the agent performs, has performed, or can perform a free action, where an action is either a physical event, such as raising one's hand to vote, or a mental event, such as willing to raise one's hand to vote. This account of free will, I believe, is extremely plausible. In particular, it also solves the problem raised by the randomness objection, since a free action is sufficiently explained either by the agent's character and motives (if it is not an open action) or by the agent's reasons or desires (if it is an open action). If, for example, Sally chooses to tell her mother the truth, then her free action is explained sufficiently by her desire to be an honest person. However, if Sally chooses not to tell her mother the truth, then her action is still explained sufficiently by her desire to stay out of trouble. Either way, Sally's free action has a sufficient explanation. Thus, according to the above account of free will, free actions do not occur without a reason or explanation and, hence, free will is

compatible with the PSR.[4] Consequently, the critic of the PSR must show that the above account of free will, as well as any other account of free will that addresses the randomness objection, are false, or at least implausible. This challenge has not yet been met. Therefore, proponents of the PSR are justified in thinking that free will does not offer empirical evidence that contingent objects can exist without a sufficient explanation.

10.2.2.3 Conclusion

In summary, if the PSR or (P4) were false, then we would have at least some empirical evidence of contingent concrete objects existing without a sufficient explanation. We do not, however, have any such evidence. We never experience situations in which it is clear that some contingent object has no sufficient explanation, even when we consider our experiences with quantum mechanics and free will. In fact, *all* the empirical evidence we do have supports the PSR. Therefore, we have good reason to accept (P4). Let us now evaluate whether the atheist can rationally deny the PSR.

10.2.3 The PSR and Atheism

According to the *Cambridge Dictionary of Philosophy*, the standard sense of the term 'atheism' is 'the view that there are no gods' (Audi 1999:59). Thus, atheism is the belief that neither God nor any other deity or supernatural entity exists. Atheism must not be confused with agnosticism, the belief that we do not know (or perhaps cannot know) whether God or any other supernatural entity exists. Now, it is not uncommon for the atheist to reject the PSR to avoid the conclusion of the cosmological or ontological arguments. However, this move is not feasible for the atheist because the rejection of the PSR is incompatible with the belief in atheism. In addition, this incompatibility is not a *logical* incompatibility, since the proposition that 'the PSR is false' is logically consistent with the proposition that 'atheism is true'. Instead, it is a type of *epistemic* incompatibility, that is, an incompatibility between one's denying the PSR and one's justification for atheism. To understand this, consider the following proposition:

(B) It is possible that a supernatural entity spontaneously comes into existence without a sufficient explanation, and without supernatural revelation we have no way of knowing whether this does, in fact, happen—a supernatural entity might exist.

[4] Pruss (2012:54–56) presents a similar response to the randomness objection.

If one affirms (B), then clearly one's belief that *no supernatural entity exists* cannot be justified, since one also believes that, despite the lack of any supernatural revelation or evidence, a supernatural entity may exist. Of course, a supernatural entity that comes into existence must be a *contingent* being. However, such a being may still be an extremely powerful, all-knowing spirit that has authority over human beings. In particular, one cannot ask why such a being came into existence, since this happened without a sufficient explanation. The incompatibility between the PSR and atheism, then, is as follows:

(C1) If one denies the PSR, one should affirm (B).
(C2) If one affirms atheism, one should deny (B).

Consequently, if one denies the PSR and affirms atheism, then one must both affirm and deny (B), a contradiction. Thus, denying the PSR removes one's justification for atheism, and affirming atheism removes one's justification for denying the PSR.

But why think that (C1) and (C2) are true? Consider first (C1). Saying that the PSR is false is the same as saying that a contingent object can exist (or come into existence) without a sufficient explanation. Hence, if the PSR is false, then, since there are no constraints on the type of contingent objects that can come into existence without sufficient explanations, a contingent supernatural being can exist or pop into existence without a sufficient explanation. This could have happened yesterday, it could happen right now, or it might happen tomorrow. Indeed, it seems far more likely that a simple spirit with no complex physical structure will spontaneously come into existence than that an incredibly complex universe will spontaneously come into existence. Furthermore, if a supernatural being does come into existence, we will not necessarily have evidence for its existence, since this being might not give us any revelation of its existence. Thus, if one denies the PSR, then one should believe (B).

(C2) is also true. If one believes that *no* supernatural being exists, then one cannot believe that some supernatural being *might* exist. The former belief denotes atheism while the latter denotes agnosticism. One cannot be both an atheist and an agnostic. Thus, if one affirms atheism, then one should reject (B). Therefore, the atheist who wishes to reject the PSR faces a problem, namely, without the PSR atheism is difficult to defend. The problem stems essentially from the fact that, if the PSR is false, then deities or supernatural beings could constantly be popping into existence, and we have no way of knowing if such a being has come into existence. Although this conclusion is not inconsistent with agnosticism, it is inconsistent with the view that no supernatural realm exists. The atheist, then, should be reluctant to give up his or her belief in the PSR.

10.2.4 Conclusion

We have good reason to believe the PSR or that every contingent concrete object that exists has a sufficient explanation in an external state of affairs why it exists. First, it is intuitively obvious that whatever has an explanation also has a sufficient

explanation. Thus, since every contingent object has an explanation of possibility, it has a sufficient explanation. Second, if the PSR were false, we would have at least some evidence of contingent objects coming into existence without a sufficient explanation. We have no such evidence. Consequently, the PSR is true. Finally, we saw that the atheist has a strong motivation for accepting the PSR: if the atheist denies the PSR, he or she must affirm that we simply cannot know whether a supernatural realm exists.

10.3 A Spontaneous Universe Is Highly Unlikely

Suppose that the above section has not convinced you that the PSR is true and you still think it is false. Is there another reason why you should believe that, if the universe came into existence, it has a sufficient explanation of its existence? Yes, I believe there is: a spontaneous universe is highly unlikely. Those who reject the PSR do not claim that *nothing* has a sufficient explanation, nor do they claim that a contingent object *cannot* have a sufficient explanation. Even the sternest critic of the PSR believes that some contingent objects have sufficient explanations, such as computers and auto mobiles, and that those contingent objects that do not have explanations *could have had* explanations. The critic of the PSR is merely claiming that some contingent objects exist without sufficient explanations, despite the fact that these objects could have had explanations.

Let us assume, for the sake of argument, that the PSR is false. What, then, may justify one's belief that a certain object has a sufficient explanation? I believe there are at least three things. First, you should believe that you sufficiently explain the existence of the things that you cause, such as the cup of coffee you make, the paper you write, or the desk you build. Second, when you see something cause another thing, you should believe that the former sufficiently explains the latter. Finally, if it is highly unlikely that some contingent object exists by chance (i.e., without a sufficient explanation), then you should believe that it has a sufficient explanation. Let us call this last condition the *Unlikelihood Principle* (UP):

(UP) A contingent object has a sufficient explanation if it is highly unlikely that it exists by chance.

The phrase 'highly unlikely' is important in this context as it emphasises that we are referring to extremely improbable states of affairs. But, what, exactly, do we mean by 'highly unlikely'? Perhaps an illustration will suffice. Suppose there are ten marbles in an opaque jar. Only one of the marbles is blue and the rest are red. Then, the odds in favour of one randomly selecting the blue marble are 1:10 (read 'one to ten'). Although it is unlikely that one will select the blue marble, it is not *highly* unlikely. You may rationally believe me if I told you that I pulled out the blue marble. But suppose, instead, that there are one billion marbles in the jar and only one marble is blue. Then the odds in favour of one randomly pulling out the blue marble are 1:1000000000. Thus, in this case, it is *highly* unlikely that the blue

marble will be selected. Indeed, given this high unlikelihood, you should not believe me if I told you I pulled out the blue marble. *This* is the type of high improbability we have in mind with the UP.

Furthermore, the UP is intuitive. If some contingent object *A* is highly unlikely to exist by chance, then, obviously, if something is going to exist inexplicably, it is far more likely that something other than *A* exists inexplicably. In other words, if *A* is a contingent object whose existence by chance is highly unlikely, and *B* is a contingent object whose existence by chance is likely, then, if some object is either going to exist inexplicably or spontaneously come into existence without an explanation, it is vastly more probable that this object will be *B*. Accordingly, since it is *highly unlikely* that *A* exists inexplicably, it is unreasonable to believe that *A* exists inexplicably. The UP, thus, appears to be true.

Now, we may argue that, since the universe is a contingent object that is highly unlikely to exist by chance (assuming the PSR is false), this fact, together with the UP implies that the universe has a sufficient explanation. We have already argued that the universe/spacetime is a contingent entity (or a contingent object or conglomerate) because it is not eternal and it came into existence a finite time ago. Hence, there is a possible world in which the universe does not exist. The crucial question, then, is whether it is highly unlikely that the universe exists by chance? It turns out that, for at least two reasons, a spontaneous universe is highly unlikely.

First, the bigger the object the more unlikely it is to exist by chance, and the universe is an extremely big object. Those who reject the PSR usually do so because they believe that certain quantum events, such as the decay of a radioactive atom, occur without sufficient explanations. So, since we are assuming that the PSR is false, let us assume that certain quantum events and certain quantum objects, such as virtual particles, do exist or come into existence without sufficient explanations. Now, the bigger the object, that is to say, the more particles it will comprise if it exists, the more unlikely it is to come into existence inexplicably, since it is more likely that one of its particles comes into existence inexplicably. For example, it is more likely that a single particle of the Eiffel Tower exists inexplicably than the entire Eiffel Tower itself exists inexplicably. After all, if the quantum realm is indeterministic (as we have assumed), then we have empirical evidence of quantum objects and particles existing inexplicably, but we do not have any evidence of large, complex objects composed of numerous particles, such as the Eiffel Tower, existing without sufficient explanations.

Thus, in relation to the universe, if some physical object were to spontaneously come into existence, then, since the universe comprises zillions of smaller objects and particles, it is more probable that one of these smaller objects spontaneously appear out of nothing than the entire universe. It is vastly more likely that a star, frog, grain of sand, photon, or virtual particle comes into existence inexplicably and out of absolutely nothing than that the entire universe—which includes all material objects, matter, space, and time—comes into existence inexplicably and out of absolutely nothing. Consequently, given the UP, the universe must have a sufficient explanation.

Second, it is highly unlikely that the universe exists by chance in light of its fine-tuning. One of the astonishing discoveries of modern cosmology is that the universe is incredibly fine-tuned for intelligent life. By the phrase 'the universe is fine-tuned' we do *not* mean that the universe is designed by an intelligent being. Instead, this is a religiously neutral statement that means that the values of both the constants of nature and the initial conditions of the universe fall into an extremely small life-permitting range compared to the range of possible life-prohibiting values. The mathematical expressions of the laws of nature contain various constants, which are simply constant values that are not set by the laws themselves but may be any of a wide range of values. Consider, for example, Newton's law of gravity:

$$F = G\frac{m_1 m_2}{r^2}$$

The gravitational constant G is a value that does not change. This value is not set by the law itself and it could have been different. Besides these constants, there are also seemingly random physical quantities, such as the entropy level, that reflect the state of the very early universe. Hence, when we say that some constant or quantity is fine-tuned, we mean that, if its value were slightly different, then intelligent, conscious, moral agents such as ourselves could not exist. Although there are many examples of cosmic fine-tuning (see Barrow and Tipler 1986; Rees 2000; Collins 2003, 2012), we will examine some of these examples only and this will suffice for our present purposes.

If the strength of gravity were increased by a factor of 3000, then it would be impossible for stars to live longer than a billion years. This would have disastrous life-prohibiting consequences. On the other hand, if the strength of gravity were zero or negative, then no solid objects, such as stars and planets, could exist. Robin Collins (2003:190) notes that 'the intelligent-life-permitting values of the gravitational force are restricted to at least the range 0 to $3x10^3G_0$, which is one part in 10^{36} of the total range of forces.' Thus, the odds of gravity being life-permitting are one part in 10^{36}! To appreciate how large 10^{36} is, consider the following figures. The age of the universe is estimated to be about 10^{17} seconds (1 followed by 17 zeros: 100,000,000,000,000,000), and the number of atoms in the entire observable universe is approximately 10^{80} (1 followed by eighty zeros). Such huge numbers are beyond comprehension. Thus, this illustrates how the strength of gravity falls into an extremely narrow life-permitting range.

The cosmological constant Λ, which Einstein originally introduced into General Relativity in an ad hoc way, acts as either a repulsive or attractive force that causes space to either expand or contract. Remarkably, the cosmological constant is fine-tuned to approximately one part in 10^{120} (Holder 2013:91–92). If the cosmological constant were slightly different, then the universe would have expanded or contracted too fast for stars and galaxies to develop and, thus, life would not exist.

Another example of fine-tuning is both the strong force and the electromagnetic force. The strong force binds the protons and neutrons in an atom together while the electromagnetic force holds atoms and molecules together. These forces are fine-tuned because, as Stephen Hawking and Leonard Mlodinow (2010:203) note, 'a change of as little as 0.5 percent in the strength of the strong nuclear force, or 4 percent in the electric force, would destroy either nearly all carbon or all oxygen in every star and, hence, the possibility of life as we know it.'

Perhaps the most impressive case of fine-tuning is the initial low entropy state of the universe. Entropy is the measure of disorder in a closed system—the lower the entropy, the higher the order. According to the Second Law of Thermodynamics, the entropy in a closed system always increases. This is the reason why the gas molecules in a vacuum sealed bottle spread out evenly throughout the bottle as time passes and never gather into one corner of the bottle and remain there. Now, it is well known that the universe started in a state of very low entropy. However, the prominent physicist, Roger Penrose, has calculated that the odds of the universe starting in such a state are one part in $10^{10(123)}$, where '10(123)' means 10^{123} (Penrose 1991:342–344, 2005:726–731, 2011:126–127)! This number is mind-bending. As Penrose remarks,

> This is an extraordinary figure. One could not possibly even *write the number down* in full, in the ordinary denary notation: it would be '1' followed by 10^{123} successive '0's! Even if we were to write a '0' on each separate proton and on each separate neutron in the entire universe—and we could throw in all the other particles as well for good measure—we should fall far short of writing down the figure needed (Penrose 1991:344 [original emphasis]).

According to Collins (2012:220), the precision of this fine-tuning 'is much, much greater than the precision that would be required to hit an individual proton if the entire visible universe were a dartboard!'

These examples illustrate how incredibly fine-tuned the universe is for life, a fact well known. After discussing several cases of fine-tuning, Hawking and Mlodinow declare,

> The laws of nature form a system that is extremely fine-tuned, and very little in physical law can be altered without destroying the possibility of the development of life as we know it. Were it not for a series of startling coincidences in the precise details of physical law, it seems, humans and similar life-forms would never have come into being (Hawking and Mlodinow 2010:205).

Likewise, Edward Robert Harrison remarks, 'life could not exist if the constants of physics had values other than those observed' (Harrison 2000:156). Therefore, it is highly unlikely that the universe exists by chance and, thus, it must have a sufficient explanation. Indeed, it seems safe to say that, given its incredible fine-tuning, it is *unreasonable* to think that the universe came into existence in such an unlikely state for no reason whatsoever.

10.4 God as the Explanation of the Universe

I have argued above that we have several good reasons to believe that *if the universe came into existence, then it has a sufficient explanation*. The following questions then arise: *What* is the sufficient explanation of the universe (or of its existence)? *Why* did the universe come into existence? It turns out that the most plausible answer is that God did it, that God brought the universe into existence. We may follow al-Ghazālī and William Lane Craig and argue that an analysis of the explanation of the universe reveals that the explanation must involve a divine being that may be identified as God.

First, in light of the fact that the universe is all physical reality, an explanation of the universe would involve some non-physical reality. Only two types of non-physical realities could possibly exist, namely, an abstract realm of one or more abstract objects, or a supernatural realm of one or more supernatural beings. However, as argued above (7.3.1), an abstract realm cannot explain why something comes into existence. Consequently, there must exist a supernatural realm—that is, there must exist one or more supernatural beings—that explains the universe's coming into being.

Second, one supernatural being is sufficient to explain the beginning of the universe. Recall that simplicity may be identified with Occam's razor, the principle that an explanation should not involve more assumptions or entities than are necessary. Of course, the simplest explanation is not always the correct explanation, and simple explanations are sometimes replaced with more complex explanations. However, experience shows that the simplest explanation that accounts for all the facts is usually the correct explanation, and a simple explanation is replaced with a more complex explanation only once it has been discovered that more entities are, in fact, necessary. For example, your bicycle tyre goes flat. It is more probable that the flat tyre may be explained by one thorn than by one hundred thorns. You do not own a cat, but you find some cat hair in your back yard. It is more probable that the cat hair is explained by one stray cat than by ten stray cats. You find a note on your car that reads 'Your back tyre is flat'. It is more likely that the note is explained by one stranger than by twenty strangers. One would resort to the more complex explanation only if one had reason to believe that multiple thorns caused the flat tyre, or that multiple cats were in your yard, or that multiple strangers wrote the note. Thus, as regards the beginning of the universe, it would be ad hoc to postulate multiple supernatural beings if it is sufficient to postulate just one being. Therefore, until we have reason to believe that multiple supernatural beings exist, we should believe that only one supernatural being explains the beginning of the universe.

Raphael Lataster and Herman Philipse (2015), however, argue that we have good reason to prefer polytheism over monotheism, namely, polytheism is far more probable than monotheism because there is just one monotheism hypothesis and it is totally overshadowed by an infinite number (or, at least, a very large number) of polytheism hypotheses. More precisely, they assume that we do not have any evidence or background knowledge that favours monotheism over polytheism and,

hence, they argue that we must invoke the principle of indifference and consider all hypotheses equally probable. They then divide the possibility space according to the number of deities that exist: hypothesis one is that one deity exists, hypothesis two is that two deities exist, hypothesis three is that three deities exist, and so on. Let *S* be the set of hypotheses from hypothesis two onward. According to Lataster and Philipse, the number of elements in *S* is either infinity or very very large, and since each hypothesis (including hypothesis one) is equally probable, it is vastly more probable that one of the hypotheses in *S* is true than that hypothesis one is true.

However, Lataster and Philipse's argument has a fatal flaw. As Mark Douglas Saward (2016) notes, the possibility space may be divided in numerous ways, and there is no reason to favour Lataster and Philipse's division over any other. For example, we may divide the possibility space according to the number of angelic beings that the deity/deities that exists creates: hypothesis one is that one deity exists who creates one angel, hypothesis two is that one deity exists who creates two angels, and so on. In this case, we have an infinite number of both monotheism and polytheism hypotheses. On the other hand, we could treat monotheism and polytheism as single hypotheses, leaving us with merely two hypotheses or else we could have polytheism as a single hypothesis against each of the monotheistic hypotheses concerning the number of angelic beings discussed above. In this case, according to Lataster and Philipse's argument, monotheism is vastly more probable than polytheism! Consequently, since they do not offer any arguments in favour of their division, their argument has no force. We should still prefer one supernatural being over a plurality of supernatural beings.

Third, the supernatural being must be a personal, conscious agent who has intentions and desires. Richard Swinburne (1993:134) correctly argues that there are two types of explanation of events, namely, scientific explanation and personal explanation. A scientific explanation explains an event in terms of some previous event or state of affairs and the laws of nature, while a personal explanation explains an event in terms of a person's intentions and desires. For example, a *scientific explanation* of why Sally's skin is turning brown is that the ultraviolet light in the sunlight is stimulating the melanocyte cells in Sally's skin to produce the melanin pigment, which is causing Sally's skin to turn brown. A *personal explanation*, on the other hand, is that Sally is intentionally tanning because she has a desire to have brown skin. Now, the beginning of the universe cannot have a scientific explanation because there is no event or law of nature prior to the first event. Thus, the supernatural being—let us call this being 'the Creator'—must be a conscious agent who intended or desired to create the universe.

Fourth, the Creator must possess free will. As al-Ghazālī argues (4.3.5), if the Creator lacked free will, it could not choose between creating the universe and not creating the universe, nor could it choose when to create the universe. Accordingly, the universe would either exist eternally or it would never come into existence. However, since the universe began a finite time ago, the Creator must have freely created it and, thus, the Creator has free will.

Wes Morriston (2000:163–168, 2003:105–107), however, recently advanced an objection to the view that creation is an act of God's (or the Creator's) free will.

Morriston argues that God's eternal will to create the universe is sufficient for the existence of the universe. However, since an eternal sufficient cause must have an eternal effect, the universe must be eternal.[5] Therefore, according to Morriston, if it is God's eternal will that the universe should exist, the universe would exist for as long as God's will has existed, namely, eternally. Morriston concludes that God cannot will from eternity to create a 'universe with a beginning' and, thus, creation *ex nihilo* cannot be an act of God's free will.

Nevertheless, however interesting, Morriston's argument fails because God's (or the Creator's) will alone is not sufficient for the existence of the universe. Not only must God will that the universe exist but God must also *actually create the universe*. Hence, God's will, together with His power and activity in creating the universe, are sufficient for the existence of the universe. To have a desire to perform some action *A* is not the same thing as actually performing *A* as a person may have a desire and not act on that desire immediately. Thus, God can will from eternity to create a finite (non-eternal) universe, and acted on this desire a finite time ago. As an analogy, imagine that, upon waking up in the morning, Jones desires to make himself a cup of coffee sometime before noon. Now, although it is Jones' will to make a cup of coffee before noon, his will is not sufficient for the existence of the cup of coffee. Sometime before noon, Jones must engage in the activity of making a cup of coffee, and this activity, together with Jones' will and ability to make a cup of coffee, is then sufficient for the existence of the cup of coffee. Likewise, in order for the universe to be created by God, God must (1) will to create the universe, (2) possess the power to create the universe, and (3) actually create the universe.

One may object that the real problem for the theist is that, if God creates a universe with a beginning, God must undergo an intrinsic change in terms of which He decides to create 'now', and that such a change is inconsistent with the theist's claim that God is unchanging. We may agree that, if God cannot undergo an intrinsic change then either God would never act on His desire to create the universe or God would bring the universe into existence from eternity. However, it is important to note that such an intrinsic change is not necessarily theologically problematic. At this point it is helpful to distinguish between a *negative* change in God and a *positive* change in God (for want of better terms). God undergoes a negative change if His character, nature, or plans change. For example, if God is all-loving at one moment but not all-loving at a later moment, then God has undergone a negative change. However, such an intrinsic change is theologically problematic, for it is inconsistent with Scripture.[6] On the other hand, a positive change in God is any non-negative change. For example, if God's knowledge changes from 'it is now time t_1' to 'it is now time t_2', then God has undergone a positive change. Such a change is not

[5] A *sufficient* cause brings forth its effect as soon as all the relevant conditions are in place. For example, a man placing his foot in sand is sufficient for a footprint in the sand. As soon as the sufficient cause occurs (i.e. the man placing his foot in the sand), the effect occurs (i.e. a footprint appears in the sand). Hence, if the man's foot is in the sand from eternity, the footprint must be eternal. This illustrates that, if a sufficient cause is eternal, its effect must be eternal.

[6] See, for example, Psalm 33:11; 102:26–27; Numbers 23:19; Malachi 3:6; James 1:17.

theologically problematic because it is consistent with Scripture. Now, since God's creative decision does not denote a change in God's character, nature, or plans, it denotes a positive change in God, for it is God's eternal plan to create the universe with a beginning and to act upon this plan by deciding to create the universe a finite time ago. The theist, therefore, may affirm that God is unchangeable in the negative sense only.

Of course, not all theists affirm that God can undergo a positive change. The strict doctrine of divine immutability (hereafter simply 'divine immutability') declares that God cannot undergo any intrinsic change whatsoever. Therefore, the defenders of divine immutability (and the defenders of divine timelessness) will find fault with the view that God undergoes an intrinsic change at the moment of creation. However, apart from affirming that God undergoes a positive intrinsic change by deciding to create at some moment, I see no other way of harmonising God's eternally willing to create with God's act of creating a finite time ago. Nevertheless, because Scripture does not rule out this view, and because divine immutability appears to conflict with *creatio ex nihilo*, I believe the theist, or the proponent of the *kalām* cosmological argument, is justified in affirming that the Creator's creative act is a *free* act that denotes a positive intrinsic change in the Creator.

Fifth, the Creator must be timeless, that is, it must be able to exist in a timeless state because it brought time itself into existence. Sixth, the Creator must have no cause because, as we have seen above (8.4), an ungrounded causal chain is impossible and every causal chain has a first cause. Thus, the Creator denotes the uncaused first cause. Seventh, the Creator must be incredibly powerful. It is difficult to imagine an act of power greater than the act of bringing the massive universe—all space, time, matter, and material objects—into existence out of nothing. Although such an act does not entail omnipotence, it strongly suggests that the Creator is omnipotent. Eighth, the Creator must be unimaginably knowledgeable, for it knows how to bring a fine tuned universe into being. Finally, the Creator must be creative because it created an intricate universe full of beautiful colours, sounds, shapes and creatures.

Our analysis thus reveals that there exists a transcendent, conscious, intelligent, timeless, causeless, incredibly powerful, unimaginably knowledgeable, astoundingly creative supernatural being who freely created the universe. Such a being surely deserves the title of 'God'. We may conclude, therefore, that if the universe has a sufficient explanation, the explanation is that God brought the universe into existence.

10.5 Conclusion

Our discussion in this volume of the *kalām* cosmological argument has revealed that the argument is a powerful argument, not only in favour of God's existence, but also in favour of the doctrine of *creatio ex nihilo*. The version of the argument that I have defended may be summarised as follows:

1. The universe came into existence because:
   (a) The argument based on traversing infinite time:
      (i) If the universe did not come into existence, then the present event could not occur.
      (ii) The present event is occurring.
      (iii) Therefore, the universe came into existence.
   (b) The argument based on ungrounded causal chains:
      (i) Every causal chain has a first cause or a transcendent cause.
      (ii) Time is a causal chain.
      (iii) Therefore, time has a first cause or a transcendent cause.
      (iv) Therefore, assuming that time does not have a transcendent cause, time has a first cause.
   (c) The gong peal paradox and the persistent liar paradox illustrate the impossible situations that would result from beginningless time.
2. If the universe came into existence, then God brought it into existence because:
   (a) If the universe came into existence, then it has a sufficient explanation because:
      (i) We have a strong intuition for this premise.
      (ii) We have no evidence against this premise.
      (iii) The fine-tuning of the universe makes it highly unlikely that the universe came into existence without a sufficient explanation.
   (b) If the universe has a sufficient explanation, the explanation is that God brought the universe into existence because conceptual analysis of the explanation of the universe illustrates that it must be God (i.e. a supernatural being who has the essential attributes traditionally ascribed to God) who brought the universe into existence.
   (c) If the sufficient explanation of the universe is that God brought the universe into existence, then God brought the universe into existence.
   (d) Therefore, if the universe came into existence, then God brought it into existence.
3. Therefore, God brought the universe into existence.

References

Audi, R. (Ed.). (1999). *The Cambridge dictionary of philosophy* (2nd ed.). Cambridge: Cambridge University Press.

Barrow, J. D., & Tipler, F. J. (1986). *The anthropic cosmological principle*. New York: Oxford University Press.

Bradley, R., & Swartz, N. (1979). *Possible worlds: An introduction to logic and its philosophy*. Indianapolis: Hackett Publishing Company.
Collins, R. (2003). Evidence for fine-tuning. In N. A. Manson (Ed.), *God and design: The teleological argument and modern science* (pp. 178–199). New York: Routledge.
Collins, R. (2012). The teleological argument: An exploration of the fine-tuning of the universe. In W. L. Craig, & J. P. Moreland (Eds.), *The Blackwell companion to natural theology* (pp. 202–281). Oxford: Wiley-Blackwell.
Craig, W. L. (1999). The ultimate question of origins: God and the beginning of the universe. *Astrophysics and Space Science, 269–270*, 721–738.
Harrison, E. R. (2000). *Cosmology: The science of the universe* (2nd ed.). Cambridge: Cambridge University Press.
Hawking, S., & Mlodinow, L. (2010). *The grand design*. London: Bantam Books.
Hoefer, C. (2010). Causal determinism. *The Stanford encyclopedia of philosophy* Spring 2010 Edition. http://plato.stanford.edu/archives/spr2010/entries/determinism-causal/. Accessed 04 July 2014.
Holder, R. D. (2013). *Big bang big God: A universe designed for life?* Oxford: Lion Books.
Hume, D. (1960). *A treatise of human nature*. Oxford: Clarendon Press.
Kane, R. (1998). *The significance of free will*. New York: Oxford University Press.
Kane, R. (2002). Some neglected pathways in the free will labyrinth. In R. Kane (Ed.), *The Oxford handbook of free will* (pp. 406–437). New York: Oxford University Press.
Kane, R. (2005). *A contemporary introduction to free will*. Oxford: Oxford University Press.
Lataster, R., & Philipse, H. (2015). The problem of polytheisms: A serious challenge to theism. *International Journal for Philosophy of Religion*. http://link.springer.com/10.1007/s11153-015-9554-x. Accessed 12 Dec 2016.
Morriston, W. (2000). Must the beginning of the universe have a personal cause? A critical examination of the kalam cosmological argument. *Faith and Philosophy, 17*(2), 149–169.
Morriston, W. (2003). A critical examination of the kalam cosmological argument. In R. Martin, & C. Bernard (Eds.), *God matters: Readings in the philosophy of religion* (pp. 95–108). New York: Longman.
Murray, M. J. (2008). *Nature red in tooth and claw: Theism and the problem of animal suffering*. Oxford: Oxford University Press. OCLC:ocn209815655.
Oppy, G. (2010). Uncaused beginnings. *Faith and Philosophy, 27*(1), 61–71.
Oppy, G. (2015). "Uncaused beginnings" revisited. *Faith and Philosophy, 32*(2), 205–210.
Penrose, R. (1991). *The emperor's new mind: Concerning computers, minds, and the laws of physics*. New York: Penguin Books.
Penrose, R. (2005). *The road to reality: A complete guide to the laws of the universe*. London: Vintage Books.
Penrose, R. (2011). *Cycles of time: An extraordinary new view of the universe*. London: Vintage Books.
Pruss, A. R. (2006). *The principle of sufficient reason: A reassessment*. New York: Cambridge University Press.
Pruss, A. R. (2012). The Leibnizian cosmological argument. In W. L. Craig, & J. P. Moreland (Eds.), *The Blackwell companion to natural theology* (pp. 24–100). Oxford: Wiley-Blackwell.
Rees, M. (2000). *Just six numbers: The deep forces that shape the universe*. New York: Basic Books.
Riggs, P. J. (2009). *Quantum causality: Conceptual issues in the causal theory of quantum mechanics*. Dordrecht: Springer.
Saward, M. D. (2016). The problem of invoking infinite polytheisms: A response to Raphael Lataster and Herman Philipse. *International Journal for Philosophy of Religion*. http://link.springer.com/10.1007/s11153-016-9585-y. Accessed 12 Dec 2016.
Schaffer, J. (2000). Overlappings: Probability-raising without causation. *Australasian Journal of Philosophy, 78*(1), 40–46.
Swinburne, R. (1993). *The coherence of theism* (Rev. ed.). Oxford: Clarendon Press.
Vilenkin, A. (2015). The beginning of the universe. *Inference: International Review of Science, 1*(4). http://inference-review.com/article/the-beginning-of-the-universe. Accessed 18 May 2016.

Index

© Springer International Publishing AG 2018

J. Erasmus, *The Kalām Cosmological Argument: A Reassessment*, Sophia Studies in Cross-cultural Philosophy of Traditions and Cultures 25,
https://doi.org/10.1007/978-3-319-73438-5