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**A PHILOSOPHICAL FRAMEWORK WITHIN THE SCIENCE-THEOLOGY
DIALOGUE:
A Critical Reflection on the Work of Ernan McMullin**

**a thesis dissertation submitted in partial fulfillment
of the requirements for the Doctor in Philosophy degree,
Saint Paul University at the University of Ottawa,
Ottawa, Canada**

**Paul Allen,
Faculty of Theology,
Saint Paul University
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by Paul Allen

Thesis Abstract

This dissertation is an investigation of the potential of critical realism in the interdisciplinary dialogue between the natural sciences and theology. In order to benefit and support the *rapprochement* between science and religion, Christian theology requires a philosophical mediation. By engaging key questions, such as the existence of God, and the relationship between God and the world in the context of a dialogue with science, theologians need to attend to the character of theological knowledge claims. What is the unity and what are the differences in scientific and theological inquiry? The work of philosopher Ernan McMullin best accounts for scientific rationality as broadly consistent with and even supportive of theological knowledge claims about God and the world.

The argument will be laid out in six steps. In the first chapter, the theological work of three recent Gifford lecturers, Ian Barbour, Arthur Peacocke and John Polkinghorne, is examined. Marking a revival of natural theology, each of these scientist-theologians has advocated critical realism in order to account for the broad epistemological similarities between the natural sciences and theology. Chapter one describes Barbour's process metaphysic, Peacocke's theology of personal self-transcendence in a panentheistic universe of natural, interrelated hierarchies and Polkinghorne's 'dual-aspect monism' of mind and matter set in a purposeful universe. Polkinghorne, in particular, offers a more forceful plea for the role of religious faith in basing theological knowledge claims. Therefore, the differences among these three thinkers demands a two prong inquiry. In spite of a consensus on critical realism, there is a marked divergence on what constitutes significant elements of theological knowledge. One inquiry is identified in the philosophy of science on the question of critical realism in scientific rationality. The other inquiry needs to be taken within theology itself on the question of critical realism and theological knowledge. The balance of the thesis is dedicated to each of these two inquiries.

Chapter two begins by identifying a philosopher, Ernan McMullin, whose fifty years of writing tenders an extensive account of scientific rationality. More recently, his writing includes a thread of analysis through the science-theology dialogue, thus providing a unique conjunction of perspectives that, according to this study, indicates a synthetic approach. A theory of scientific rationality is developed on the basis of the philosophical analyses by Ernan McMullin. His theory of scientific rationality is known as retroduction. Retroduction is a pattern of inference, which accounts for the hypothetical causes of unobservable entities as verifiable, meaningful objects of a scientific inquiry. According to McMullin, in contrast to neo-Aristotelian, positivist and various instrumentalist positions, a philosophical ontology based on the act of judgment in

science is secured. Structural explanations of entities arise through a imaginative discovery followed by a process of verification that operates on particular values, especially theory fertility.

In chapter three, the theory of retrodution is verified as a historically secure theory of scientific progress. Retrodution is a theory that can thus be transposed from a theory of scientific explanation to the basis for an integrated critical realist theory of knowledge in the natural sciences. Retrodution meets the objections of anti-realists who rely on Thomas Kuhn's landmark *The Structure of Scientific Revolutions*, where Kuhn contends that the sheer incommensurability of different paradigms of scientific knowledge outweigh any evidence of progress. Equally important, in light of the popularity of Imre Lakatos' historically inspired methodology, McMullin lays out a challenge to idealist constructs of science. McMullin distinguishes between epistemic and non-epistemic values in order to show that the meaning of a verified scientific theory is neither restricted to a rhetorical scientific community nor reducible to the single criterion of empirical adequacy for evaluating a theory. Values such as theory fertility, coherence, and simplicity guide theory verification through acts of human imagination across scientific paradigms, thus buttressing science from instrumentalist socio-historical critiques. This pattern is itself verifiable in the work of Galileo and Newton for example, in the way that each scientist deals with the hypothetical realities of earthly motion and gravitation respectively.

In chapter four, the contemporary discipline of cosmology is treated as unique in illustrating the power of McMullin's theory of retrodution. Cosmology is an explanatory and a limit discipline in the natural sciences. An integrated notion of critical realism is tested against the cosmology, where retrodution meets particular success in both extrapolating to the existence of theoretical structures and then, opening up the theological question of God from the vantage point of ongoing verifications of universal intelligibility. Cosmology is a unique scientific discipline for combining a tight methodological connection between scientific practice with philosophical issues such as the anthropic principle, empirical data with theoretical tools and intellectual with existential inquiries.

Over the course of the final two chapters, this study presents and expands upon two basic movements of McMullin's theological thought. In chapter five, as a result of the way in which critical realism is understood to operate in the sciences, McMullin's distinction between faith and rationality is presented with regard to the notions of creation, the anthropic principle and evolution. McMullin upholds the distinction between faith and rationality partly reclaimed by Polkinghorne, by orienting theology more exclusively to history in terms of redemptive categories. Nevertheless, he articulates a nature/history distinction differently from contemporary fideist or tradition-specific perspectives by basing his theological outlook on the broadly Augustinian idea of a Divine illumination of created human reason expressed through a twofold structure of the human imagination. The imagination operates concretely on perceived objects or analogically, on unvisualizable objects. Especially in the latter mode, the imagination is theologically significant, because as McMullin argues. It is a manifestation of *spiritus*.

Chapter six brings forward McMullin's contribution of the term 'consonance' as a view of integration among the disciplines that respects the view of a transcendent creator God. This chapter amplifies McMullin's mix of integrative and distinguishing theological elements beyond one he has developed thus far. A clarification of McMullin's integration is possible through reference to Peacocke's christological resolution to the questions of natural theology. By way of accounting for McMullin's position more concisely, this study appeals to Bernard Lonergan's distinction of theological knowledge from scientific disciplines where verification is pursued. A natural knowledge of God is claimed on the basis of an unverifiable principle that is the verifiable source for making any knowledge claim.

In conclusion, having secured an explanatory notion of critical realism in terms of self-transcendence in retroduction, this study points to theological analogy as a way of correcting an overemphasis on the role of models and metaphors. Imagination plays a similar role in theological inquiry as it does in scientific inquiry. Theologically speaking, the imagination operates in terms of the discovery of self-transcendence and its validation in christology. From this study, it is hoped that a dialogue between theology and the natural sciences can better articulate a vision to our civilization.

McMullin positively contributes toward the renewal of Thomism in Christian and Roman Catholic theology through recourse to pragmatic and Augustinian philosophical and theological insights. He offers a post-Kuhnian modified realist position that brings the philosophy of science forward through an attention to the history of science. On this basis, an integrated framework relating the philosophy of science and theology is viable. Moreover, the science-theology dialogue is better situated to reveal the philosophical and theological significance to the operations and meaning of scientific inquiry.

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Acknowledgements

It is common to cite the collaborative and collegial support that has been granted to the author of an involved study such as this. In my case, I simply could not have completed this project without the support I received from family and friends.

First, I want to acknowledge the generous time and effort taken by the Saint Paul University library staff. Their timely gatherings of the many requested books and articles made my research much easier than would otherwise have been the case. In particular, many thanks are due to André Paris and Larry Eshelman for their help and encouragement. I also want to thank the staff and members of the Saint Paul Faculty of Theology who gave of their time and shared their wisdom and learning along the way. Special mention goes out to those who took part in several successive Lonergan discussion groups.

I also want to thank the former administrator of the faculty, Maureen LaPlaca, whose direction was valued, as well as to all the staff of the faculty, especially Brigitte Legare, Anne Ethier and Francine Quesnel.

I want to also extend a special thanks to Peter Monette and Christine Jamieson, two colleagues with the Lonergan Website as well as my colleagues in the Science and Religion Course Programme, whose collegial friendship and manifest collective vision lightened the burdens of everyday research and writing.

During the gestation of this project, I caught a glimpse of the degree to which the wisdom of my thesis director Prof. James Pambrun would play out in contributing enormously to any successes that might transpire from my doctoral studies. My hunch was borne out. It is rare that doctoral degree candidates should receive both wise counsel and constitutive formation simultaneously. I am extremely grateful to Jim for being both a guide and a mentor.

I want to thank all the members of my family, both near and far, for their unwavering support for my work. My parents deserve heartfelt thanks for their kind support. My son Jeremy deserves thanks for being a daily gift that reminds me of the meaning of creation. He has brought forth concrete ways of the joy and hope that lie at the heart of the journey of faith.

Last and most of all, I want to thank my wife, Monica. Her love and kindness through these years has been extraordinary and devoted. Without Monica's assistance and willingness to endure, this degree could not even have been contemplated. She deserves a large part of the credit for this project arriving at its destination. Monica, thank you.

Introduction

1. The Theological Landscape

In her landmark work, *The Human Condition*, Hannah Arendt discusses the emergence of a cultural split in modernity between the private and public realms:

“The presence of others who see what we see and hear what we hear assures us of the reality of the world and ourselves, and while the intimacy of a fully developed private life, such as had never been known before the rise of the modern age and the concomitant decline of the public realm, will always greatly intensify and enrich the whole scale of subjective emotions and private feelings, this intensification will always come to pass at the expense of the assurance of the reality of the world...”¹

This prescient evaluation by Arendt contains even more salience now than when her book was published in 1958. Religion is certainly one arena of public life that has been profoundly impacted by the progressive diminution of the public realm amid the ascendance of various private realms.

In Christian theology, a phenomenon associated with this shift is the privatization of faith. There has been a gradual yet profound movement toward the individual determination of meaning in the practice of religious faith. This phenomenon is multi-dimensional. It can be illustrated in conjunction with many other shifts in the cultural and spiritual landscape. The decline in the authority of the churches and forms of religious leadership is one closely related trend. However, new quests to reclaim theoretical, interdisciplinary ground in theological studies has emerged, after a steady decline in such interest.

Diagnoses of theology's tenuous situation have flourished during the past forty years as contemporary theologians shifted away from theoretically dense positions in order to reflect more humbly on the guiding motifs of the life of faith. Christian theology is charged with misjudging

its own intellectual task. It is alleged that Christian theology has forgotten both its primary concern to speak about overcoming evil and about employing language proper to this goal. As David Tracy comments with regards to this issue,

“The form of modern theory in theodicy - clear, systematic, argumentative, above all, rational - assured itself that no other form - prayer, liturgy, sacrament, song, narrative, lament, tragedy - was needed to encompass the problem of suffering or to name and think either hope or God.”²

Tracy’s point needs to be heeded by theologians. Nevertheless, his call for theological integrity raises a further question. What if the word “God” possesses no meaning in our cultures? It is a truism that God is not a shared understanding, neither as a Being who can be affirmed, nor in what God might be like. While the influence of philosophical atheism may have been overstated, and while new spiritualities are gaining ground, there is little to indicate that the word “God” resounds with common meaning today. Even if theology became further rooted in historical praxis and concrete concern, would this step adequately address theology’s identity crisis as it is manifest in a lack of common meaning for the word God?

2. The Science-Theology Dialogue

A new intellectual movement has gained ground in religious and theological academies that might complement the pragmatic, historical turn in contemporary theology. It is the pursuit of a unified view of the universe. More and more theologians realize that part of the difficulty in communicating theology in contemporary culture is the lack of a common intellectual context. Without such a context, theological language is fragmentary, not systematic. On the question of systematization, the success of the natural sciences marks an interesting contrast to theology’s perceived lack of direction.

However, theology has been provided with a welcome challenge. According to Pope John Paul II,

“Theology has been defined as an effort of faith to achieve understanding, as *fides quarens intellectum*. As such, it must be in vital interchange today with science just as it always has been with philosophy and other forms of learning. Theology will have to call on the findings of science to one degree or another as it pursues its primary concern for the human person, the reaches of freedom, the possibilities of Christian community, the nature of belief and the intelligibility of nature and history. The vitality and significance of theology for humanity will in a profound way be reflected in its ability to incorporate these findings.”³

This call by John Paul II for theologians to engage in a dialogue with science was issued in 1988. It is indicative of a new level of interdisciplinary cohesion between the natural sciences and theology that has gained prominence. This cohesion has been a special concern of many in the Judaeo-Christian theological traditions. What was until recently a sporadic exchange has emerged to become a systematic and academic form of discourse.⁴ This is a remarkable turn of events, given the centuries-old discord between the natural sciences and religion. Since the scientific revolution made its mark on the intellectual landscape in western Europe during the seventeenth century, science and religious faith have been at odds with one another over their respective cultural authority due to fundamentally different understandings of the natural world. Now, this papal call to incorporate the findings of science into theological reflection is one piece of evidence that a breakthrough has occurred.

However, if the theological incorporation of scientific findings is as urgent as John Paul II states, then how can it be carried out? Is there a method available for doing this? It might be assumed that a *rapprochement* between science and religion renders the drawing of theological conclusions from scientific findings a more effortless task. But a glance at the science-theology

literature shows that disagreements persist among a wide range of issues. The problems are much more complex than early appraisals anticipated. The early intellectual breakthroughs that gave birth to this dialogue with the sciences co-exist within a distinct variety of theological, philosophical traditions and socio-historical contexts.⁵ Some are tempted to focus, therefore, on the astounding new promise of particular disciplines, especially physics and cosmology. The established popularity of writers such as Paul Davies and Stephen Hawking is evidence of a cultural receptivity for a coherence between religion and astrophysics in particular. But others, such as noted scientist and writer Stephen Jay Gould, claim that any such coherence can only come when science and religion pertain to “non-overlapping magisteria.”⁶ For Gould, *rapprochement* means that science and religion possess their own strictly demarcated areas of investigation and concern.

The emerging variety, complexity and divergence among different thinkers on the question of the science-religion *rapprochement* implies that theologians need to integrate the findings of scientists with tremendous caution. Clearly, theologians would like a more hospitable environment for theology than Gould’s position would allow. But if so, how? A risk lies in theologians selecting a less objective cluster of insights from the sciences. This way, theology imperils its search to escape intellectual segregation. Therefore, theologians can ill afford to gloss over those features of rupture and disunity that still mark relations with the natural sciences. It is ineffective to depict science in agreement with religious faith on the basis of selectively chosen issues and phenomena.

In this study, the focus will be on how critical realism figures as a theory of knowledge in the theological portrayal of scientific findings. It will nevertheless stress the important role that

an analysis of historic events plays in disclosing such a theory of knowledge.⁷ Thus, this study will account for theological appeals to knowledge in light of the dialogue with the scientific disciplines in a contemporary context, and in a way that respects the thrust of authentic scientific research. During the twentieth century, the natural sciences proceeded as if the question of God was superfluous to scientific inquiry. Given the success of science, this was interpreted outside the natural sciences as a sign that religious questions do not matter fundamentally speaking.

In order to benefit and assist the *rapprochement* between science and religion, we require a philosophy that spells out the theological meaning of a dialogue with the sciences. We need to orient our concern around the question of God. This philosophy needs to explore both the unity and differentiations at the heart of what the human subject does in the act of any inquiry, whether scientific or theological. It is true that theologians once attached themselves to various pre-modern philosophies in order to explain the universe's created character. However, as theology and philosophy became attuned to other concerns, and as science became more autonomous and authoritative within more and more cultures, these philosophies became increasingly problematic. Theologians themselves are increasingly wary of adopting a philosophical or metaphysical outlook because they have associated such an outlook with cultural irrelevance.

Others may feel deeply ambivalent about a theological study that adopts or proposes a philosophical outlook due to philosophy's inherent religious agnosticism. Many theologians recognize that specific religious concerns are neglected when theologians employ philosophical language. Theologians may feel therefore that an engagement with the science-religion dialogue is best handled within more strictly defined theological, religious or even mystical parameters. Such approaches typically stress spiritual desire and harmonic worldviews. The so-called 'New

Age' movement is one obvious manifestation of a univocal combination of science and spirituality. It is also filtered through particular political and social objectives, which are complex to assess. Theologically speaking, such approaches do not usually admit the centrality of rational argument to resolve conceptual difficulties. Insofar as this implies a flight to irrationality, this route cannot sustain longer term impacts. And therefore, it is not a path that can be followed in this study.

One other note of ambivalence is regarding the charge that such an investigation is too 'theoretical.' The high degree of abstraction required by such reflection can be perceived as a regress or as a hegemonic attempt at integration. Theoretical concerns can appear disengaged from personal experience or unlikely to enrich the dimensions of meaning that contemporary theologians rightly emphasize.

However, in this study, the "abstract" nature of the inquiry is conceived as an engagement with the significance of the disciplines as they present themselves in the dialogue.⁸ It is true that without the quest for personal meaning, the science-theology dialogue could not venture far. This personal search lies at the origins of the science-religion *rapprochement*. In fact, the theological contribution to the dialogue can be deeply insightful when it links the personal dimension to the strictly intellectual form of the discourse.

In this study, knowledge in contemporary science and philosophy is under review for its theological significance. The dimension of personal meaning is indirectly involved as a consequence. However, a theological significance is optimally identified through the adoption of a philosophical framework. Only a philosophical framework can elevate the theological significance of a dialogue with the sciences, since philosophical frameworks are already

employed in the separate evaluations of knowledge claims in the natural sciences and theology respectively. Such a framework may logically begin with the success and rationality scientific reason in its explanatory function. A philosophical framework is required to appraise what theology claims cohere or contrast with science. Can such a framework also assist in stating how science and theology co-operate to provide a unified worldview? This study will attempt to answer this question by considering key philosophical elements that make up a mediating framework for the benefit of theological reflection.

3 The problem: Knowledge of God and Critical Realism

If philosophy can mediate the natural sciences with theology, what is the principal issue at stake? Without hesitation, the answer is a theory of knowledge. In theology, the issue is whether we can have some knowledge of God. More specifically, the issue is how we understand this knowledge and the similarities or differences between it and other forms of knowing. Three contemporary thinkers in particular have successfully linked scientific knowledge with a knowledge of God. These thinkers are: Ian Barbour, Arthur Peacocke and John Polkinghorne, and I will take up their respective proposals in this study.

They each agree that critical realism is an applicable theory of knowledge in both the natural sciences and theology. They claim that knowledge is critical realist in different disciplines due to a claimed differentiation of meaning in understanding aspects of real existence in spite of the contingencies that mark the engagements of the knower. They adopt a critical realist position on how knowledge is achieved in both the natural sciences and theology. They also make this claim as practicing natural scientists with an interest and education in theological studies.

This position on a common theory of knowledge marks a profound contrast with the

historical conflicts between science and religion. The work of these thinkers raises new possibilities in forging a theological incorporation of scientific findings. What is crucial however is that they diverge from one another on what the term critical realism means, both generally and especially in theology. Hence, their respective contributions raise the need to probe the critical realist position to see what might lie behind such divergences. This is a very important task, since it investigates the claim that in knowing nature, we are already on the way to achieving a limited knowledge of God. But, what marks the continuity in scientific and theological knowing, given the obvious discontinuities involved?

The answer to this question is best approached in light of a summary of the science-theology exchange by John Polkinghorne, one of the three thinkers being examined. In a recent book, he comments:

“In the past ten years, there has been a considerable amount of thought and speculation among those concerned with the interface between science and theology, concerning the extent to which it is possible to speak with integrity about the notion of God’s acts in the world, whilst at the same time accepting with necessary seriousness what science can say about that world’s regular processes.”⁹

The significance of the proposals Polkinghorne cites are far-reaching. What appears to be most revolutionary are the arguments offered for God’s activity in the universe. Indeed, the subtitle for the CTNS/Vatican Observatory series of research volumes is “Scientific Perspectives on Divine Action.”¹⁰ This subtitle radically counters reigning patterns of thought regarding the place of reflection on God’s relationship with the world. For such theological proposals to succeed, they will need to engage and respond constructively to the criticism that will come from both scientists and theologians. The issue of knowledge lies at the heart of such a response.

At the crux of the different claims to knowledge is a difference regarding how each

discipline claims to understand existence as such. For the sciences, what exists is the universe, specifically, the universe as natural. These natural components are as diverse as chemical molecules, stellar nebulae and living organisms. Theology's claim to knowledge concerns God. The question is whether a single position on knowledge like critical realism can effectively straddle both disciplines as an explanatory position on what is intended in different acts of knowing.

Investigating critical realism has become more complicated since theology's shift away from doctrinal explanations toward metaphor, narrative and forms of literary interpretation in order to illumine religious meaning.¹¹ Without doubt, theology has been humbled by the ability of the natural sciences to offer broad explanations for the operation of the universe. This is an understandable development. It reopens a theological loss of cultural authority and an honest search for new sources in theological inquiry. The cultural impact of losing a common theological worldview, even one that could be shared among religious traditions, has yet to be addressed.

Theologians need to appraise this loss of worldview. Theologians need to revisit the exigency and history of worldviews. If God does act in the world as Creator, then theologians need to attend to the empirical ramifications of such a claim. We need to corroborate the significance of symbol, story and metaphor as the mode of theological communication.¹² Theologians need to become clearer about what theological knowledge is. Can theologians restore God-language without relegating the knowledge of the physical universe that challenges such language? Can the shared belief in creation on the part of the world's major religions be affirmed without radically contradicting scientific knowledge?

While this study does not examine in detail such claims as God's action in the world, it will ask how theologians understand themselves to be making knowledge claims. It will investigate how critical realism is an issue that invites further reflection on the unity and interdisciplinary nature of understanding and knowledge. Thus, this study will be distinct from a substantial proportion of the science-theology discourse.¹³ That is, it asks whether we can make a claim about God's existence and relationship to the world in a way that reinforces the specificity of theological claims while valuing scientific knowledge. A more coherent sense of understanding and knowledge provided by an examination of critical realism could offer much promise along these lines. Critical realism can be extended to show how theology mediates between the demarcation lines separating the methodology of the natural sciences and the personal stance of religious faith.

4 Overview

The stages of argumentation in this study is based upon the following thesis: critical realism is a philosophical framework that enriches the dialogue between theology and the natural sciences by accounting for epistemological and ontological elements of scientific rationality. With these distinct elements in place, we gain an understanding of the exact shape and trajectory science poses toward the question of God and theology, seen in relief against the limits of scientific knowledge. This account of critical realism can incorporate and broaden the work of Ian Barbour, Arthur Peacocke and John Polkinghorne.

More significantly, it could be much further developed with the help of philosopher Ernan McMullin. McMullin's theory of retrodution, in particular, offers an account of scientific rationality with more fully developed epistemological and metaphysical elements. These

elements, in turn, could base a wider account of critical realism. His theory has been worked out with respect to the human dimension and an honest need to account for existence generally speaking, while keeping alive the God question in a consistent manner. Although McMullin's writings treat a vast array of topics, his insights grasp a strategy that can wend a way through the morass of disputes in the philosophy of science. His work collectively responds to the need for an explanatory theory of scientific knowledge that accounts for human rationality and the historical trajectories of science in the fullest possible way. McMullin's theory of retrodution and other related historical arguments develop a position of scientific realism in the philosophy of science that does not merely critique positivist or historicist arguments. Rather, his position is founded upon the process of scientific investigation itself.

The career and published works of Ernan McMullin are marked by different stages of reflection on issues in the philosophy of science, philosophy of nature and religion. Over the past twenty years in particular, McMullin has demonstrated an increased attention to certain issues, primarily philosophical, in the dialogue between religion/theology and the natural sciences. This attention to science-religion and science-theology dialogue concerns is based in previous rigorous investigations in the philosophy of science. As such, McMullin's work offers us a unique collage of reflections. Whereas most participants in the dialogue usually engage the subject matter from either a scientific or theological/religious viewpoint, McMullin brings both of these forward within his own work as a philosopher of science and priest. In the chapters that follow, this study argues that McMullin's thought is enriched by a wide notion of rationality. His epistemological and theological orientations drive straight to the heart of the dilemmas that characterize some of the key theological and philosophical positions of the Gifford Lecturers.

In selecting McMullin as a thinker who is able to clarify the meaning of important concepts and philosophical tools used by the Gifford Lectures, a figure is chosen whose lifelong work exhibits a broad understanding of the issues at stake in the dialogue. While he has not published a book length text that treats the issues in the way that other theologians and philosophers have done, his understanding of the range of issues, as evident in numerous articles, is impressive.¹⁴ McMullin demonstrates an awareness of the depth of the issues that are involved when a theological perspective of the world is at stake. His immersion in the philosophy of science does not imply that his theological analyses are captured within the terms and debates of the philosophy of science. On the contrary, he has judiciously shown an awareness of the specific crucial issues in philosophy that touch on theological concerns, while both writing and thinking within the questions and highly dialectical investigations of the philosophy of science on the one hand and maintaining a steadfast theological perspective on the other hand. Also, he has sustained an attention to the interaction between science and theology that is evident in an increasing volume of work, especially since his publication in 1981 of a lengthy and often cited article “How Should Cosmology relate to Theology?”¹⁵

The argument of this study will be laid out in six steps:

1) Three recent Gifford lecturers (Ian Barbour, Arthur Peacocke and John Polkinghorne) have advocated a theory of knowledge termed critical realism in order to account for the broad epistemological similarities between the natural sciences and theology. Each of their proposals contains unique metaphysical and theological elements that deserve an analysis and appropriation for probing whether critical realism is, in fact, an adequate interdisciplinary theory of knowledge. Yet, their efforts expose a limit in dealing with critical realism. This limit is the way in which

critical realism is expressed in purely descriptive or dialectical terms. This study claims that the notion of critical realism can serve as a heuristic, explanatory notion that does more than describe interdisciplinary, epistemological similitude.

2) Critical realism can be secured on the basis of a theory of scientific rationality that is not vulnerable to positivist or empiricist critiques. Ernan McMullin's theory of retrodution secures theory discovery and verification, which overcome these critiques by pointing to the heuristic character of the imagination which works to demonstrate the ontological character of successful science.

3) The religious and theological implications of the Galileo and Darwin controversies have received an enormous amount of attention as historical episodes that demonstrate the profound difficulties involved in theological interpretations of the natural world. The theory of retoduction is verified in the activity of scientists such as Newton and Galileo. McMullin's historical analysis of these figures, coupled with his incorporation of anti-realist and sociological critiques of scientific rationality supports the ontological character of scientific rationality with the secured critical component from a historical study of science.

4) The contemporary discipline of cosmology is unique in illustrating the power of McMullin's theory of retrodution as the limit discipline in the natural sciences. As such, it also takes up the presence of human values in scientific rationality in terms of the question of human destiny in a contingent universe. At this juncture, the God question attains its specificity in the science-theology dialogue.

5) In line with the priority on faith that Polkinghorne emphasizes, and given the theological implications of McMullin's development of a theory of scientific rationality, theology

can claim a God-World relationship. The key step here lies in making a distinction between the epistemological elements of scientific rationality and the transcendent heuristic of the human imagination in the act of understanding the cosmic scope of knowledge. A transcendent atemporal God coheres with this understanding of critical realism.

6) McMullin's contribution of the term 'consonance' provides a view of integration among the disciplines that respects the view of a transcendent creator God. This integrating worldview builds on the theological and anthropological integration developed by Peacocke. It affirms through the distinct recourse to contingency and personal meaning in the doctrine of creation that a theological knowledge claim will employ the tool of analogy. Knowledge claims in natural theology rest on an analogy from an unverifiable principle of the knower in the act of knowing, in contrast to the full, ongoing achievement of verification in the empirical sciences. Critical realism specifies the distinctiveness of analogical claims, secure in the portrait of scientific rationality as developed by McMullin.

In conclusion, this study will point to possible areas of future research that are implied by the reflections made here. Theology can pursue its own questions for reflection on religion and revelation with an openness to understanding the conditions in which these reflections are systematized and communicated. This study makes it clear how a strategy of openness can be carried out in dialogue with the natural sciences while positively respecting and reinforcing the experience of religious faith. The question lies in ensuring what function an inquiry takes in theology. To suppose, *a priori*, that theological traditions can only cede ground or re-claim it in a zero-sum intellectual context is to radically forego any positive theological collaboration with other disciplines.¹⁶ Rather, collaboration can serve to buttress theology's presence and concerns

in expanding interdisciplinary inquiries. The God-question is a question that persists, and it refuses to be dismissed.

Endnotes

1. Hannah Arendt, *The Human Condition* (Chicago: University of Chicago Press, 1958), p. 50.
2. David Tracy, "Evil, Suffering, Hope: The Search for New Forms of Contemporary Theodicy" in *CTSA Proceedings* 50 (1995), p. 18.
3. John Paul II, Message to George Coyne, Director, Vatican Observatory in Robert J. Russell, William R. Stoeger, SJ and George Coyne, SJ, eds. *Physics, Philosophy and Theology: A Common Quest for Understanding* (Vatican City, 1997 3rd. ed.), p. M10.
4. In this study, I most frequently refer to the "science-theology" dialogue, except where certain circumstances warrant a reference to the wider, substantially broader "science-religion" dialogue.
5. I freely acknowledge the intellectual parameters that these questions set. However, I do not want to pursue the theoretical questions in this thesis on the assumption that socio-cultural or historical contingencies have no role to play. It is true that personal and social meanings of this interdisciplinary truce in different cultures remain largely unexamined. The intellectual questions are meanwhile given increasing attention, especially in the West. For insights into the cultural dynamics at work in the dialogue, one would need to bracket the philosophical or theological questions in favour of historical, sociological or psychological investigations. This has not been done, with some exceptions. For example, see John H. Brooke's *Science and Religion: A Historical Perspective* (Cambridge, 1991) or Geoffrey Cantor's *Michael Faraday: Sandemanian and scientist A study of science and religion in the nineteenth century* (MacMillan, 1991).
6. See Stephen Jay Gould, *Rocks of Ages: Science and Religion in the Fullness of Life* (New York: Ballantine Books, 1999).
7. These events will not analyzed *per se* for how they structured science-religion relations. Some examples of important historical surveys of the faith-science relationship are: David Lindberg and Ronald Numbers, *God and Nature: Historical Essays on the Encounter Between Christianity and Science* (Berkeley: University of California Press, 1986), Stanley L. Jaki, *The Road of Science and the Ways to God* (Chicago: University of Chicago Press, 1978), John Hedley Brooke, *Science and Religion: Historical Issues* (Cambridge: Cambridge University Press, 1991) and Ian Barbour, *Religion and Science: Historical and Contemporary Issues* rev. ed. (New York: Harper Collins, 1997). One of the classic treatments of the science/faith question is by Andrew Dickson White, entitled *A History of the Warfare of Science with Theology* (2nd. Ed.: Dover Pub. Co., 1960, 2 vols.).
8. See Bernard Lonergan's *Method in Theology*, p. 93 for an explanation of abstraction in terms of a differentiation in human consciousness beyond the confines of 'common sense' where common sense and theory are conceived as different stages in human meaning.
9. See John Polkinghorne, *Belief in God in an Age of Science*. (New Haven: Yale University Press, 1998), p. 48.
10. See, for example, the first volume: Robert John Russell, William R. Stoeger and George Coyne, eds., *Physics, Philosophy and Theology: A Common Quest for Understanding* (Vatican Observatory/University of Notre Dame Press, 1988).
11. It is not incidental that Christianity itself began as a movement referred to in its' early form, as 'a way' of living, over against the Greco-Roman religions, where the accent was on how and what to think.

12. To begin with, as Bernard Lonergan points out, “to explain the symbol [...] is to go beyond the symbol.” in *Method in Theology*, p. 67.

13. For example, the phrase “divine action” is used in many texts as a presumed understanding for how God relates to the world, that is, by “acting” in it. I do not dispute this presumption. I do, however, question whether it is such a foundational notion in the science-theology dialogue. I think that even more foundational work on how this might be a claim of knowledge is necessary before such investigations can have the desired impact.

14. McMullin’s engagement with theological themes has intensified over the past fifteen years in a way that is congruent with his reading and interpretation of other general philosophical issues. His most explicit theological articles are: “Plantinga’s defense of special creation” in *Christian Scholar’s Review* 21 (1991), pp. 55-79, “Evolution and special creation” in *Zygon* 28 (1993), pp. 299-335, “Religion and Cosmology” in Hetherington, Noriss, ed. *Encyclopedia of Cosmology* (New York: Garland, 1993) pp. 579-95, “Fine-tuning the Universe?” in Shale, M. and Shields, G. eds. *Science, Technology and Religious Ideas* (Lanham, MD.: University Press of America, 1994), pp. 97-125, “Evolutionary Contingency and Cosmic Purpose” in Michael J. Himes and Stephen J. Hope, eds., *Finding God in All Things: Essays in Honor of Michael J. Buckley, S.J.* (New York: Crossroad, 1996), pp. 140-61, his review of *Belief in God in an Age of Science* by John Polkinghorne in *Commonweal* v. 125, n. 17 (Oct. 9, 1998), pp. 22-23, “Galileo on science and Scripture” in Peter Machamer, ed., *The Cambridge Companion to Galileo* (London: Cambridge University Press, 1998), pp. 271-347, “Natural science and belief in a Creator” in Russell, R., Stoeger, W. and Coyne, G., eds. *Physics, Philosophy and Theology: A Common Quest for Understanding* (Notre Dame, IN.: Vatican Observatory and University of Notre Dame Press, 1988), pp. 49-79. However, the theological content of his philosophical articles is occasionally more fascinating for the ways in which McMullin reveals how theological concerns provide insight whereas strictly philosophical investigations do not. See, for example, his references to Augustine in the article “Enlarging Imagination” in *Tijdschrift voor Filosofie* 58, n.2 (June, 1996), pp. 227-260. Other scientists/philosophers of science whose work could have provided alternatives to McMullin in addressing the Gifford Lecturers are thinkers such as Philip Clayton and Jean Ladrière. Historians of science John H. Brooke, William Wallace and Stanley Jaki could also have been select expert thinkers to incorporate as well. However, these thinkers, with the exception of Ladrière, do not pursue the issue of rationality in depth. Clayton leaves it more as the question to be answered (see the introduction to chap. 5) Although van Huyssteen is a key figure in this issue, his post-foundationalism is somewhat distant in this regard for its more explicit basis in pragmatist philosophy.

15. In *The Sciences and Theology in the Twentieth Century* ed. Arthur Peacocke (Notre Dame: University of Notre Dame Press, 1981), pp. 17-57.

16. The work of theologians such as John Milbank is evidence of this kind of stance, though for him the human sciences are the primary locus of distraction for the theological ‘forgetfulness’ of religious experience. Michael J. Buckley’s *At the Origins of Modern Atheism* (New Haven and London: Yale University Press, 1987) is more successful in showing that theological apologetics, once inextricably intertwined with notions of scientific causality, lost their primary warrant in religious experience, which resulted in the widespread acceptance of deism. The justification for re-linking the philosophical enterprise with theology in this study is based on the historical insight that the errors of medieval nominalism, which shaped the Enlightenment’s fateful separation between faith and science, mind and world, can be overcome while ensuring the integrity of theological reflection. This diagnosis is ably constructed with meticulous historical analysis in Louis Dupré’s *Passage to Modernity: An Essay in the Hermeneutics of Nature and Culture* (New Haven: Yale University Press, 1993).

Chapter One: Contemporary Natural Theology and Critical Realism

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1.1 Introduction: The Gifford Lectures

One approach in which the issue of critical realism has been framed is natural theology. Natural theology is a form of reflection that takes its structure of questioning from the discipline of philosophy and its point of departure from the world as 'given' to speak about God as creator. So it is logical that an analysis of select lectures by scientists in this field would yield a set of fruitful reflections on the relationship between scientific and theological knowledge. Moreover, it follows that these three "scientist-theologians" would discuss the God-World relationship in their Gifford lectures. The experience of God as creator is pivotal for the entire Christian theological tradition. It is the chief locus of concern in both natural theology and the science-theology dialogue.¹

Natural theology has been the focus of the Gifford lectures, a prominent series of lectures that have become a culturally privileged forum for addressing the topic. The three thinkers I named in the introduction, Ian Barbour, Arthur Peacocke and John Polkinghorne, have been prominent Gifford lecturers. They delivered Gifford lectures in 1989-90, 1993 and 1993-94 respectively, each of which been published in book form. As such, they have committed themselves to reflections in the science-theology dialogue from within the general parameters of the natural theology tradition.²

Their common objective is to describe a cognitive and epistemological basis to theological claims regarding the natural universe. There are, nonetheless, distinct and important differences among these thinkers. It is worth noting in particular the contribution of John Polkinghorne. His examination of creedal theology with an eye on science in *The Faith of a Physicist* addresses the estrangement of redemptive and revelational theology from the science-

theology discourse. This marks a significant break from the natural theology of previous Gifford lectures. Simultaneously, it marks a break from the philosophical approach to God that characterizes the bulk of reflections in the science-theology dialogue.³

Since the Creed is a form of theological language that arose in the context of a specifically Christian tradition centered on the redemptive experience of Christ's disciples and the Christian church, Polkinghorne's departure requires that we pay attention. His focus on the Creed may hold a clue to a problem in the science-theology dialogue. Perhaps the notion of critical realism, in defining what is acceptable as knowledge, has been too theologically restrictive. Polkinghorne argues convincingly in his work that faith, redemptive categories, human historicity or revelation theology should not be avoided. In speaking explicitly of faith, Polkinghorne indicates that theology needs to claim more than its recovery of cognitive and epistemological dimensions.

In suggesting that the God-World question in theology implies taking up the issue of knowledge, it is equally implied that the critical realist theory of knowledge is involved. Since the worldviews of thinkers like Barbour, Peacocke and Polkinghorne address the God-World question, they each require appraising in terms of how their views on knowledge and worldview cohere. They hold a common position on the nature of knowledge. But, do they successfully account for God as a distinct object of theological knowledge? If so, how? Are they explicit in what makes up a claim to knowledge in regards to both the world and the world *vis à vis* God? Through a better understanding of the meaning of critical realism on the part of each thinker, their theological positions can be freshly clarified and open to constructive expansion.

Until recently, critical realism was virtually unchallenged in the science-theology

dialogue. Now, with a wave of critiques over alleged oversights in the natural sciences and theology, this position requires a thorough re-examination.⁴ The selection of the three Gifford lectures is thus a natural point of departure for such a re-examination. Barbour, Peacocke and Polkinghorne already provide key elements for adopting a wider philosophical framework.⁵

The aim is to reinforce what the three Gifford lecturers emphasize as the cognitive locus of theological knowledge, given the correlations that exist outside theology. A focus on critical realism alerts theologians on how to deal with the complexities of appropriating subject matter that is steeped in conflicting philosophical allegiances.⁶ However, I shall argue that, although each Gifford lecturer defends critical realism with common terms and references, each of them develops the term with respect to a different form of discourse. This is especially apparent in the case of Polkinghorne. In spite of a shared descriptive phrase designating how theology and the sciences understand the reality that they investigate, there exist important differences in their understanding of what critical realism means for theology. This divergence is why the issue of critical realism, their common methodological position, deserves a systematic analysis. If the methodological question cannot be settled with some assurance, then it is unlikely that agreement on specific theories, discoveries or interpretations can ever be resolved.

Each lecturer advances the belief that theology contains cognitive content. Theology does not refer to arbitrary sets of religious language expressed differently according to the religious outlook of a particular tradition or culture. Nevertheless, their ways of configuring the relationship between theology and the sciences requires a critical analysis with respect to their common strategies and their divergences from one another. Each lecturer's contribution will first be analyzed. As their lectures stand, Ian Barbour, Arthur Peacocke and John Polkinghorne have

contributed to identifying and describing the implications of historical conflicts, contemporary scientific findings and certain philosophical areas of discussion for Christian theology. As we shall see, these reflections are adequate descriptions for why theology remains a valid and meaningful discipline in the shadow of the spectacular advances in scientific thought. However, in order to see why this re-examination of critical realism requires further work, a fuller examination of the history and philosophy of science and a re-affirmation of theological language will seek to clarify the long range meaning of their contributions.

Two concerns emerge in reading these lectures and other similar reflections. The first question concerns the depth of philosophical acumen that each lecturer brings to his theological inquiry. It concerns the degree and range within which human rationality has been understood in supporting the position of critical realism in science and theology. The risk lies in theology attaching itself to an idealist interpretation of science, wherein proposals in systematic theology become perceived as idealist in character, thus perpetuating a historical trend.

The second concern raised by a reading of these lectures is whether these theologians select too liberally from the scientific data to suit their theological purposes. The problem is the degree to which theological sources have been understood and represented well. To the degree that science and scientific rationality are philosophically skewed, there are indirect consequences for theology. To the degree that theological knowledge is skewed, there are also consequences for whether a dialogue with science will be authentic. Bearing in mind Polkinghorne's stance on faith, how does his departure from natural theology disclose a problem in the way that theological knowledge claims are treated in the science-theology dialogue? Do the differences among Polkinghorne, Peacocke and Barbour on this subject undermine the apparent agreement

on how knowledge is achieved in the critical realist position?

In response, this study will explore a theological reflection that might draw on an explanatory account of a critical realist view of knowledge. This question is crucial in view of the entire neo-Kantian move to conceptually construct objects as the pre-condition for knowing these objects by subjects. Barbour develops the term critical realism in relation to religion and religious claims from its usual locus in science. Peacocke develops critical realism in relation to a theological systematics that depends for its part, on a biologically oriented theological anthropology. Polkinghorne develops critical realism in relation to the basic claim that faith is reasonable.

In short, this study argues that in these three Gifford lecturers, there is an incomplete critical realist philosophical framework, because on the religious side of the dialogue, the term is developed with three different purposes in mind. As this chapter will show, for Barbour, critical realism is developed with attention to dialectical problematics and their foundational resolution, inspired by contemporary debates in the philosophy of science. For Peacocke, critical realism is developed as a tool for understanding how to systematically integrate theological notions in an interdisciplinary context. Polkinghorne, finally, is concerned to show the reasonable status of doctrines in theological discourse. Critical realism offers the epistemological basis for doing this. While these three different aims are related and not necessarily contradictory with one another, there is insufficient evidence to suggest that each thinker refers to a common critical realist position.

On the scientific side, this chapter will make the case that these diverse theological interpretations of critical realism draw on a similar descriptive approach to science and scientific

rationality. While this common employment of the term 'critical realist' from philosophy of science helps identify their advocacy of a general critical realist theory of knowledge, their lack of reference to an explanatory perspective limits the extent to which critical realism is exploited as a legitimately profound insight and philosophical discovery. On the contrary, this study seeks to show that critical realism is just such a discovery, yet one whose scope of meaning has been taken for granted.

In the following analysis of Barbour's *Religion in An Age of Science*, Peacocke's *Theology for a Scientific Age* and Polkinghorne's *The Faith of a Physicist*, the focus will remain on the specific contents of each thinker's proposed critical realism. This analysis will outline the resources marshaled in defense of critical realism, the main insights each thinker makes into it, the implications arising from these insights, and a summary evaluation of the relationship between these three investigations into critical realism in a theological light.

1.2 Ian Barbour: *Religion in An Age of Science*

Barbour's interpretation of critical realism is directly inspired by Thomas Kuhn, especially his agreement with Kuhn's notion of paradigms that mark off different periods of normal scientific investigation from one another. In the wake of the critical turn in philosophy, Barbour identifies models and theories which correspond with truth as an internal or epistemological limit to knowledge. Moreover, the correspondence between scientific data with theories on the one hand, and religious experience with belief on the other hand, is ample justification for a Whiteheadian metaphysic that stresses the interconnected web of reality, understood in dialectically complementary ways. This section will reflect on Barbour's insight on critical realism. In conclusion, his contribution to setting out the meaning of critical realism is

registered as nothing less than the twentieth century renewal in a theological view of nature. Among our three thinkers, Barbour was the first to deliver the Gifford Lectures. He delivered them at the University of Aberdeen in 1989. The title of these lectures was first published as *Religion in an Age of Science*. It has since been re-published as *Religion and Science: Historical and Contemporary Issues*, and remains the most well known religious engagement with the natural sciences in the history of the Gifford lectures.⁷ Barbour's work has since been lauded as the standard text by which other science-religion discourse is evaluated.⁸ This is especially true with respect to Barbour's famous four-fold typology for science-religion interaction: conflict, independence, dialogue and integration.⁹

For Barbour, critical realism is an epistemological breakthrough that occurred during the mid-twentieth century. It opened up a new view on the achievement of knowledge across disciplinary boundaries, especially in the sciences. The reason for this shift was the demise of scientific positivism in philosophical circles, especially in the early 1960's. The chief source cited to support Barbour's adoption of critical realism against a tenacious positivism is Kuhn's *The Structure of Scientific Revolutions*.¹⁰ Another source that receives significant attention along the same lines is Michael Polanyi's book *Personal Knowledge*.¹¹ Barbour also mentions a similar theory of scientific research programmes by philosopher of science Imre Lakatos,¹² but it is really Kuhn and the historicist movement to whom Barbour gives credit for advancing critical realism in the philosophy of science. According to Kuhn and others, science advances as a community of knowledge in different stages. It does not advance, as popular optimistic portraits previously advocated, in terms of sets of logical deductions from empirical proofs.

Barbour has advocated critical realism from 1966 onwards as a physicist and a religious

believer. It is not surprising that he criticized scientific positivism, beginning with his book entitled *Issues in Science and Religion*.¹³ Positivism, after all, was widely understood to be hostile to religious claims. Positivist philosophy emphasized deductions from sense observation, while religion and theology referred to knowledge of the unobservable. During the 1960's, empirical positivism was transformed through Karl Popper's more sophisticated version in his theory of 'falsification.' This theory marked off scientific knowledge from all other forms of knowledge, and confirmed for many the judgment by C.P. Snow that the pursuit of knowledge existed in two separate and distinct 'cultures.'

The 1997 edition of Barbour's Gifford lectures are divided into four sections. "Religion and the History of Science", "Religion and the Methods of Science", "Religion and the Theories of Science" and "Philosophical and Theological Reflections."¹⁴ Parts one, three and four summarize the historical and contemporary contents of the dialogue. This treatment includes figures and topics as diverse as Newton, Darwin, evolution, the anthropic principle and creation. The second part deals specifically with the notion of critical realism as an explanation for what comprises a knowledge claim, and for how the disciplines are mediated. Critical realism is laid out here in chapter five. The sections in that chapter are titled "The Structures of Science and Religion," "The Role of Models," "The Role of Paradigms," and "Tentativeness and Commitment."

Barbour's earlier book *Issues in Science and Religion* includes a foundational definition of critical realism that is repeated and qualified in *Religion and Science*. His early definition is that:

"Critical realism acknowledges the indirectness of reference and the realistic intent of

language as used in the scientific community. It can point to both the extraordinarily abstract character of theoretical physics *and* the necessity of experimental observation which distinguishes it from pure mathematics [...] If the goal of science is to *understand nature*, we can unify the concern for empirical testing found in positivism with the concern for intellectual coherence found in idealism, while avoiding the exclusive preoccupation of either.”¹⁵

Critical realism, therefore, introduces the possibility of methodological unity and cohesion in scientific rationality by taking up the concerns of two opposed schools of thought. This unity embraces both experimentally tested entities and the theoretical constructs employed in truly understanding those entities.

Later, in Barbour’s Gifford lectures, he repeats his earlier definition and relates it to its wider philosophical significance. Critical realism is introduced as the best explanatory term available in science-religion discourse, because it is more than just useful:

“Against instrumentalism, which sees both scientific theories and religious beliefs as human constructs as useful for specific human purposes, I advocate a critical realism holding that both communities make cognitive claims about realities beyond the human world.”¹⁶

Barbour asserts that both theology and the sciences refer to an extra-mental reality. Furthermore, critical realism involves the “meaning of truth,” not some dimension of truth itself. Truth is not identified, but it is aimed at. Critical realism means a “correspondence with reality [...] because reality is inaccessible to us.”¹⁷ Following Kuhn, Barbour stresses the contingencies of human scientific activity in the construction and verification of hypotheses. Because these activities are contingent, Barbour concludes that truth *per se* is inaccessible. The meaning of attaining truth is more important than its propositional fact.

These statements vary to some degree from the classical realist position that objects are known as they really are in human cognitional activity providing that inferences are made on

sound principles and adhere to solid logic. However, Barbour's critical realism couches the priority of the real or "ontology" in terms of the less certain word "meaning." What does this nuance mean? As we shall see, Barbour defines a number of parameters regarding the ability of science to arrive at truth statements.

One of these parameters is the suggestion that scientific activity is largely a task of weighing and deliberating among a cluster of virtues or criteria in order to decide which scientific theories correctly explain empirical data. Truth is attained through a combination of several criteria. Beyond positivism, there is not a single logical or mathematical criterion for a theory's agreement with the data. This is also the case with respect to the way in which Karl Popper formulated the view of falsification. Correspondence with reality is conceived differently from the 'naive realist' position on knowledge due to a combined set of criteria acting as the correct evaluation of scientific theories. According to Barbour, these criteria for the truth of theories are: 1) agreement with the data, 2) theory coherence, 3) theory scope and 4) theory fertility. The latter criterion is especially important for its associations with Kuhn's accent on the problem-solving, pragmatic activity of scientific communities.¹⁸ However, it does not stand alone in scientific inquiry and theory evaluation. Barbour criticizes the positivist movement in the philosophy of science for relying on single criteria for characterizing scientific rationality. The positivist insistence on equating reality with what we sense or logically deduce is naïve. In contrast, he says, "the realist asserts that the real is not reduced to the observable."¹⁹

Perhaps the most characteristic feature of Barbour's critical realism is his position that structural parallels exist between science and religion. Indeed, he believes that they share similar epistemological structures. He believes that parallels exist between data and theory in science on

the one hand, and experience and belief in religion on the other hand. It is on the basis of this supposed parallelism that dialogue between the disciplines can be fruitful.²⁰ We understand in different disciplines, according to Barbour, due to an essential similarity in disciplinary structure. This is also true with respect to the use of models and operative paradigms in science or religion/theology.²¹ The religious phenomena of beliefs and religious experience influence each other in mutual modification.

Barbour's employment of theory lies in terms of the existence of models. He draws connections between ways of interpreting data in science and interpreting experience in religion as parallel quests for truth. Insofar as the stages of knowledge are identifiable within religion and science, Barbour cites a critical realist position that is substantially different from standard treatments in the philosophy of science. The difference is that Barbour extends critical realism into the understanding of religion and religious knowledge. In both science and religion, "models and theories are abstract symbol systems, which inadequately and selectively represent particular aspects of the world for specific purposes."²² In both areas, there exists a common reference to reality and truth through different paradigms in a continual, transitory and progressive process.

The critical realist parallels between science and religion demonstrate Barbour's goal, which is to fundamentally address "the challenge to religious belief...from the assumption that the scientific method is the only road to knowledge."²³ Borrowing from critical realists in the philosophy of science, Barbour argues that since the natural sciences use theoretical tools such as models and metaphors in advancing knowledge, their presence in religion should be seen as a strength in religious knowledge claims, not a weakness. This is an important element in his Gifford Lectures, because it permeates the entire description of the structural parallels in religion

and science. As such, it constitutes Barbour's defining interpretation of critical realism.

Using Kuhnian terminology, Barbour expresses his reliance on the philosophy of science for understanding religion and theology by describing theology as either 'normal' or 'revolutionary.'²⁴ While this may be analogously helpful to describe the history of theology in terms of stability and change, Barbour implies more. He implies that theology's ability to communicate religious knowledge at different times through different traditions is bound by this paradigm structure. Hence, the constraints on theology to make knowledge claims appear as prominent as the constraints he sets on the explanatory intent of the natural sciences.

An example marks his position even more clearly. Barbour augments his argument for structural parallelism in religion and science by comparing the use of personal and impersonal models for God within a greater "paradigm community." Religion in the west and east are thus similar to the wave and particle models that describe sub-atomic reality in quantum physics.²⁵ The structural parallels between the disciplines are articulated analogously yet strongly in this example. As objects of the disciplines in these examples, God and light are comparable in light of the fact that they are understood as a duality. Realism is not abandoned. It is qualified by an agnosticism that is inherent in the concept of complementarity. Thus, complementarity is an ontological category that Barbour actually works with in order to characterize scientific and religious models of reality, even though he is reluctant to articulate it as such.²⁶ As such, it is key evidence that Barbour cites as the implication of critical realism. It is the implication for a worldview. It is evidence that the reference to truth, models and metaphors in scientific rationality yields the distinct possibility of a holistic, conceptual view of the universe.

A holistic unified worldview is a central possibility arising from Barbour's adoption of

critical realism. This indicates that Barbour is really arguing for a philosophical position on the science-theology exchange. According to Barbour, it is now possible for a general metaphysic to mediate the similarly structured disciplines of theology and the sciences. One of the reasons Barbour is able to carve out this position is due to his studied avoidance of narrow theological goals. He respects the integrity of the sciences with regard to the purpose of a metaphysical position without presuming a theological *a priori*.

For Barbour, critical realism implies a quality of knowledge in science and religion. It is tentative knowledge. In science, this is well understood because of the central role given to hypotheses. But this tentativeness is something that Barbour is anxious to emphasize in religion as well. This understanding of the tentativeness of critical realism is extended by Barbour to religion's own polarities: faith and doubt. For Barbour, one's personal involvement incorporates an attitude of personal trust and confidence. However, he argues that this should not become "blind trust," and he proposes a commitment to methodical self-criticism and doubt. For Barbour, doubt is essential and involves "calling into question every religious symbol."²⁷

Barbour identifies process thought as the tradition that best grounds these epistemological parallels. The parallelism that encompasses and structures each discipline is significant for allowing a metaphysical mediation. This meaning is expressed in the ongoing search for truth, our grasp of which is never finalized, even in extraordinary discoveries. For Barbour, the methods of science are metaphysical, since they can be understood as an ensemble. The act of modeling and the employment of values that serve as criteria in scientific theory evaluation attest to the possibilities of metaphysics. Realism can be thus derived as meaningful rather than abstract. It incorporates religious knowledge. Critical realism is not reduced to a logic that

represents empirical reality.

Process gives metaphysical credence to a form of unity that recognizes tentative knowledge. Barbour describes this tentativeness as the ever present *via media* between different “polarities.”

“in which the first term [is] more prominent in science and the second in religion: objectivity and subjectivity; rationality and personal judgment; universality and historical conditioning; criticism and tradition; and tentativeness and commitment.”²⁸

Religion is clearly anchored in subjective experience for Barbour. As such, “some features of religion seem to be without parallel in science...Religion is indeed a way of life.”²⁹ This raises significant further questions about whether science and religion cohere with such a portrait of being more or less objective and subjective by degree. Although the emphases are different in science and religion, a dialectical structure of direct and reflective knowledge remains intact for each.³⁰

What does Barbour’s critical realism mean for theology? Barbour’s last chapter entitled “God and Nature.” includes some clues that expand a bit further the process thought metaphysic. Barbour chooses to broaden the process metaphysic by calling on the meaning of relationality and extending it into God. This comprises Barbour’s theology of nature, and his understanding of God. In it, he moves beyond the issue of methodological parallels among the disciplines. He moves to depict the God-World relationship and the character of God. Here is where the results of religious critical realism bear theological fruit.

For Barbour, the category “process” encompasses a theological metaphysic that is epistemologically based in this subject-object relationship. It does not infringe on the way we know in any one discipline. Process thought’s chief virtue lies in what it “allows.” By proposing

a process understanding of God, Barbour affirms that God possesses a dipolar nature with a subjective and objective pole. This mirrors our knowledge of human understanding. As one who continually creates, God maintains an ongoing relationship between creator and created. God's duality is a frame of reference for divine reality that is both transcendent and immanent. Since religion parallels science, process thought bridges both disciplines. Process thought is the key ontological expression of critical realism

Entities are understood in process thought as self-creating "actual occasions" following Whitehead's line of thought. Process is articulated as the underlying order, as the general character of reality.³¹ The category process sees time as primary, and it affirms the interconnectedness of events. Thus, it sees reality as an organic process, a web of entities involved in efficient and final causation.³² Metaphysically, since entities possess such value, they provide "an ongoing contribution to the life of God."³³ So, although Barbour draws out an outline of theological models, metaphors and paradigms in his chapter on methodology, he discards these considerations when he making more explicit theological claims. He chooses instead to rely more exclusively on the process metaphysical tradition to discuss God.

Process thought accounts for the universe in terms of God's activity. Having a dipolar nature, God can be expressed as creating the universe *ex nihilo*. However, Barbour goes on to affirm that the ontological structure of entities chiefly concern relationship. The God-universe relationship is important in a way beyond what Barbour feels is contained in the traditional creation doctrine. The ontology of relationship extends to one between the universe itself and its ground of being and becoming. God's activity in the world is best understood through reference to a "single conceptual scheme" that neatly brings together both God's creating activity and

God's redeeming activity. The advantage of process thought lies in being able to account for both these types of divine activity without opposition or contradiction. For Barbour, this virtue of process thought contrasts with many dualist accounts in historical and contemporary models.³⁴

For Barbour, the process metaphysic allies with a portrait of intelligibility gained through realism. As a meta-philosophy, process thought indicates an ontological extension. What is consistent between Barbour's application of critical realism in epistemology and his adoption of the process category is a reliance upon dialectic. Dialectic is present in the tentative act of knowing as well as in the known object. This dialectic is extended into God's di-polarity by virtue of personal and impersonal models of God.³⁵ Thus, Barbour commits himself theologically by placing the dialectic that characterizes his interdisciplinary methodological parallelism into God. Barbour works from the epistemological tensions between faith and doubt, subject and object, and data and theory by incorporating dialectical tension in his process model for God. God's life can be adequately accounted for in terms of immanence and transcendence, a complementary pair of basic divine attributes.

How can Barbour's proposal be evaluated? First of all, it is striking how Barbour develops an understanding of critical realism and its applicability to the sphere of religion. As it applies to religion, critical realism is borrowed from the sciences as a result of new insights in the philosophy of science. It is the philosophy of science to which Barbour refers most frequently in his writings, with some references to works in the philosophy of religion. For Barbour, since science is a successful domain of human reasoning, it may assist religious scholars to understand religious language, its range of meaning and intent. The legitimacy granted to theology is an extension of insights made in the philosophy of science. Theology's legitimacy is not granted by

virtue of its own form of reasoning or particular insights identified in its modern history.

This dependence on the lessons of the philosophy of science are crucial given Barbour's dependence on the ambiguous legacy of Kuhn. The ambiguity results from the tension between a realist account of the operations of science and the historicist account of science in Kuhn's work. It should be added that Kuhn himself was reluctant to affirm genuinely realist claims on scientific knowledge. He leaned in a historicist direction, especially in his later writings.³⁶

Barbour offers another key element to his theology beyond this dependence on Kuhn however. This is through his reference to analogy. He notes that "[l]ike scientific models, religious models are analogical."³⁷ Religious and scientific models are similar by correlating patterns of human experience. They also possess a continuity of reference by virtue of the fact that models are based to a large extent on human language. In both science and religion, models are analogical, yet they lead to beliefs. However, in the case of religious knowledge, Barbour notes, stories are qualitatively different ways of communicating meaning. Yet, critical realism is able to account for this religious form of models, but not literally as in the sciences. However, by seeing stories or narrative as an extension of the scientific model, Barbour stretches critical realism beyond the parameters of a knowledge claim into the distinct realm of meaning. Barbour's goal of methodological parallelism stretches what is better thought of as a fundamental discontinuity between scientific and religious knowledge. In religious reflection, there is arguably a more central role for analogy in characterizing theological knowledge. Analogy is indeed an historically central form of theological knowledge. As such, it has been employed specifically because it is a form of reason that accounts for the utter dissimilarity by those who experience a transcendent, atemporal God. In amending Barbour's reflections, it might be justifiable to argue

for theology's dependence on analogy as different from science's use of analogy.³⁸

This issue raises the wider question of whether and how meaning and truth are interrelated. This lies beyond the scope of this study. However, as science employs analogical models in order to understand empirical reality, could we not suggest more of a contrast with theology's analogical reference to a non-natural reality? Perhaps this distinction might clarify why narrative and the study of religious texts is completely different from the terms and relations of analogy in scientific rationality.

A reading of Barbour's Gifford lectures reveals an extraordinary confidence in dialectic, complementarity, di-polarity and other forms of duality. Why this is pertinent is due to Barbour's commitment to the metaphysical implications of critical realism. The metaphysical duality he expresses originates in his affirmation of the realist intent of critical realism. The following statement is the most conceptually strong in the entire text: "Realists insist that being is prior to knowing."³⁹ Here, one can see that Barbour presupposes a duality of being and knowing, ontology and epistemology. However, this raises questions over the extent to which Barbour is still captive to the dualist philosophies he wants to overcome. Such questions become more pressing when we focus on Barbour's explanation of knowledge strictly in terms of paradigm communities on the one hand and the non-human world on the other hand.

Is this philosophically legitimate? Is this the best way to account for scientific or theological knowledge claims? Barbour is suggesting that a dialectical view is best understood along diachronic (Kuhnian) paradigms. He also allows for the possibility of a synchronic view across Lakatosian research programs as well. But, Barbour possibly misses a more fundamental account for why and how scientific and religious knowledge exists at all. Barbour's descriptive

account leaves unanswered the probability that knowing and knowledge can be further differentiated beyond simple affirmations of duality. Duality is emphasized in terms of epistemologically parallel structures and ontological complementarity. However, this still places too much subject-object tension at the heart of a position on knowing and understanding. This tension is evident in Barbour's own position that each of these are present in scientific and theological rationality by degree. The process metaphysic demonstrates how the universal presence of relationality is dialectical and religiously meaningful. However, Barbour's emphasis on dialectic leaves the God-universe relationship unexplained beyond the statement that relationality is present. Is there not more to be understood? Put another way, can critical realism be construed with different theological implications than he is able to provide?

Furthermore, it is not certain how the epistemological parallels Barbour highlights in his version of critical realism necessitates a metaphysical position. Barbour's quest for unity and interdisciplinary integrity is advanced by noting these similar epistemological structures, but only to a certain limit. Process, on a reading of Barbour's interpretation, integrates the disciplines without reducing either discipline to a form of the other. But it presumes that science and religion pertain to different ways of understanding the same identical reality. Further, the process metaphysic does not account for knowledge as progressively attained, even though it captures a sense of the ontological relatedness of the constituent parts of the universe. There is in Barbour an epistemological underdetermination of metaphysical claims that requires clarification and amendment. Can critical realism come to mean something with a more dynamic scope? Could there be a better way to argue for a metaphysic in which the epistemological elements of critical realism are held as differentiated elements in the achievement of knowledge? Otherwise, it may

be the case that metaphysics overlays the disciplines as an ideal category without adding any meaning to their knowledge and operations.

In attempting to clear up some of the ambiguity around the meaning of realism in science, it might be best to turn to a study of the ontological aims and claims in a study of the history of science. In fact, Barbour's revisions to his Gifford Lectures have already attempted this. In the 1997 edition, his insertion of an additional 75 pages treat some of the historical controversies in the period from the seventeenth to the nineteenth centuries. What is missing from this survey, however, is an evaluation of these issues with an eye to see if critical realism is verified in this historical record. What is missing is an examination of the knowledge claims from these historical case studies beyond a general description of the historical events themselves.

Barbour's work therefore offers little explicit connection between his historical support for critical realism and his actual epistemological position, although both are well developed as separate accounts. Yet, he envisions the unity and integration of a metaphysical orientation to critical realism. His coverage of historical issues does indicate that no metaphysical reflection on knowledge should go unaware of historical contingencies that shape such attempts. This is executed by Barbour in a general account. He adopts a metaphysical position without proposing detailed criticisms or amendments of other positions.⁴⁰

Barbour's turn to the theological task of appropriating the science-religion dialogue in order to emphasize God's relationship in and with the universe is a major step in his argument. With process thought secured as a unifying scheme for critical realism, Barbour is able to state that a God-World relationship can be claimed, although it is not clear how Barbour applies critical realism to his theological thinking. He leaves his reflections open to include the insights

of major world religions. His recourse to process thought should be understood in this light.

Barbour's Christian process theism is nevertheless present in his study. What needs to be underlined is that his process theism is disconnected from the earlier chapter 5, which describes a religious version of critical realism. Nonetheless, Barbour is correct in demonstrating that critical realism is the epistemological breakthrough beyond positivism that allows an integrative approach to knowledge to be made.

It is clear that Barbour's definition of critical realism depends on a notion of truth that is viewed in terms of correspondence with natural reality. There is, moreover, a direct metaphysical implication that reality is fundamentally unified as a single process. Religion and science are different ways of understanding this reality. A philosophy of language is assumed on Barbour's part. Science and religion employ similar sorts of tools, from metaphors to models in revealing the character of God and nature. However, this method of realizing a unified worldview is a key reason in explaining why opposition to critical realism in the science-theology dialogue has now emerged. While Barbour retrieves a metaphysical worldview from his general presentation of critical realism, he leaves critical realism vulnerable on the issues of language and the differentiation of reality. Apart from this problem, these elements of scientific rationality base a critical realism that comprises a significant development of previous attempts at proposing a realist view of the world.

It is therefore prudent to investigate another Gifford lecturer to see what a less metaphysically indebted view of critical realism would offer. Can the unity that Barbour seeks be framed in a way that places metaphysics at the service of differentiations in knowledge in accordance with the different disciplines? Also, could more be said in connection with the

historical theological claims of knowledge about God? Arthur Peacocke's Gifford Lectures offer just the kind of theological response that builds on Barbour's generalized account along these different lines. Indeed, Peacocke's work, with its emphasis on christology, is oriented towards identifying a theological problem from a similar starting point in nature as epistemology and scientific rationality.

1.3 Arthur Peacocke: *Theology for a Scientific Age*

In this section, Peacocke's application of critical realism from the philosophy of science into systematic theology will be analysed and evaluated. Peacocke is inspired by the rise of critical realism in a similar vein to Barbour. However, he stresses the role of metaphor and analogy in achieving knowledge, especially in theology. Indeed, Peacocke intentionally develops systematic theology as a distinct enterprise. As such, theology possesses a vested interest in a multi-leveled view of the universe in some agreement with the inquiries of the other disciplines. Unlike Barbour, Peacocke opts for a more nuanced metaphysical approach that is not indebted to any particular philosophical tradition. Instead, he emphasizes the role and significance of human personhood as an emergent feature in the unfolding of life. Moreover, human persons are oriented to their own self-transcendence. Peacocke selects the christological tradition as an ideal form of self-transcendence. The result is a positive theological programme. However, while he proposes a viable theological worldview, he remains tentative on the distinct characteristics of rational investigation pertaining to both scientific and theological inquiry.

Like Barbour, Arthur Peacocke addressed the topic of critical realism extensively before delivering his Gifford lectures. Peacocke's reflections are first evident in *Intimations of Reality: Critical Realism in Science and Religion*⁴¹, which is the publication of his Mendenhall lectures.

However, starting earlier in his 1978 Bampton lectures, published as *Creation and the World of Science*⁴², Peacocke began to show a reluctance toward an explicit philosophical metaphysic as a tool to integrate the disciplines. Since then, compared with Barbour, Peacocke has repeatedly appraised knowledge more in terms of disciplinary limits with the guidance of a theological systematics.

Like Barbour, Peacocke states his allegiance to critical realism for understanding how knowledge is achieved in theology and the natural sciences. However, he does not opt for an explicit metaphysical tool like process to unite the differentiated knowledge of different disciplines as Barbour does. Instead, he describes the theological significance of the relationships among three poles in Being: God, humans and the world. This frames his Gifford lectures as a whole as the subtitle indicates. Peacocke assumes that some sort of metaphysical underpinning to interdisciplinary knowledge is present. However, he suggests that it is inadequate to argue that world and God are in mere relationship. Peacocke wants to make a systematic theological account of this relationship. He also stresses a comprehensive worldview, without employing the technical language of philosophical categories.

Peacocke spells out the meaning of critical realism in *Intimations of Reality*. The insights from this work are then condensed and transposed in his Gifford lectures. In both works, Peacocke narrates critical realism's rise. This is illuminating, since like Barbour, Peacocke sees the re-emergence of realism in science as the result of a dissatisfaction with positivism. However, he is more explicit regarding another problem in the philosophy of science he names. From a scientific positivism during the 1920' s to the 1940' s, there followed an over-exuberant preoccupation with the sociology of scientific knowledge in the 1960' s and 1970's. Peacocke

takes issue with this preoccupation. Thus, realism re-emerges as attention “to actual scientific practice, both historical and contemporary [...] it is basically a philosophical position.”⁴³

Why philosophical? Because, according to Peacocke, the return to a realist position in science is “linked with the much vexed philosophical problem of the nature of ‘truth.’”⁴⁴

Nevertheless, the question then becomes an equally contentious debate about how realism is plausibly defended. Is realism defended with reference to theories or the entities discovered in scientific experiments? At this point, Peacocke breaks off from the narrative and turns to a brief analysis of models, not only in science, but also in theology.

Using the work of Janet Soskice as a guide, Peacocke argues for the “high” view of models in scientific practice, over against a naïve realist or instrumentalist view of models in science. Models mediate theory and possible phenomena as theoretical, imagined constructs. These constructs are never literal. As Peacocke notes, this is theologically significant, because science does not involve empirically certain or literal knowledge, an assumption that has been central in theology for sometime. Models require a theory of language. In particular, they require a theory of metaphor, in order to show how science explains. The metaphor explains what the model identifies analogically. Analogy, therefore, is the kind of knowledge that scientific models provide in the process of constructing the most adequate theories. Scientific theories are dependent on the analogical models that give rise to theories in an ongoing process of discovery and modification. They are not autonomous, mathematically based deductive schemes as positivism envisioned, according to Peacocke. While vital differences exist between scientific and theological models, the analogical element is similar and crucial. The “reality ... believers seek to depict is one that the creature cannot claim to describe as it is in itself - *ex hypothesi* God

as transcendent is beyond all explicit depiction whether by language or visual image.”⁴⁵

Yet paradoxically, theology and science are “mutually interacting approaches to reality.” Both aim to “depict reality”.⁴⁶ Rather than serving as an explicit theological or scientific epistemology for understanding the world, critical realism is a position that highlights personal knowing in general. So, reality is not reduced to logical sets of theories. Neither is reality “predominantly socially conditioned,” into which theology adds a further dimension of social meaning.⁴⁷ The result of applying critical realism to theology illuminates the basic human condition of being persons who know. In general then, Peacocke’s articulation of critical realism resembles Barbour’s, although there is marginally more dependence upon a theory of language and the theological utility of models than Barbour allows.

Unlike Barbour, Peacocke treats critical realism somewhat less comprehensively. He does not provide details on the mode of explanation or knowledge attained in scientific inquiry. A likely explanation is that Peacocke is devoted to proposing a theological systematics, a concern that first arose in his 1979 work *Creation and the World of Science*. The interdisciplinary and epistemological concern of critical realism thus appears to play a secondary role in framing Peacocke’s theological inquiry. At least, as an epistemological breakthrough documented elsewhere, Peacocke does not develop it beyond what Barbour provides. Nevertheless, Peacocke summarizes his position with reference to the philosopher of science Ernan McMullin’s definition of *scientific* realism. The significance of this move will emerge from a treatment of scientific realism in the next chapter. Quoting from McMullin’s article “A Case for Scientific Realism,” Peacocke agrees with McMullin’s claim that:

“The basic claim made by such a critical scientific realism [...] is that it is the long-term

success of a scientific theory that warrants the belief that ‘something like the entities and structure postulated by the theory actually exists’.”⁴⁸

Peacocke cites with approval this ontological reference to critical realism. Existence is the issue.

Peacocke proceeds to refer to the history of science in support of critical realism. But he stops short of buttressing his position with an historical analysis. Before moving into a discussion of theological subjects, Peacocke pauses to clarify his interpretation of critical realism by commenting on its basis in a ‘theory of reference’:

“[...]the realism is always qualified as ‘critical’ since the language of science is [...] fundamentally metaphorical and revisable, while nevertheless referring [...] this position of critical realism as regards the status of scientific propositions inevitably involves some theory of reference.”⁴⁹

He cites the work of Soskice once again to support of a theory of language which anchors scientific knowledge in a way that is consonant with religion and theology. As with Barbour’s work, this linguistic theory of reference affirms the presence of metaphor and analogy in both disciplines.

In expanding Barbour’s more limited criticism of social constructionists in a philosophy of science, Peacocke’s account of science takes into consideration the socio-historical critiques, but in a new way:

“the theory of reference on which a critical realism rests will include an overt social perspective, for this enhances our understanding of the way in which the reality of a referent persists through change in theory and is gradually established in a community by a critical winnowing process.”⁵⁰

The positive contribution to knowledge which Peacocke ascribes to science’s social contingencies marks the historicist interpretation of the philosophy of science. But he turns the critique around in order to affirm a broader notion of the knowledge arising from scientific

activity in social settings. This is a significant judgment on Peacocke's part. He embraces the investigations, but not the historicist conclusions that are usually drawn. As such, he parallels Barbour's caution concerning strictly historicist readings of science. But it affirms the role of social factors in theory deliberation. Yet, Peacocke does not deliberately define critical realism in light of these factors.

What do these somewhat different reflections on critical realism imply? On this question of metaphysical implication, the differences between Barbour and Peacocke are pronounced. The reason for this is due to the fact that Peacocke rapidly turns his attention to a view of nature as a hierarchy of communicating levels, not a process. Peacocke has especially insightful suggestions concerning the human as a "microcosm" of the universe itself.⁵¹ Human persons span the four levels of the universe identified metaphysically by Peacocke: i) the physical world, ii) living organisms, iii) the behaviour of living organisms and iv) human culture.⁵²

This proposal is made in the interests of establishing a worldview. The clearest indication that Peacocke sees this proposal as the result of critical realism is made in *Intimations of Reality*:

"If we adopt such a skeptical and qualified realist interpretation of scientific theories and models, then it behooves us to take seriously the picture of the natural, including human, world that contemporary science depicts."⁵³

In drawing together a portrait of a natural hierarchy of parts and wholes, Peacocke spends considerable effort depicting the world, and the various disciplines, as both parallel and multi-layered.

This is the thrust of his Gifford lectures, and it comprises the background to Peacocke's decision to offer a christological component to his theological argument. The reason behind his choice to speak of natural, human and divine as different communicating levels of the universe is

to theologically extend the natural world's multi-leveled reality into the human domain. For Peacocke, the scientific disciplines are not only related among themselves, they also exist as hierarchical levels of complex systems. Again, he sees this as significant for a critical realist, because each science has its own distinctive level of operation. The implication is that theology too is distinctive, yet still a part of the spectrum of disciplines. It has its own role to play.⁵⁴

What is also theologically significant is that Peacocke's 'top-down' and 'bottom-up' causal processes act as two different natural causal vectors, giving theology a specific explanatory function concerning the action of God. Peacocke highlights 'top-down' causation generally:

"the role of top-down causation in no way derogates from that of 'bottom-up' causation. But the need for recognition of the former is greater because hardly anyone since the rise of the reductionistic scientific methodologies doubts the significance of the latter."⁵⁵

What is top-down causation? It is something that has a real significance for living systems.

Peacocke sees it as

"changes [...] of the constituent units [...] *because* of their incorporation into the system as a whole, which is exerting specific constraints on its units, making them behave otherwise than they would in isolation."⁵⁶

There is a "further epistemological implication," which is that

"our epistemological analyses correspond, however inadequately and provisionally, to realities which must be deemed to exist at the various levels being studied - that is, they also have an ontological reference, however elusive."⁵⁷

Where top-down causation becomes really significant for Peacocke is in realizing that the communication between different levels of the universe occur within human life itself. Such a depiction of communication implies a *telos* and purpose to the universe. This can be justly supposed as the fruit of Peacocke's investigations in molecular biology. The life of a cell cannot

be understood by understanding the different individual constituents of a cell. It has to be understood as a whole unit. The same holism applies to the integral structure of human meaning and history. The 'natural' existence of top-down causation intensifies and complexifies in the higher levels of living organisms and species. For this reason among others, Peacocke sees good reason to view human history as a distinct causal vector of top-down action in the human species. It is through our capacity for self-awareness that we become human, a process unique to human beings that involves coming to terms with death and the purpose of life.⁵⁸

It is this presence of purpose or existential meaning at the human level that is pivotal. It is where theology and science make overlapping claims about reality. In the lead up to his christological reflections, Peacocke goes on to emphasize human personhood in this context. The word 'person' takes on added meaning in the cross-traffic of bottom-up (biological) and top-down (cultural and religious) causation. We are 'self-transcendent.'⁵⁹ Peacocke provides a lucid and crisp definition of what this signifies:

"Self-awareness and self-consciousness, coupled with our intelligence and imagination, generate a capacity for self-transcendence which is the root from which stems the possibility of a sense of the numinous - and so of the divine [...]"⁶⁰

Through this prism of human self-awareness in the context of nature, the question of God emerges, as this study will make clear after considering the specific limits encountered in the discipline of cosmology. We shall return to the theme of self-transcendence in chapter six.

The God-question is a personal question. As personal, however, it is also a natural question. It is a question that is more than either intellectual or existential, taken separately. There are two distinct forms of questions that Peacocke sees as the ground for speaking about God: the search for intelligibility in the 'inference to best explanation' and the search for

personal meaning. Nevertheless, he admits that we cannot avoid merging the two searches into one. We proceed “by urging our questions about the cosmos in forms that include ourselves [...]”.⁶¹ While this reflection on the distinct searches for truth and meaning is brief, it leads to Peacocke’s metaphysical position. He terms this position “non-reductive emergentism.” His extended treatments of God, Christology and theological anthropology follow from this metaphysical position. Peacocke, however, does not argue for it as a metaphysical position. He does not argue for it as a logical extension of a critical position on knowledge. As such, his short chapter six, “Asking Why?: The Search for Intelligibility and Meaning,” is an important stage in his move from a view of knowledge and nature to a view of God. The bridge indicates an importance to the value of questions and the act of questioning.

As for the theological meaning of personhood, Peacocke stresses communication by and among persons, including God, who is supra-personal. Communication is a more specific result of intelligibility. It is the expression of top-down divine activity mirrored by our self-transcendence “upwards.”⁶² Given our dual understanding of hierarchies in nature, and of ourselves as self-transcendent, God’s transcendence as both within and beyond the world is affirmed. This is what Peacocke espouses as panentheism. This theological concept is not emphasized by Peacocke. However, it extends what is already the case in hierarchies of nature, a view that is itself made possible by critical realism. As such, panentheism is indirectly related to critical realism.

Theologically, Peacocke allows considerable leeway for further clarifications to amend his conceptually unified proposal. For example, he is anxious to stress God’s “general revelation” based on the Pauline theological impulse, expressed in Romans 1:19-20, that knowledge of God

is diffuse and available to all of humanity. This leads to his affirmation of the Holy Spirit in terms of divine communication and top-down causation. As a critical realist, Peacocke affirms both the individuality of religious experiences on the one hand, and the necessity of affirming a human “causal joint” between God and World on the other hand.

Peacocke is not satisfied with what he sees as a satisfaction on the part of theologians for merely affirming God’s action as analogically similar to ours. Peacocke argues for a realist interpretation of theology in order to affirm *how* God exercises influence through the multi-layered events in the world. This, in turn, suggests the need for a more adequate theory of human action (how the mind and body interact akin to top-down causation) in order to obtain a better theory of analogy to speak of God’s action. Peacocke ends his section on God with a broad consideration of models of God and divine action that might resemble such a solution in analogy.

However, his position does not explicitly arise from his critical realist position. Peacocke tentatively adopts a panentheist model of God’s relationship with the world. Yet, this is still a model, and as such, it does not expand his theological knowledge claim beyond what is already stated through his reflections on personhood and communication. By discussing models so positively however, Peacocke contrasts his position with the “two realm” or mutual independence image of science and theology. Theology is critical realist because of its aim is to “articulate [...] by means of metaphor and model, experiences of God [...]”⁶³ Consequently, for Peacocke, theology needs to pay attention to the critical realist perspectives available in the sciences about the world, including the human. However, is theology critically realist merely by proposing models in similarity to the sciences? Is it not possible to see theology’s models and forms of analogical knowledge as unique due to theology’s distinctly different object, namely

God?

In summary, Peacocke sees critical realism as a position that sustains scientific and theological claims better than instrumentalism, historicism or empiricism. However, it is not clear that critical realism is an insight that contains theological significance beyond strictly epistemological questions. As with Barbour's account of the notion, Peacocke's critical realism remains descriptive. Furthermore, there is no reason establishing his connection of critical realism with the God-World panentheistic model any more than Barbour's connection between critical realism and process thought is justified.

Both history and language remain areas for specific theological probing. This is more serious for Peacocke than it is for Barbour, given Peacocke's attempt to move beyond describing the possibility of doing theology to actually proposing a theological systematics. Hence, his final section on theological anthropology is devoted to a portrait of the human in this light. This is where his christological focus enters as a distinct mode of reflection among the three thinkers being examined here. Peacocke sees the life of Jesus as a life that fulfills the personal search for meaning by a radical confrontation and triumph over death.

So, how do we evaluate Peacocke's metaphysical and theological implications of critical realism? The theological reflections seem incongruous with the modest portrait of he provides of critical realism. Furthermore, christology seems an unlikely destination for Peacocke to reach, since natural theology has historically avoided references to christology. The connection that seems to bind Peacocke's different approaches is the quest for a unified worldview, the same quest that leads Barbour to embrace the category of process. Peacocke, however, does not emphasize the tentativeness of such a unity. Instead, he turns to the different disciplines that

positively express the levels of hierarchy.

A hierarchical image of disciplines and nature best characterizes the universe. At the apex of this hierarchy stands the human being in the natural hierarchy and the disciplines of human culture in the hierarchy of disciplines. He is more directly concerned with addressing theological problems raised by the natural sciences, biology and other specializations that are oriented around the human species. Barbour does not do this directly. For Peacocke, there is religious significance in the very notion of personhood, a microcosm of the multi-layered, hierarchically organized universe. The implication, though it is one not accentuated by Peacocke himself, is that critical realism permits such an explicitly theological project to go forward.

The widespread occurrence of communication among and between levels of reality, notably between nature, humans and God, is of paramount importance to Peacocke. This coheres with Peacocke's biological interests and his argument against reductionism. For nature, humans and God to be interrelated, his biological imagination is at work here in seeing a universal organism, a panentheist system, to take shape. But, Peacocke also provides a theological rationale for the possibility of revelation in harmony with a natural theology. What is unclear is whether Peacocke's account, with its christological climax, adequately coheres with the particularities of faith and revelation that lie beyond the reach of an overarching model. Does there need to be a further distinction made at the boundary of fact and meaning, between nature and history, between knowledge and divine revelation? Would this distinction threaten the unified system Peacocke proposes? Could critical realism help demarcate such an extension in this systematic theology?

The answer to these questions may lie in the very portrait of human existence that

Peacocke presents. The theological question is what portrait of human rationality gives us positive evidence to suppose that a divine creation of the world can be affirmed as theological knowledge? The key insight that Peacocke overlooks when he defines a theological version of critical realism is his claim concerning a basic twofold nature of human questioning. The limit of Peacocke's critical realism lies in his lack of attention to a truly definitive account of rationality as one basis for a more adequate theory of the God-World relationship. The possibility that theology, as a discipline, lies beyond the limits set by critical realism is established through Peacocke's very own reflections in chapter 6 concerning the basic twofold structure of questioning. It would be preferable, based on this reflection, going on an appreciation for the role of faith, that God's transcendence and theology's role in answering questions of meaning are connected. The question is: how is the connection between God and meaning a result of a critical realist position in knowledge, even with a basis in scientific rationality?

The fact that within the human domain, these various levels are interrelated, is testimony to the viability of a theological anthropology that understands both a unity and a teleology to human identity. Peacocke suggests that "the other" emerges within the human at the layer of culture, implying the distinctiveness of the transcendent dimension to human discourse and striving. This is clarified in terms of the transcendent nature of persons. Like other existing beings, we are greater than our constituent parts. Unlike other existing beings, our transcendence is not understood through recourse to a biological principle.

Peacocke's subsequent move from this discussion to a presentation of christology is a move that draws on previous theological strategies of articulating the God-question in terms of a christology-from-below.⁶⁴ This is reinforced by his belief that a weak version of the 'anthropic

principle' offers theology an ability to make sense of the questions of meaning which arise from within the realm of intelligibility.⁶⁵

In conclusion, Peacocke offers a systematic theology that can incorporate a christologically informed idea of God within the horizon of human understanding. His accent on the complementarity of knowing and known in his critical realist epistemology is described in relation to a knowledge of the world. However, his divergence from Barbour on a concept of God, and his tentativeness on the role of theoretical metaphysics is suggestive of the need for a more precise solution.

While Peacocke sees theology's function as *fides quarens intellectum*, there is a limit reached by arguing for theological knowledge strictly in terms of critical realism. Indeed, Peacocke's own citation of the questions of meaning for human persons is an indicator that theological knowledge claims go beyond the understanding of understanding. Peacocke's quest to incorporate revelation and self-transcendence within a theological synthesis or system needs further refinement. This would seem to be particularly necessary in terms of the life of faith and religious experience. Yet, perhaps there are also further clues about the limits of critical realism with respect to theology that arise in the very critical realist portrait of rationality and human knowing itself. Might we perhaps extend Barbour and Peacocke's adoption of critical realism against both positivist and historicist options as indicative of a profound intuition about the range and goals of human intentionality in general? Can we locate their obvious concern for unity in knowing as more intricately connected with this range of human intentionality? Perhaps by exploring the work of John Polkinghorne, these questions can be further demarcated.

1.4 John Polkinghorne: *The Faith of a Physicist*

For Polkinghorne, there is much more to be said in terms of a hard distinction between faith and rationality. This section will present Polkinghorne's accent on intelligibility as a basis for the goal of inquiry that he articulates as a critical realist framework for understanding knowledge. In contrast to Barbour and Peacocke, Polkinghorne downplays the role of theoretical constructs in scientific investigation and emphasizes the importance of models and metaphor in theology, thereby securing a contrast between the disciplines. The result is interdisciplinary consonance. Instead, Polkinghorne holds out much more hope for a theological metaphysic, as exemplified in the search for a causal joint linking Creator and creation. This is highly possible with the anthropic principle for example. This search is driven by the exigency to refashion the Creed and theological doctrines under the light of faith. As a result of this outlook, Polkinghorne's theologically oriented casting of critical realism is focussed on distinctions rather than unity in human rationality. We are therefore invited by the prospect of expanding critical realism to highlight specific distinctions as they pertain to the possibility of a longer term integration of the disciplines that is neither fideistic nor rationalistic.

John Polkinghorne's Gifford Lectures are entitled *The Faith of a Physicist*. His work is strikingly different from Peacocke and Barbour's Gifford lectures. First, there is an explicit appeal in Polkinghorne's work to the distinction between natural and revealed theology. Second, in contrast to Peacocke's attempt to describe revelation as general and to Barbour's guidance of revelation under a philosophical category, Polkinghorne returns to doctrine as a distinct theological form of knowledge. Polkinghorne offers an empirical reflection on the Creed. He attempts to articulate the plausible natural or scientific grounds that justify the kind of explanations found in the Creed, and by extension, doctrinal Christian theology. He explicitly

sets out to describe the contents of doctrinal theology as the unique hermeneutical context for theology. He is evidently wary of staying with the more general theological notions provided by Barbour and Peacocke.

In taking this significant step, Polkinghorne intimates that doctrinal theology and natural theology should be explicitly differentiated. He underlines this differentiation by departing from the style of earlier work. Earlier writings, and others since *The Faith of a Physicist* was published, conform much more to natural theology. It is essential to refer to these works by Polkinghorne in evaluating his overall position.⁶⁶ In light of his choice to reflect on the Creed in his Gifford lectures, Polkinghorne lays down a definitive challenge. He chooses to work within the parameters of revealed theology in a prestigious forum dedicated to natural theology.

Polkinghorne strongly implies that the arguments offered within the natural theology tradition are insufficient by themselves. For Barbour and Peacocke, the natural/revealed theology distinction does not determine their theological notions as it does for Polkinghorne. Complicating the issue is the fact that Polkinghorne labels revealed theology as systematic and natural theology as philosophical theology.⁶⁷

Where does critical realism fit into Polkinghorne's position? While Polkinghorne's position on the issue is not unfamiliar given what Barbour and Peacocke provide in terms of a historical sketch in the philosophy of science, the fact is that measuring Polkinghorne's theological position is more complex. For Polkinghorne, critical realism is understood in similar terms as it is for Peacocke. It is the breakthrough that justifies a renewal in theology given a cultural disillusionment with a purely natural account of reality. Critical realism integrates the act of knowing with the known in the affirmation of a unified worldview. Polkinghorne articulates

this view metaphysically as a “dual-aspect monism.” Knower and known are two aspects of a wider unity.

Before turning to Polkinghorne’s explicit theological orientation to critical realism. I will survey his understanding of critical realism in science. In a later book entitled *Scientists as Theologians*, Polkinghorne evaluates his contribution alongside Barbour and Peacocke’s. In it, Polkinghorne defines critical realism. Quoting Peacocke and McMullin, he notes:

“In practice, working scientists, I would argue, adopt a skeptical and qualified realism, according to which their theories and models are proposed and regarded as “candidates for reality””⁶⁸

He goes on, however, to clarify his own interpretation of critical realism in a highly significant passage: “I have added to my critical realism the suggestion that it is intelligibility that is the key to reality [...]”⁶⁹ But what is this intelligibility that is not included in Barbour and Peacocke’s definitions of critical realism? One indication comes from an earlier work *Reason and Reality*:

“[...] the critical realist believes the way things are will provide the necessary clue to how they are to be understood. Those who commit themselves to this trust in a rational cosmos are asserting intelligibility to be the key to reality.”⁷⁰

This affirmation coheres roughly with Barbour’s articulation of a correspondence theory of truth, an epistemological verisimilitude in arriving at ontological fact. But, Polkinghorne distances himself from naïve realism. Trust in a rational cosmos is not the same thing as a belief in certainty. After quoting from Ernan McMullin’s oft-cited article on scientific realism,⁷¹

Polkinghorne comments that rational inquiry is

“not characterized by an unwillingness to take intellectual risks, so that we cling to what is deductively certain, but to [...] venture on the construction of a metaphysical scheme whose justification will lie in its attainment of comprehensive explanatory power. The success of science should encourage us to take such a bet on the reasonableness of the world and commit ourselves to an openness of experience to being understood.”⁷²

Rational inquiry is meaningful and leads Polkinghorne to reject a deductive foundationalism in knowledge, while embracing a new kind of foundations expressed in the sheer confidence of reason and the human drive to make sense of our experience. He calls this concern a quest to identify and address the exigencies of “motivated belief.”⁷³ Later, Polkinghorne implies this attitude allies with Lonergan’s version of the cosmological argument for the existence of God.⁷⁴ He is thus open to metaphysical frameworks as unifying schemes. In this regard, Polkinghorne shows promise in being able to foresee a wider constructive meaning from critical realism without adopting a specific theoretical commitment as a result. He sees a purpose in ‘rational inquiry.’ Also, while he describes the possibility of an explicit metaphysical way of accounting for this, he does not offer a technical explanation for the different elements of intelligibility in relation to rationality.

He cites crucial differences between Barbour, Peacocke and himself on critical realism. Using and understanding models and metaphors are “undoubtedly influenced by our differing experiences of doing science.”⁷⁵ He notes, however, that Barbour and Peacocke endorse the role of models in scientific rationality as significant. They each cite the model as “symbolic representation,” “imaginative tool”, and a “state of affairs brought into a resemblance with another state of affairs.” Polkinghorne disagrees, since science and theology are different in the way they employ models. For him, models play a far more fundamental role in theology. Models are much less important in science. What the other two scientist theologians each miss, according to Polkinghorne, is the clear scientific intent to explain in practice. This is the *telos* of the model, and it goes beyond simply understanding and affirming the model’s analogical character, which Peacocke emphasizes.⁷⁶ Rather, as Polkinghorne notes, the really exciting aspect of scientific

practice concerns theory construction.

Another fascinating observation comes in the same chapter of *Scientists as Theologians* where Polkinghorne rejects the role that Barbour and Peacocke give to metaphor in scientific explanations. So far as Polkinghorne is concerned, models are frequently used, while metaphors are rarely used. When they are, scientists are using “picturesque shorthand for ideas that they can readily and more adequately convey in precise scientific language [...]”⁷⁷ The use of metaphors in science should therefore be downplayed. What is at work in Polkinghorne’s criticisms of Peacocke and Barbour here?

Polkinghorne contrasts his approach from the other two lecturers on epistemological questions. The definition of critical realism is definitely at stake. However, the underlying current in his critique seems to be on how truth is claimed. Polkinghorne seems to be searching for a way to sharpen the accent on cosmic intelligibility and the coherence of our rationality in the face of the general quest for unity that Barbour and Peacocke share. He seems to be aware that if the claim for unity is falsely argued, it may be imperilled.

Nevertheless, Polkinghorne turns away from epistemological considerations to focus on theology. He views the significant differences between the three thinkers in terms of theology. Polkinghorne articulates this contrast as follows:

“I believe that a main source of divergence between myself and Barbour and Peacocke will be found to lie in the degree to which one needs to pursue an assimilative strategy and the degree to which one can press the search for specific areas of consonance [...] As discussion has moved on from the periphery of contact between science and theology and come close to the heart of the latter’s concerns, divergences have begun to appear between us.”⁷⁸

In sum, Polkinghorne sees a greater role for theological tradition in defining the way in which

critical realism applies within theology. He notes “perhaps rather more than my scientist-theologian colleagues, I am anxious to locate our twentieth-century understandings within that development of Christian doctrine [...]”⁷⁹ Yet, he is also prepared to shed the one major element of classical theism that stresses God’s atemporality. He wants to stress God’s temporality instead. He makes this move in order to promote the doctrinal weight of christology and the incarnational aspects of God.⁸⁰

Polkinghorne’s theological anxiety stretches to include the way he practices interdisciplinary consonance. It is reflected in the way he treats the cosmological anthropic principle, for example. Alongside intelligibility, the anthropic principle is a frequently mentioned topic in science-theology discussions.⁸¹ Polkinghorne is willing to appropriate such scientific theories in order to revise natural theology, even though theories such as the anthropic principle are virtually unverifiable as scientific theories. However, there is considerable ambiguity in Polkinghorne’s thought on such issues. For example, Polkinghorne states elsewhere that the key to natural theology is simply:

“*insight*,...a way of looking at the totality of things which has coherence and intelligibility...not particular circumstances, but to law and circumstance which underlie all physical occurrences.”⁸²

The claim here is a cosmological one, a belief in an intelligibility that crosses disciplinary and boundaries of physical levels. Intelligibility defies reduction into one particular phenomenon or any metaphysical concept. However, Polkinghorne does not emphasize insight as the underlying manifold in the sciences and theology. Rather, he emphasizes consonance between the disciplines, based on this metaphysical fact.

How does Polkinghorne’s accent on critical realism become metaphysically reflected? He

states several times in various ways that “epistemology models ontology,”⁸³ but what does this really imply? Is there a way he captures the different elements of his critical realist outlook that can account for what this means? Polkinghorne does not deal with such metaphysical descriptions in *The Faith of a Physicist*. However, he elsewhere defends a view he terms “dual-aspect monism” following the lead of some philosophers of mind such as Thomas Nagel.⁸⁴

The theological importance of “dual-aspect monism” is apparent. It conceptualizes the possibility that God guides creation through both history (mind) and nature (matter).

Polkinghorne does not rule out divine action in and through matter as well as mind, through nature as well as history. He foresees the distinct possibility of “theological talk of the Spirit guiding and leading creation [...] cashed out within the flexibility of physical process” based on the current evidence for openness in quantum and chaotic systems.⁸⁵ Here, the metaphysical and the theological come together.

In fact, Polkinghorne has much to comment on theology as a critical realist discipline. In *Reason and Reality*, Polkinghorne describes his critical realism as:

“based on an analogy with science’s approach to exploring the way things are. Because it is realist, theology will want to retain an evidential appeal to Scripture as ground for belief. Because it is critical realism, theology will seek to respect the nature of the Reality it encounters.”⁸⁶

In acknowledging the Kuhnian revolution in the philosophy of science Polkinghorne indicates, like Barbour, that a theological critical realism is modeled on the scientific version. He goes on in another later text to claim the validity of the interpretive priority of knowledge. He notes that

“Intelligibility requires the adoption of a prior interpretive point of view in the effort to make sense of what is going on. Another reason our realism must be qualified as ‘critical’ lies in this need to don these theoretical spectacles in the attempt to perceive pattern in the flux of events. Neither in science nor in theology will we derive much insight from

simply staring at raw data.”⁸⁷

The question is what Polkinghorne means by an interpretive point of view? Does he mean it as a closed paradigm, in Thomas Kuhn’s theory of the structure of scientific knowledge? Or does he mean interpretive, in the sense of those theoretical constructs that make sense of the data? It is unclear, although Polkinghorne does disavow scientific historicism. Polkinghorne focuses on the notion of circularity in knowledge. Both hermeneutically and epistemologically, he sees a great deal of evidence for verisimilitude between the known and the knower. But he is lacking an explanatory theory to state why this is the case. This lack of detail on what constitutes the limits of an interpretive viewpoint of knowledge and its further theological significance is critical.

In evaluating Polkinghorne’s stance, one is impressed by the fact that Polkinghorne agrees with Barbour and Peacocke on critical realism.⁸⁸ As with Barbour and Peacocke, he claims it is transferable to theology. However, he then approaches theology as a discipline that requires significant modifications to clarify its uniqueness. He argues against what he sees as the deleterious consequences of theological generalization. Such generalization, he points out, can jeopardize the uniqueness of theology.⁸⁹ Nevertheless, Polkinghorne cites a critical realism operative in understanding the Holy Spirit and the Church, for example.⁹⁰ However, the problem with this way of structuring theological knowledge gives the impression that theology is actually similar to the other disciplines. What is ironic is that Polkinghorne presents theology’s dependence on faith as truly distinctive. The reader is left with conflicting interpretations of Polkinghorne’s position.

It is puzzling why Polkinghorne does not directly utilize the theology of creation as one theological prism through which to view the presence of intelligibility. This would be a logical

indicator of consonance to express the faith of a physicist. He offers only one chapter on creation in the Gifford lectures. In contrast, Barbour argues in greater detail for a view or theology of nature, as does Peacocke. But, Polkinghorne's theological realism refers primarily to the historical realization of God's will. The divine underwriting of realism owes its origins to God's original work: "God will not mislead us, either in the revelation of himself, or in the works of his Creation."⁹¹

While there is a legitimacy to this line of argument, it might be worth asking whether such a leap from the rationality of the cosmos to a confidence in the will of God is best carried out without a more elaborate mediation of revelation. Given the centrality of human rationality in critical realism, is there not an element of rationality that contains such a mediating importance? Perhaps the theological consequence of critical realism is that it is more than structurally transferable? Polkinghorne demonstrates some awareness of the fruitfulness of other theological explorations in analogy and imagination in all aspects of rationality. His citation of Keith Ward's "capacious understanding of rationality" is a glimpse of this.⁹²

The question of the Holy Spirit is an interesting issue that draws Polkinghorne's theological instincts to the foreground. In *The Faith of a Physicist*, Polkinghorne treats the Holy Spirit as a way to distinguish his contribution from Barbour and Peacocke's panentheism.⁹³ In holding out for a sharper distinction between Creator and creation, Polkinghorne seizes on a theological issue that supports a careful distinction between revelational and natural theology. He is reluctant to conceive the Holy Spirit as the mere presence and activity of general experience understood theologically. This is the way in which Polkinghorne wants to go beyond Peacocke's emphasis on top-down causation. For Polkinghorne, this perhaps neglects the role of bottom up

personal decision to participate in the life of God.

While there is no evidence of opposition between systematic and doctrinal theology in his writing, Polkinghorne suggests contradictory lines of thinking. As a result of the focus on doctrine however, *The Faith of a Physicist* lacks methodological reflections on science that characterize Barbour and Peacocke's lectures.⁹⁴ Polkinghorne wants to re-situate theology away from being an interpretive framework. He wants it to be an interpretive framework with its own data of religious experience that exists as a distinct data-theory level in human culture. So, with religious experience of the faith community, Polkinghorne re-introduces "bottom-up" causation within theology. For theology to affirm the top-down causation of divine action, there has to be a concomitant "bottom-up" theological intention that can positively anticipate divine presence. Here, he is deliberately choosing to emphasize a different metaphysical trajectory than Peacocke's top-down causation. This explains his choice to use the Creed as an interpretive framework with its basis in religious experience, broadly conceived. But, Polkinghorne also has in mind the needs of a revived natural theology: "If natural theology is to flourish again, it will require more input from the theological side."⁹⁵

Without grounding intelligibility in terms of insight, Polkinghorne allows for a limited metaphysical appreciation of dual-aspect monism. It is a view of science based on the assertion of a certain order inherent in the collection of insights without a reflecting on whether this claimed order can sustain itself in a theory or in light of the history of such claims. This is somewhat ironic, considering Polkinghorne's intention to persuade his readers of the theological implications of cosmic intelligibility. These implications are especially apparent in the indeterminism of chaotic systems in nature, according to Polkinghorne. We must not evade the

search for a “causal joint” between God and nature, between Creator and created. Furthermore, this causal joint may also exist partly through clues afforded by the ontological openness of quantum events. Thus, “God’s providential interaction is purely through the top-down input of information.”⁹⁶ Polkinghorne wants to reconcile such a general statement of providence with the kind of emphasis on christology and incarnation that is the hallmark of his Gifford lectures. The quest to see how this can be better understood seems warranted however. What is needed is a philosophical mediation to express both the complementarity and the nexus of the mental world with the material world in terms of the different questions and disciplines accounted for by critical realism.⁹⁷

If God is thus understood, what is the difference between critical realism in science from critical realism in theology? The difference, for Polkinghorne, has to do with the different grounds of experience or evidence: scientific experience is repeatable, religious experience is uniquely known in particular historical episodes. Each version of critical realism is nevertheless similar because both versions testify to a form of motivated belief. Polkinghorne raises the key reasons behind why religious motivation operates in theology to block an easy linkage between disciplinary structures. Again, this is ironic in light of what I have already stated with regard to Polkinghorne’s adoption of a similar notion of critical realism in science and theology: that the disciplines are unified by virtue of their similar structures.

Nevertheless, Polkinghorne also holds that theology is sufficiently distinct in its historical and faith-centered reflection that it cannot be simply tagged at one end of the spectrum of knowledge. Faith disrupts such a systematic account. Polkinghorne’s stress on religious and theological uniqueness also possesses an epistemic dimension. Theology possesses its own

rational grounds for making a knowledge claim:

“Metaphor is not intrinsic to scientific discourse, but it certainly is to theological discourse. The latter’s need to use finite language about the uncapturable infinity of the divine nature requires the indefinite open-endedness that metaphor affords, its poetic power to grant intuitive illumination.”⁹⁸

While this characterization of metaphor might require amending with respect to particular issues, I believe that Polkinghorne has identified something extremely important. While Barbour and Peacocke have contributed to supporting theology with the ability to make knowledge claims, they may have neglected to account for some basic differences between theology and the natural sciences. Polkinghorne’s embrace of faith is evidence of his unique emphasis.

Polkinghorne goes farther than Peacocke in the sense of explicitly stressing the inevitability of a metaphysical view. He believes that Peacocke is too hesitant when it comes to acknowledging the presence of metaphysical insights. This point is valid. Peacocke’s reserved way of discussing panentheism shows how he is reluctant to follow through on his own portrait. Polkinghorne’s lack of reserve on the other hand, is strikingly different. Yet, Polkinghorne’s dual-aspect monism seems too descriptive and inadequately defended to account for the complexities of intelligibility and rationality. He sees dual-aspect monism as a “metaphysic in which mind and matter are complementary aspects of one ‘world-stuff’, perceived in the different phases of the material and the mental.”⁹⁹ Yet, this remains a descriptive account of metaphysics. It mirrors and repeats Polkinghorne’s frequently made statement that epistemology and ontology model one another. If epistemology does model ontology, we would need an adequate way to affirm the elements of this model based on the evidence for this view in the history of science and scientific rationality. As such, this saying does not comprise a theory of knowledge.

Polkinghorne's depiction of critical realism both coheres with previous usage, as well as corrects an over-systematized and structurally focused account of knowledge. There is a legitimacy to Polkinghorne's protests against the conception of science and theology as epistemologically equivalent, although he does advocate their epistemological parallels. However, similar to the question raised with respect to Peacocke's work, there is still a lack of connection between Polkinghorne's definition of critical realism with both the *telos* of human inquiry he emphasizes, and the differentiated knowledge of a transcendent God that is reflected as a claim of knowledge in theological critical realism.

The chief ramification of Polkinghorne's contribution is still the character of human rationality. Is it yet possible to carve out a portrait of human rationality starting from the way in which we understand nature that could yield a better understanding on the place of faith and revelation? As Polkinghorne states it, faith is a stance of hope that stands in contrast to human rationality. The intelligibility of the universe meets a limit that is undefined at the level of human rationality. In short, there are still several avenues available to draw out the unity that each Gifford lecturer seeks as a result of their respective insights into critical realism.

1.5 Conclusion

One philosopher in particular holds important keys to answering this question on rationality and theological knowledge claims. Eran McMullin is a philosopher who has written extensively on the various dimensions of scientific rationality, the history of science and the issue of realism. At the heart of his contribution is an operative distinction between scientific and critical realism. He combines this insight, among others, with a keen theological sense of meaning. Moreover, he has incorporated science and cosmology into his philosophical reflections

on human rationality, including those questions that touch on the question of God. McMullin's writings cover the underlying nature of the dialectic in the philosophy of science, from Ptolemy and Aristotle to the modern realist and non-realist positions with a contemporary understanding of rationality worked out in dialogue with both theology and recent scientific discoveries.

Partly owing to the fact that each of these three Gifford lecturers rely on Ernan McMullin, the next chapter will develop further McMullin's definition of science and scientific rationality. His more foundational account is a necessary step to retrieve a shared basis for a philosophical framework in the science-theology dialogue. In short, such a differentiated analysis might help frame a more theologically judicious approach to how the connection between rationality, critical realism and theological reflection is specified. Indeed, McMullin has worked out a theory of scientific rationality that opens up a profound resources for metaphysical and theological reflection.

What emerges from this analysis of the three scientist-theologians is a mixed picture of the philosophical and theological scope of the critical realism. Their penchant to describe critical realism opens its meaning to further development. But, as indicated earlier, the rejection of critical realism by other science-theology dialogue thinkers may amount to a rejection of a term that has been ambiguously and insufficiently developed. This is particularly the case with respect to theology. Critical realism has yet to be fully transposed from an explanatory context in the philosophy of science into an interdisciplinary setting suitable for the science-theology dialogue.

What needs to be done is to better account for critical realism. This account would take up the quest for unity in knowledge expressed by each lecturer as in:

a) Barbour's identification of critical realism as key to science-theology rapprochement

through the process metaphysic,

b) Peacocke's insight that critical realism implies a hierarchy of levels of nature and disciplines with human reality as a distinct microcosm of the universe into which personal self-transcendence is real and the basis for systematically establishing a God-World relation and

c) Polkinghorne's judgement that the act of human understanding is the most significant feature of critical realism in a context where human inquiry possesses a *telos* and where a revealed faith in a God who transcends the universe can be apprehended in roughly critical realist terms. For Polkinghorne, we need to move beyond an understanding of critical realism where theology is allowed to operate to one in which theological knowledge claims are indirectly confirmed by their interdisciplinary investigations.

A renewed critical realism would go beyond simply describing the achievement of knowledge as a *via media* between subject/object, nature/history and mind/matter. It would account for the act of knowing as accounted for in terms of a theory of knowing in the history of our exercising rationality itself. It would also go beyond a dialectical metaphysic that sees knowing and known in some kind of opposition. With the thought of Ernan McMullin, this very possibility exists, starting from the way in which he analyses how realism has overcome positivism and historicism in science. This continues in McMullin's deft handling of the distinctive role religious faith plays in the act of self-understanding.

There are two central questions that can be brought to bear on the inadequacies of critical realism discussed thus far. These questions will guide the analysis in the rest of this study:

1) Is there an explanatory theory of scientific knowledge that accounts for human rationality and the historical trajectories of science in the fullest possible way while providing a

heuristic for an integrated metaphysical worldview?

2) What elements of this account of critical realism can reconstruct how theological knowledge claims operate, given the way human rationality understands scientifically, and does this apply to God?

The first question regards critical realism as an insight from the philosophy of science, and it is taken up with regard to three issues: scientific realism, scientific history and cosmology. These three issues are treated in chapters two, three and four. The second question concerns to what degree it contributes to theological method. This question is treated in chapters five and six respectively. Chapter five highlights the distinctiveness of theological inquiry that emerges directly from the portrait of critical realism in chapters two, three and four. Chapter six addresses what becomes integrated in a critical realist worldview, given the differentiations in knowledge that are present in a renewed critical realism.

Clearly, these three figures have been singularly able to wrest back a capacity to make knowledge claims for theology in the aftermath of scientific positivism. But is knowledge merely epistemologically similar? Is there something more basic in the act of knowing that is distinct to one discipline or the other? As this study will show, imagination and consonance are key indicators of what conclusions may be drawn from the development of a critical realist framework.

The next four chapters will deal with material provided in the lifetime work of philosopher Ernan McMullin. As mentioned earlier, Barbour, Peacocke and Polkinghorne each cite Ernan McMullin in their defence of critical realism. His thought, however, has not been incorporated in any detail into their respective definitions. What is more significant is that each

citation of McMullin draws on his definition of scientific realism, not critical realism. This indicates that an understanding of critical realism may lie in McMullin's work in the area of the philosophy of science. Because McMullin deals mostly with scientific realism, the notion of critical realism he employs needs developing as the result of an exercise in summary and interpretation. This is an analysis that is germane to both the definition of critical realism itself, and the internal dynamics of McMullin's work.

Endnotes

1. Yet, the understanding of God as redeemer of humanity stands as a contrasting approach outside the parameters of this traditional approach. This approach is closely associated with questions of evil, sin and the theology of revelation. The focus of the science-theology dialogue may shift in the future as new studies in neuro-biology, psychology and theological anthropology develop in response to the rise of socio-biology. When this takes place however, it will have to contend with the key methodological issues that have also surfaced. See, for instance, the recently published book by James B. Ashbrook and Carol Rausch Albright entitled *The Humanizing Brain: Where Religion and Neuroscience Meet* (Cleveland: Pilgrim Press, 1997).

2. As Polkinghorne summarizes it, these lectures are intended to reflect on the natural knowledge of God "by those who aspire to be 'sincere lovers of and earnest inquirers after truth'." See *The Faith of a Physicist*, p. 1. A list of recent lecturers treating religion-science issues include Ian Barbour (1989-90, 1990-91), Arthur Peacocke (1993-94), John Polkinghorne (1994), Stanley Jaki (1974-75, 1975-76), Peter Jones (1995), Mary Midgley (1989-90), and Seyyed Hossein Nasr (1980-81). Other historically notable lectures on the same theme are A.N. Whitehead's 1927-28 lectures published as *Process and Reality: An Essay in Cosmology* (Cambridge: Cambridge University Press, 1929) and Carl Friedrich von Weizsäcker's 1959-60 lectures published as *The Relevance of Science: Creation and Cosmogony* (New York: Harper and Row, 1964). In his introduction to a history of the Lectures, Stanley Jaki writes: "In a world increasingly bogged down in technological pursuits and at a loss to cope with problems - psychological, social, moral, and ideological - they create, no academic organ has kept so alive some higher perspectives as have the lectureships which Lord decided to establish a hundred years ago." See Jaki, *Lord Gifford and his lectures: a centenary retrospect* (Edinburgh: Scottish Academic Press, 1986), p. 1. Given the wide scope of the science-theology exchanges, it is fitting that this prominent series might be a helpful way to build bridges, not only between disciplines, but also between the academy and culture.

3. It is true that Polkinghorne's decision is not absolutely unique in terms of the history of the Lectures. Jaki assesses Barth's 1936-37/37-38 lectures as follows: "In charging both Luther and Calvin with disloyalty to the spirit of Reformation on account of their occasional recourse to natural theology, Barth merely served witness to the reluctance of Christian theologians to cut their moorings from reason, for fear of undercutting their very credibility. Barth was certainly alone among Christian lecturers in inveighing against natural theology." See Jaki, *Lord Gifford and his Lectures: A Centenary Retrospect* (Edinburgh: Scottish Academic Press, 1995), p. 59. Nevertheless, Polkinghorne's decision does not amount to a disavowal of natural theology in the manner that Barth articulated it, but rather an evaluation of a *strictly* "natural" theological approach to questions of faith and science from the standpoint of revealed or creedal theology.

4. Such critiques include the following: Nancey Murphy, "From Critical Realism to a Methodological Approach: Response to Robbins, van Huyssteen and Hefner" in *Zygon* 23, n.3 (1988), pp.287-90. See also the contributions in *Rethinking Theology and Science: Six Models for the Dialogue* ed. Niels Henrik Gregersen and J. Wentzel van Huyssteen (Eerdmans, 1998).

5. By a framework, one can follow Yves Congar's judicious theological definition, taken from his appraisal of early patristic systematics: a "propaedeutic [...] philosophy and the human sciences in relation to the contemplative activity of the believer." See Congar, *The History of Theology* trans. by Hunter Guthrie, SJ (Garden City, NY: Doubleday, 1968), p. 41.

6. I am mindful of the historical background that is essential to grappling with theology's identity. In terms of how theology is understood *vis à vis* the natural sciences and philosophy, Wolfhart Pannenberg's *Theology and the Philosophy of Science* (London: DLT, 1976) is an excellent overview and insightful diagnosis of the situation. See especially Part One "Theology Between the Unity and Multiplicity of the Sciences", and particularly chapter 1 "From Positivism to Critical Rationalism" for a summary of the most relevant figures and issues in determining the current status of theology as a discipline. My study here tackles similar material as Pannenberg's work. However,

this study deals with the more limited subject of theological knowledge in light of the proposed epistemological position of critical realism. Pannenberg, in contrast, is concerned with wider issues involved in the structure of all scientific disciplines, theology included.

7. (New York: HarperSanFrancisco, 1997). The first edition was published as *Religion In An Age of Science: The Gifford Lectures vol. 1* 1989-90 (New York: HarperCollins, 1990). Other lectures tend to be more specifically thematic. For examples, see Stanley Jaki, *The Road of Science and the Ways to God* (Chicago: University of Chicago Press, 1978) and Holmes Rolston, *Genes, Genesis and God: Values and Their Origins in Natural and Human History* (Cambridge: Cambridge University press, 1999).

8. The *Center for Theology and the Natural Sciences* has found Barbour's work to be the most popular text in college and university courses on religion and sciences, through an informal survey. This citation is electronically published at: <www.ctns.org/>.

9. Ian Barbour, *Religion and Science: Historical and Contemporary Issues* (Harper SanFrancisco, 1997), Part 2, chapter 4: pp. 77-105. (I will cite the 1997 version of the published lectures unless stated otherwise.)

10. (Chicago: University of Chicago Press, 1978) 3rd. ed. Cited in Barbour *passim*.

11. (Chicago: University of Chicago press, 1958). Cited in Barbour (1997) *passim*.

12. See *Religion and Science*, pp. 130-34.

13. (London: SCM Press, 1966).

14. The first historical section of the book has been added to the second edition of the lectures. This perhaps indicates that Barbour saw a need to place his discussion of methodologies in science and religion in a concrete context.

15. Ian Barbour, *Issues in Science and Religion* (Englewood Cliffs, NJ: Prentice-Hall, 1966), pp. 172-73.

16. *Religion and Science*, p.89.

17. *Religion and Science*, p. 110.

18. *Religion and Science*, pp. 109-110.

19. *Issues in Science and Religion* , p. 168

20. *Religion and Science*, pp. 106-113.

21. pp. 115-130.

22. *Religion and Science* , p. 117.

23. *Issues in Science and Religion* , p. 137. (p. 66)

24. *Religion and Science*, p. 130. The reliance on Kuhn's historical interpretation of the philosophy of science is made fairly explicitly, as in the section on paradigms in science and religion specifically (pp. 122-29; 51-58).
25. *Religion and Science*, p. 120.
26. *Religion and Science*, pp. 117, 121-23, 169 and on p. 170 where Barbour nuances his approval more firmly by offering several "conditions for applying the concept of complementarity."
27. *Religion and Science*, p. 135.
28. *ibid.* p. 136.
29. *ibid.* p. 136 and p. 157.
30. *Religion and Science*, pp. 106-113. Cf. *Myths, Models and Paradigms: The Nature of Scientific and Religious Language* (London: SCM Press, 1974), pp. 34-38 and *Issues in Science and Religion*, pp. 137-174, which is the chapter entitled "The Methods of Science". Although this chapter appears mid-way through the book, it follows a historical survey, in which no programmatic arguments are advanced.
31. cf. Barbour's connection of various points of dispute in science-religion discourse in *Religion in an Age of Science*, pp. 152, 185, 218-42, 260-70. It is significant that Barbour qualifies his adoption of a process framework in the science-religion dialogue in three ways. First, he distinguishes between process thought in general and the system that Whitehead developed (p. 263). Second, he subjects process thought to the possibility of an evaluation according to the criteria of critically realist knowledge in science (pp. 265-67), although this possibility is outlined very briefly. Third, Barbour places process thought into the context of dialectics in theological method, eventually allowing that as a *model*, it offers "fewer weaknesses" than the models of neo-Thomism, kenoticism, monarchical theology, existentialism, etc. What he assumes, and what I will take up in chapter five, is the idea that models of the God-World relationship speak of *one* similarly to the way models operate heuristically in science.
32. *Religion and Science*, pp. 285-286.
33. *Religion and Science*, p. 220. Barbour makes this point in the chapter on astronomy and creation.
34. *Religion and Science*, pp. 331-32.
35. *Religion and Science*, p. 117, 121.
36. This is generally what scholars ascribe to Kuhn, though I would hastily add that he apparently rejected the relativism in the philosophy of science that flourished in his wake. See an analysis of the ambiguity in Kuhn's work in Ernan McMullin, "The rational and the social in the history of science" in Brown, J. R., ed. *Scientific Rationality: The Sociological Turn* (Dordrecht: Reidel), pp. 127-63 and "The shaping of scientific rationality" in McMullin, ed. *Construction and Constraint: The Shaping of Scientific Rationality* (Notre Dame: University of Notre Dame Press), pp. 1-47.
37. *Religion and Science*, p. 119.
38. See the discussion in chapter six on how this issue forms the crux of a debate between Ernan McMullin and Arthur Peacocke.

39. *ibid.* p. 169.

35. As Nancey Murphy has commented on Barbour's work, it is "encyclopaedic" in style. See Murphy, "Ian Barbour on Religion and the Methods of Science: An Assessment" in *Zygon* vol. 31, n.1 (1996), p. 12. She adds "Ian tends to canvass a topic thoroughly, treating all of its related aspects and surveying the range of positions on each issue before setting forth his own views."

41. (Notre Dame, IN.: University of Notre Dame Press, 1984).

42. (Oxford: Clarendon Press, 1979).

43. *ibid.* p. 22-23.

44. *ibid.*

45. *ibid.* p. 44.

46. See *Theology for a Scientific Age*, p. 21 and *God and Science: A Quest for Christian Credibility* (London: SPCK, 1996), p. 5.

47. *ibid.* p. 19.

48. Cf. *Theology for a Scientific Age*, p. 12 and *Intimations of Reality*, p. 24. The quote is from McMullin's oft-cited article "A Case for Scientific Realism" in Leplin, *Scientific Realism*, p. 26. Peacocke mentions McMullin's contribution as being "a formidable case for...a critical scientific realism...based on the histories of, for example, geology, cell biology and chemistry..." See Peacocke, *God and Science: A Quest for Christian Credibility* (London: SPCK, 1996), p. 5.

49. Cf. *Theology for a Scientific Age*, p. 13

50. *ibid.*

51. *Theology for a Scientific Age*, p. 214

52. *Theology for a Scientific Age*, chapter 12. These four levels comprise what Peacocke believes are the scientific discovery of the 'natural' basis of human being in the world.

53. *ibid.* p. 34.

54. *ibid.* p. 39.

55. *ibid.* p. 54.

56. *ibid.* pp. 53-54.

57. *ibid.* p. 54.

58. "[...] this thread of intentionality and purpose which runs through a self-conscious human life becomes increasingly coloured by awareness of the inevitable termination of its continuity in death." (ibid, p. 75)
59. "What [is] uniquely characteristic of human beings is their ability as 'subjects' to treat the content of consciousness as putative 'objects,' that is, to be self-aware." p. 74.
60. ibid.
61. ibid. p. 89.
62. *Theology for a Scientific Age*, p. 191ff.
63. ibid. p. 21.
64. See his discussion of organic, monarchial and aesthetic models of divine creation in *Theology for a Scientific Age*, pp. 166-70. I would note the strong similarities between Peacocke's endeavors made from the vantage point of the natural sciences with one of the most prominent theological projects undertaken by Karl Rahner, namely the suggestion that human freedom and anthropology implies the question of transcendence.
65. ibid, pp. 106-112. I will return to the issue of the anthropic principle in chapter four.
66. Christology, in particular, is developed with the classic statements more in mind than any one particular anthropological insight that might be derived from modern scientific research. Cf. *The Faith of A Physicist*, chapters 5.6 and 7.
67. See *Scientists as Theologians*, p. 12.
68. He quotes from Peacocke's *Intimations of Reality*, p. 25.
69. See *Scientists as Theologians*, p. 14, *Science and Creation*, p. 32 and *Reason and Reality*, p. 11. In *Science and Creation*, Polkinghorne explicitly acknowledges his debt for this view to Bernard Lonergan, on whom he relies for a theory of judgment that underlies his belief in intelligibility.
70. *Reason and Reality*, p. 11.
71. "A Case for Scientific Realism" in J. Leplin, ed. *Scientific Realism* (Berkeley: Univ. of California Press, 1984).
72. *Reason and Reality*, p. 11.
73. See *Scientists as Theologians*, passim.
74. ibid. Cf. Lonergan's *Insight*, especially chapters. 19 and 20.
75. ibid, p. 22.
76. *Scientists as Theologians* (London: SPCK, 1996), p. 19.
77. ibid. p. 20.

78. *ibid.* p. 8.

79. *ibid.* p. 17.

80. *Belief in God in an Age of Science*, p. 70.

81. Cf. *The Faith of a Physicist*, p. 192, "A Received Natural Theology" in Fennema, Jan and Paul, Iain, eds. *Science and religion: One world- changing perspectives on reality* (Dordrecht: Kluwer Academic Publishers, 1990), p. 89. Cf. *Reason and Reality* (Philadelphia: Trinity Press International, 1991), pp. 76-78.

82. See John Polkinghorne, "A Received Natural Theology" in Jan Fennema and Iain Paul, eds., *Science and Religion*, p. 89.

83. *Scientists as Theologians*, p. 14.

84. See *Reason and Reality* and *Science and Providence*, *passim*.

85. *ibid.* p. 37.

86. Polkinghorne, *Reason and Reality* (Philadelphia: Trinity Press International, 1991), p. 69.

87. *Scientists as Theologians*, p. 15.

88. *Scientists as Theologians*, p. 14.

89. *The Faith of a Physicist*, p. 4.

90. Other examples include Polkinghorne's use of the term "bottom-up" thinking in trinitarian theology in *The Faith of a Physicist*, p. 154 and on p. 156, where he says that realism in a theological perspective is "divinely underwritten."

91. *ibid.* p. 156.

92. *ibid.* pp. 40-41: Ward notes that rationality in theology can operate with the "highest use of philosophical reason in the conceiving and application of a new organizing idea, or a new interpretation of an existing idea, which enables one to build up a new, more comprehensive scheme for understanding the world [...]" Polkinghorne takes this as sufficient reason for revaluing the older proofs for the existence of God.

93. *ibid.* p. 151.

94. In fact, as one reviewer has commented, there is little content in Polkinghorne's *The Faith of A Physicist* that deals with religion and science. (See James F. Moore, "How Religious Tradition Survives in the World of Science: John Polkinghorne and Norbert Samuelson" in *Zygon* 32, 1 (Mar., 1997), pp. 115-24. In *Faith of a Physicist*, science is explicitly mentioned in a short section in chapter two concerning scientific realism, and sporadically elsewhere as a form of knowledge.

95. *ibid.* p. 44.

96. Polkinghorne, *Belief in God in an Age of Science* (New Haven: Yale University Press, 1998), pp. 71-72.

97. See *Science and Creation*, pp. 76-7.

98. *ibid.*

99. *Scientists as Theologians*, p. 29.

Chapter Two: McMullin's Scientific Realism and the Theory of Retroduction

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2.1 Introduction

In chapter one, the term critical realism has been introduced as an epistemological theory of knowledge employed by three scientist-theologians. Barbour, Peacocke and Polkinghorne each propose their epistemological viewpoints as interdisciplinary positions that capture, in their own ways, a *via media* between the contingencies of the historical subject and a universal intelligibility of scientific rationality. However, on the link between rationality and critical realism in theology, there are substantial differences of opinion. The process metaphysical theology of Barbour, the personal panentheism of Peacocke and the revelation theism of Polkinghorne are real differences that indicate a diversity of theological positions that exist alongside a shared position on knowledge in the sciences. While they wager their theological positions on an account of existence generally, the theological claims are widely divergent. At the same time, this diversity reflects the need to bolster an account of critical realism. A more adequate account of critical realism could yield a common account of theological knowledge claims, just as it has for a scientifically coherent understanding of existence.

So, by virtue of the diversity of their positions on God and the God-world relationship, critical realism needs to contain a sharper identity so that theological knowledge claims can be understood as rational, not a short circuiting of human rationality. With critical realism defined with the assistance of the Gifford lecturers, there is an urgent need to expand its meaning. Given that Barbour, Peacocke and Polkinghorne allow for a theological form of critical realism, there is a serious problem between their agreement on critical realism on the one hand and their chosen strategies for shedding light on a natural knowledge of God on the other hand.

Left alone, this influential set of lectures may leave the impression that the science-

theology dialogue cannot contribute toward an understanding of human rationality that is both oriented to a scientific understanding of the world while positively open to the question of God. As they stand, these natural theologies in dialogue with the natural sciences provide only a descriptive account of their epistemological perspectives and their metaphysical or theological judgments. As a result, each account of critical realism falls short of explaining human self-understanding in light of our understanding of the world. Failing an explanatory theory of scientific rationality which treats the human dimension with integrity, we will not have the ability to make claims about God from our understanding of nature and existence.

2.2.1 Realism: Why is it a Theological Issue?

Realism is a philosophical position that identifies the terms and relations for affirming the existence of this universe. This determination of existence is fundamentally an ontological style of philosophy where the object of inquiry is “Being”, a conceptual term that usually pertains to the proportionate universe. The issue that needs to be resolved is how a theory of knowledge is able to account for both orienting poles of knowledge, the act of knowing and the known, without reducing the significance of either pole.

Select writings from McMullin’s corpus have been chosen in order to develop a cluster of insights that will re-structure a critical realist philosophical framework for the science-theology dialogue.¹ But, laying out a new interpretation of critical realism requires stages of reflection that steps away from the descriptive accounts offered by the Gifford lecturers in order to settle the more foundational issue of rationality.

The general philosophical tools used by the Gifford Lecturers are concepts and understandings that intend to harmonize theology and the natural sciences by affirming the

epistemological parallels in each discipline. The intent of their efforts is beneficial for the *rapprochement* among the disciplines. However, much more needs to be developed in terms of what comprises human rationality in affirming existence. The Gifford lecturers, as we have seen, each defend a view of reality in broadly realist terms. However, their discussion of realism does not answer the fundamental question: is a critical realist knowledge of existence the result of an inquiry into scientific inquiry itself? Or is it merely adopted to counter metaphysical positions like naïve realism or relativism?

It is true that the Gifford lecturers want to recover a wider meaning from science's ability to account for existence as a whole. This recovery of meaning consists, first of all, in affirming existence by answering the question of how any discipline can affirm anything at all. In a recent essay on how philosophy mediates the natural sciences and theology, Jean Ladrière puts the issue of existence at the center of interdisciplinary concern in the aftermath of the Cartesian "turn to the subject":

"As relation to itself, experience is the existence as such, that way of being real which consists in being oneself while always transcending oneself, in the movement of unceasing overcoming in which existence aims at something like the truth of itself. Existence, considered in that perspective of coming to itself, in the form of a radical question with respect to its own being, and correlatively in the feeling of a radical responsibility toward itself, is destiny."²

He goes on to link this question of the "destiny" of existence with self-understanding as an interdisciplinary exercise:

"What philosophy, as mediation between science and theology, can suggest [...] is that the appropriate place for an effective encounter between them is existence, understood as the mode of being which is characteristic of human reality and viewed as the concrete carrier of the life of sense. Both science and theology contribute to the self-understanding by which existence becomes aware of its significance."³

The problem that has emerged at the heart of the science-theology dialogue is whether or not it is possible to speak confidently about the meaning and reality of existence. The alternatives are the adoption of historicist, instrumentalist or relativist frameworks for interpreting science. It is often assumed by adherents to these alternatives that since the natural sciences are moving toward greater specialization and incomprehensibility, perhaps existence is fractured and fundamentally disparate. In attempting to speak about existence, there are several possible strategies available. The common element in the alternatives to affirming existence is a basic anti-realism. On the question of an adequate philosophy of language about existence, much work has been carried out in hermeneutical philosophy. However, this study takes its starting point from within the philosophy of science and the debates that deal with realism.⁴

The question for those who reflect on science is whether or not natural entities are explained by scientific methods in a way that discloses their real existence. If natural entities are not real, then a unity and a coherence of existence is lost, resulting in a loss of common ground for science and natural theology. Without an affirmation of real entities and the affirmation of existence as a whole, meaningful dialogue becomes impossible. It is on this basic question that the Gifford lecturers wager their theological and metaphysical links to the natural sciences. This is why this study begins with the apparently non-theological issue of existence. This point of departure is also extremely cognizant of the variety of postmodern philosophical critiques of science and religion that take issue with the supposed hegemony that discussion of existence implies. Science-theology dialogue must grapple with the perception that a concern with existence has been associated with zealous attempts to overstate the meaning of unity and generalized universal claims.

However, existence and reality are not irredeemably biased concerns in philosophy. Just the opposite case can be forcefully made. It can be made if we clarify how a realist affirmation of existence takes into consideration the history of scientific claims in some way. This clarification hinges on whether or not critical realism accounts for the act of knowing and the affirmation of existence. We would then have a vantage point for evaluating the critical realism of the Gifford lecturers, particularly as it pertains to theology.

2.2.2 Realism in the Science-Theology Dialogue

In the introduction to her recent work *Anglo-American Postmodernity: Philosophical Perspectives on Science, Religion and Ethics*, Nancey Murphy critiques critical realism:

“[...] the most prominent debate in current philosophy of science concerns scientific (critical) realism. This is exactly the sort of issue we should expect to draw fire since scientific realism is an attempt to salvage the referential/representative theory of language and its close kin, the correspondence theory of truth.”⁵

This quote concerns the range of meaning contained in the use of the term critical realism. The problems of language and correspondence that Murphy identifies seem to be associated with a particular traditional form of realism. This study, however, intends to show how Ernan McMullin defends a realist position without recourse to a crude correspondence theory or a naïve theory of language. This task can be successfully demonstrated with reference to the history of science and a philosophical reading of that historical experience.

This inquiry begins with how McMullin takes us back to a critique of neo-Aristotelian philosophies of science. In this respect, he differs from many scientific realists. But, Murphy's evaluation does not appear to account for this kind of alternative version of critical or scientific realism. Her description of realism makes scientific and critical realism equivalent. This is a key

problematic assumption. It is present throughout the science-theology dialogue.

The lack of a distinction between scientific realism and critical realism needs to be carefully identified. At times, the terms are used interchangeably, even by McMullin himself. Yet, with McMullin, a conscious distinction is operative between them, because he restricts his work in the philosophy of science to speaking about scientific realism, while he tends to restrict his use of the term “critical realism” to his treatment of issues in the science-religion dialogue. This difference in usage according to the question at stake is a clue to a crucial difference between a realist affirmation of scientific data and a realist affirmation of the truth of the universe as existence. A confusion between the two leads to profound difficulties, especially when it becomes possible to construct meaningful implications on the basis of one or the other. The highlighting of actual historical testimony justifies McMullin’s distinction between scientific and critical realism. Furthermore, a deeper appreciation of critical realism is not possible without a clear understanding of how scientific realism operates in profoundly rational and historical terms. On both these counts, McMullin offers a theory that takes up these issues at the level of a theory of knowledge.

Murphy’s frustration contains some validity. It results from the perception that critical realism tends to mean all things to all people. It has been given a privileged epistemological status while remaining bound to descriptive interpretations. Both the Gifford lecturers and their detractors seem to assume that critical realism has a univocal, descriptive meaning.⁶ As we shall see from McMullin’s working out of a theory of scientific rationality, Murphy’s skepticism is confirmed by “anti-realist” philosophers. But, McMullin develops another definition of realism, and this is where I begin in this chapter.

First, however, a clarification is necessary. The task of specifying the meaning of critical realism requires the identification of two basic notions. The terms “critical” and “realism” are distinct “subjective” and “objective” poles in a general theory of knowing or epistemology. The word ‘critical’ identifies the modern understanding of the complex, historically situated construction of knowledge by the human subject. It directs our attention to the collaborative and tentative claims to truth and meaning since Descartes. The critical component of this philosophical perspective denotes the entire post-Cartesian ‘turn to the subject’ in philosophical reflection and in the human sciences. This is what was referred to by Jean Ladrière in his emphasis on the experience of existence in a mediating phenomenological philosophy. In addition, it implies the significance of the contingent historical components of knowledge, as well as the emergence of hermeneutics and phenomenology underlying this philosophical shift.

Based on McMullin’s work, it is insufficient to settle for the belief that realism is the best option available from within the philosophy of science in a religious interpretation of reality. What is needed is an investigation into the question “what is critical realism?” How and why is critical realism the best alternative? The reason for pursuing this epistemological question, as I have stated already, is not merely to probe the meaning of critical realism in the field of the philosophy of science, but rather to ascertain the scientific understanding of the world such that questions regarding God and meaning arise.

The task at hand is to go beyond agreeing that critical realism is the best option available in favour of an inquiry to how the operations and results of scientific process lead to a more fruitful understanding of the world as a reality, and a sharp understanding of the limits of science. The world, as scientifically understood, is further known by wisdom derived from the disciplines

of philosophy and theology.

The question “what is critical realism?” means asking how questions and concerns in science lead to knowledge. The aim is to investigate how that knowledge as knowledge of the world also indicates possibilities of religious meaning expressed in theology. Understanding critical realism implies a recognition of the import of scientific practice, as it becomes a part of natural theology’s own probing of the world for clues about religious meaning and, ultimately, God. Before engaging McMullin’s work in the realist debate however, it is first necessary to clarify McMullin’s specific location as a philosopher in these debates.

2.3 Ernan McMullin

Many within the philosophy of science have gained an appreciation for McMullin’s unique admixture of philosophical traditions in his work. He has shown an ability to incorporate a variety of schools of thought into his approach including, most notably, the Thomist appropriation of neo-Aristotelianism, and the pragmatic philosophy of Charles Peirce. His accomplishments in the philosophy of science have earned him two books published in his honour.⁷ In terms of evaluating what positions McMullin opposes, this judgment is not easy to render. He eschews the relativism of Feyerabend and the historicism of Thomas Kuhn yet, as we shall see, with considerable interpretive nuance.

One example of the complexity of McMullin’s philosophical nuances is his reading during the late 1950’s of Bernard Lonergan. In a review of Lonergan’s *Insight*, McMullin takes the position that Lonergan’s metaphysical realism is indebted to the Kantian tradition, even though the section of *Insight* McMullin reviews deals with the profoundly *a posteriori* considerations arising from the act of understanding in scientific investigations in the first five

chapters of *Insight*.⁸ McMullin is reticent to pursue explicit metaphysical reflection in the interpretation of the natural sciences. Indeed, other readings in his later works confirm this early suspicion. McMullin's apparent reservations regarding Lonergan's philosophy of science in *Insight* is only one expression of serious reservations regarding the Kantian (idealist) tradition in philosophy.⁹ One is led to think, therefore, that the empirically oriented Aristotelian tradition is one that McMullin feels he is most indebted to. Although, as we shall see, such an evaluation cannot be made without considerable qualification.

There are two ways in which McMullin's thought has been interpreted and employed within the science-religion dialogue. It should be noted that McMullin's work has been widely read, as the Gifford lecturers' usage of McMullin makes clear. However, given McMullin's philosophical acumen, it is interesting to note that two philosophical theologians, Wentzel van Huysteen and Willem Drees have also drawn on his work in interesting ways. van Huysteen's most recent work *The Shaping of Rationality: Toward Interdisciplinarity in Theology and Science*¹⁰ mentions McMullin's work in scientific rationality as a significant contributing factor in the decision over the book's title.¹¹

Drees also employs McMullin's contributions in the philosophy of science and methodological questions in the science-religion dialogue. However, he appears anxious to locate McMullin's cautious defense of scientific realism as evidence for the limited significance that realism now plays in the exchanges. In *Religion, Science and Naturalism*¹² Drees makes the case for an "ontological naturalism," in which religion is understood as a fundamentally natural phenomenon.¹³ Since such a position is not McMullin's own, Drees's employment of McMullin's thought is of limited value, although significant for its alternative incorporation of

epistemological seriousness within a metaphysical naturalist framework..

McMullin has developed philosophical tools and highlighted patterns of thought that account for human inquiry through the scientific disciplines. Going on McMullin's attention to the historical record and his careful sifting of different epistemological and philosophical issues in scientific inquiry, we can conclude that Murphy's criticisms on language and truth address different concerns with regards to communication. Based on a reading and interpretation of McMullin, there is a more primary attention on the epistemological structure between question and answer, between data and theory. In philosophy of science, McMullin emphasizes this structure by referring to the terms and relations of explanation: insight and imagination, theory acceptance and verification. By identifying the relationship between these elements in scientific explanation, we understand how an explanation can be termed 'successful.'

The primary significance of scientific realism stands apart from particular yet legitimate linguistic and socio-historical considerations that contextualize and modify scientific explanations. McMullin's appeals to a theory of scientific explanation shows how cognitional, epistemological and metaphysical questions emerge in an interdependent relationship with regard to the act of explanation. An account of the contingencies that shape how these questions emerge should not imply the denial of the structure and meaning of scientific explanations. While many socio-historical interpreters of science do deny that science offers an explanatory form of knowledge, this is not a necessary conclusion from a consideration of socio-historical contingencies in scientific inquiry.

What separates a successful theory of scientific realism from unsuccessful theories of scientific realism, as exemplified in neo-Aristotelian and positivist systems, is whether such a

position coheres with the history of science. Ultimately, does a critical realist appreciation of knowledge conform to what scientists have been doing? This focus on scientific practice is different from a strictly logical conception of what goes forward in scientific argumentation. Quite legitimately, a formal or logical conception of rationality epitomized by science is something that non-foundationalists like Nancey Murphy feel impinges on the religious dimension of being human.

The need for a theological account of world-process to go beyond the separation effected by the post-Kantian rupture between knowing and existence is critical for re-shaping a theological relationship with the natural sciences. Philosophically speaking, the recovery of critical realism is nothing less than a restoration of a metaphysical horizon irreducible to the speculative totalities exposed by Husserl and Heidegger. However, the shape of critical realism as the alternative position advocated by the Gifford Lecturers, remains essentially vulnerable. In particular they are vulnerable to postmodernist and post-foundationalist critiques. McMullin, on the other hand, offers us an occasion to build on the promise that critical realism still possesses

As was mentioned earlier with regard to van Huyssteen, this critique of critical realism has struck a chord. However, it is wholly conceivable that these critiques can be incorporated or at least merged with a broader notion of critical realism. The critiques against critical realism originate from a sophisticated mixture of idealist and pragmatist conceptions of cognition and epistemology that allows little positive explanatory value in metaphysical meaning. But, McMullin's own appropriation of pragmatist notions such as "success," and his transposition of Charles Peirce's term 'abduction' into 'retroduction' is already evidence that McMullin's understanding of critical realism is not a metaphysically pre-determined philosophy. The task that

lies before us is to take critical realism out of an entrenched opposition of the terms ‘critical’ and ‘realism’ within the notion.

McMullin’s development of the term scientific realism extends beyond a strictly methodological conception of a philosophical framework. It positively facilitates the religious question of God in a way that science is understood through the experience of self-transcendence, a hallmark of scientific rationality itself, especially in cosmology. Since McMullin’s treatment of these issues is informed by the extensive methodological programme he posits in the philosophy of science, there is a double clarity that an analysis of these historical ‘content’ issues provides. First, he clarifies the methodological elements of scientific explanation. Second, this explanatory theory for scientific rationality is verified by his historical analysis of these episodes.

2.4. What is Science?: A Twofold Distinction

What are the natural sciences? This question, which might appear overly general, is in fact, a key to sorting out competing theories and explanations about world process and the meaning of science. McMullin answers the question “what is science?” in at least three different yet interrelated ways, each of which takes up clusters of related questions albeit in response to this one specific question. The three ways are with regard to:

- 1) the meaning of the word ‘science’.
- 2) the broad *goals* of science and
- 3) the function and structure of *knowledge* in the natural sciences.

First, there is the question of what science means. This way of tackling the question is the most direct. In one of his early published articles, McMullin lays out an extensive summary of the work in the history and philosophy of science as a way of taking up this question.¹⁴ Drawing

on a distinction that is well known yet variously named in the philosophy of science, he discusses two senses in which the word science is used. First, it is understood as a series of linked propositions that connect reported and experimentally verified observations with ongoing theories that seek to “generalize or explain them.”(S1).¹⁵ Second, science is understood as the wider “ensemble of activities of the scientist” containing not only the propositions per se, but also the influences, extra scientific factors, accounts of discoveries, false starts and conceptual modifications that actually make up scientific activity (S2).¹⁶ But, “S2 will be difficult to comprehend; the effort to grasp it may well seem unrewarding or even futile.” All the same, “(t)he interest of S2 is only this, that in a very definite sense it serves to explain how S1 came to be formulated in the first place.”¹⁷

These comments demonstrate a basic perspective on the question of science that would likely be shared by most contemporary philosophers of science, even if disagreements about the interpretation of the significance of S2 in relation to S1 are manifestly apparent in the continuing debates within the discipline. Indeed, the rise and decline of logical positivism, represented in the widely read philosophy of Karl Popper, testifies to a desire to explain the operations of science (S2) in terms of scientific propositions or explanations (S1). The ramifications of this effort as well as the intentions of the opposite trend in the work of philosophers Thomas Kuhn and Paul Feyerabend (the historicist school) to explain S1 in terms of S2, is sufficient evidence to support the distinction McMullin makes between S1 and S2.

This distinction possesses an additional significance. It pertains directly to the methodological concern of this thesis. There is an uneasy relationship that exists between two competing forms of knowledge: explanation and understanding. These levels of knowledge exist

by virtue of the distinction between operations and propositions, not only in science, but also in philosophy and theology. As such, the effort to explain the results of science, as represented by S1 (explanations), in terms of the effort to understand what science is doing in terms of its operations (S2 or understanding) is key to what McMullin lays out in other articles on scientific realism. It is crucial also to the links he draws, as a consequence, with philosophy and theology. By raising the distinction between explanation and understanding, this study does not intend to promote a metaphysical overlay to the S1/S2 relationship. Rather, it is to evoke, in language more familiar to the hermeneutical tradition, a portrait of science that depends on the type of question being posed to science. ‘What is Science?’ can be understood both in terms of ‘what do scientists *know*?’ (S1) and ‘what are scientists doing when they know what they know?’ (S2). Put another way, this is the distinction between scientific contents and scientific operations which clarify the contents of scientific knowledge.

One of the hallmarks of McMullin’s contribution to the issue of the scope of scientific knowledge is his belief that a permanent and meaningful relationship exists between S1 and S2. Furthermore, a study of this relationship yields a systematic pattern of a growing body of knowledge with implications for other disciplines. Moreover, this body of knowledge uncovers, as McMullin says, a “realm...not one of man’s making; it is more “real” than he is himself because it is unchanging and independent of the contingencies of time.”¹⁸

This is the realm of intelligibility, of insight through the power of mind, an understanding of which the Greeks identified by the word *nous*. It evokes what Aristotle developed in works such as the *Physics*, namely the belief in essences or the natures of things. Of course, science is not unique in achieving a realization of the power of mind, but it has been at the forefront,

alongside mathematics, as inquiry into the world opening up the affirmation of true knowledge of the world, and affirmation of the world itself as real.¹⁹ The breakthroughs in Greek science, which McMullin repeatedly alludes to in his philosophical treatments of science, especially through his analysis of Aristotle, are developments in understanding only insofar as they consisted in a *demonstrative* restriction on what counted as science: as the fruit of deductions from sense perception. As the controversies at the outset of the scientific revolution show, the Greek and specifically the Aristotelian ideal of science failed to account for the rise of methods showing the existence of unobservable entities. The 17th. century set of events is the starting point for another typology in the answer to the question “What is science?”. Given the divergent claims and radical discontinuities in scientific procedures existing in different historical periods, what is science then? This question raises issues that are particularly germane to the theological nature of this investigation. This is due to the fact that science emerged successfully contemporaneous with a relative decline in the cultural resonance of religious and theological patterns of thought precisely during the seventeenth century.

2.5 McMullin’s “The Goals of Natural Science”

As an answer to the second question concerning the goals of science, McMullin defines it in terms of S2: as “an activity on the part of a skilled community”, not to be confused with its “other, commoner, sense as a body of propositions set down in a textbook...”²⁰ Science, in spite of being intangible by itself, is a unified, identifiable form of knowledge. Science is not reducible to S1 or a cumulative account of its explanatory achievements. According to McMullin, it is a story which philosophers have not told well. He highlights five “morals of the story”.²¹ He begins by probing the dispute between those who believe that science originated with the Babylonians

and those who believe that science emerged in ancient Greece. The dispute, according to McMullin, arises from two competing conceptions of what science is. One conception is what he calls P-science, the type of science associated with the aims of Babylonians to predict astronomical and other natural events.²² The second (Greek) conception of science, labeled D-science, is the idea that science searches for explanations or causal natures of things and their changes: the essence or animating principle of something as *deductively* explained in methodical sequence.²³

In an unprecedented historical development already alluded to, the seventeenth century scientific revolution combined these two conceptions of science into one understanding of scientific investigation which put the accent on theory.²⁴ This revolution is the key shift into theoretical or T-science.²⁵ T-science is the modern form of science understood most broadly as S2. The sweeping breadth of this story of science hinges essentially on its unity and synthesis. It questions an understanding of science as inherently pluralist.

This leads McMullin to begin his summary of “morals of the story” with the statement that science is a single activity. This activity is an enterprise that encompasses a diversity of investigations and methods of investigation.²⁶ First, changes in the goals of science are guided by a continuous community of scholars and researchers. Second, these changes in scientific goals are directed by reasons internal to the activity itself, rather than any particular cultural and economic factor. The seventeenth century shift is the best illustration of this point.²⁷ Third, science developed as an empirically oriented activity, but one which was precisely not controlled by the desire for technical or technological praxis. This appraisal takes into account Bacon’s well known penchant for technical control yet cautions against the opposite appraisal of science as a

contemplative (non-empirical) activity. Fourth, there is a distinct rationality at the heart of scientific activity. Scientific rationality specifies particular goals of science, however changeable, that intend to modify and enlarge rather than overturn the original established goals. The implication is that scientific rationality is not strictly dependent upon particular communities at particular times. McMullin pauses here to ensure that his partial agreement with Thomas Kuhn is clearly understood: “(t)his rationality *is* learned by the experience of scientists.”²⁸ McMullin departs from Kuhn in his fifth and final moral in stating that “(t)he rationality of science can be philosophically justified.”²⁹ Furthermore,

“(w)hat happens in philosophy of science reflects at the second level what happens in science itself. That is, it is empirically discovered in scientific practice that certain kinds of evaluative procedures or of epistemic demands...are effective in bringing about the broadly-stated goals of science. Then a theory of a broadly philosophical sort is brought about to *account* for this.”³⁰

The result is that we may “construct a philosophy of science that derives both from the learning that has gone on in history and from a more general logical and epistemological framework.”³¹

The philosophy of science is a discipline construed by McMullin to reveal each of these five morals, but especially the fifth moral, which identifies the goals of science not in terms of either the history of scientific discoveries or a normative explanatory structure, but rather both of these things interacting in an irreducible way.

The central implication of this list of morals is that the strengths and weaknesses of logical positivism and historicism, the two leading movements in twentieth century philosophy of science, be taken into account. The insights of one cannot be laid out as providing the full array of orientations for a philosophy of science to the detriment of the other in zero-sum fashion, an insight that Barbour and Peacocke each express. However, the fusion of the insights of each

movement should be understood in terms of comparing and contrasting their own insightful trajectories. Each depends upon historical antecedents in a single activity of science: P science for the historicists and D-science for the logical positivists and empiricists. Going on McMullin's meta-historical framework, T-science, represented by the triumph of theoretical reasoning regarding unobservable objects during the seventeenth century, represents a new level of reasoning. In T-science, there emerges a wider basis for taking up the historical and explanatory frameworks of science together. T-science, by its very characterization as a historical category of unprecedented scientific advance into the realm of unobservable intelligibilities, puts into question the reductionist tendencies of empiricist positivism as a philosophy of scientific history. At the same time, because it is an advance on which all subsequent advances are fundamentally dependent, a crudely historicist interpretation of scientific history is also reductionistic.

The incorporation and surpassing of earlier methodologies by the practitioners of seventeenth century T-science provides a philosophical justification to account for this event according to McMullin. Yet, at this point, it is extremely important to distinguish this fifth moral of McMullin's from other interpretations of science that appear to argue for the same position, but which, in fact, are remarkably different. The question guiding this pursuit of a distinction is: "how is science to be understood?" The general answer involves a reference to philosophy. But what kind of philosophy? How does a philosophical understanding of science add to the knowledge provided by the scientific investigations themselves?

In order to state in more exact terms McMullin's contribution to this question, it would be worthwhile to contrast his approach with the approach taken by neo-Aristotelian and neo-Thomist philosophers of this century. Their arguments are well known in the philosophy of

science. While McMullin shares with this tradition the broad aim of associating the sciences with foundational forms of knowledge, such as the quest for metaphysical knowledge, he diverges from this school of thought in certain key respects.

2.6.1 What is Scientific Realism?: Two Realist Traditions

Picking up the third question McMullin identifies in defining science, he constructs scientific knowledge in terms of its function and structure. This is the point where the question of realism is most apparent. The importance of examining McMullin's distinctiveness within the Thomist/neo-Aristotelian tradition lies in attaching the precise philosophical meaning that McMullin attributes to the natural sciences. By specifying his contribution in this regard, McMullin's contribution can be distinguished from others within a philosophical tradition with which he is generally associated. This in turn offers us the occasion to note a minor interpretive problem in Barbour's and Peacocke's citation of McMullin as a figure supposedly constricted within the limits of the Thomist particular school of traditional realism.

McMullin develops a critique of traditional realism from early in his writings, which is based on an account of the failure of the conceptualist model of a "science" of nature.³² Generally speaking, the sort of realism McMullin critically evaluates is the kind of position associated with propositions, statements of representational claims about nature revealed in the conducting of experiments, and defined through the existence of logical sequences and relations among and between natural laws. Variations notwithstanding, this is a summary of the Aristotelian tradition in its early twentieth century form. This is the philosophy of nature that had been commonly expressed in the scholastic neo-Thomist theological manuals until mid-century.³³ McMullin describes this tradition

“as a philosophy of science based on a prior theory of knowledge and of natural essence [...] This sort of philosophy of science can be called “normative,” because it is supposed to serve as a norm for the scientist, suggesting to him, on grounds prior to the specifics of his own scientific inquiry, what he should aim at and how the main logical structures of his work should appear.”³⁴

Modern neo-Aristotelians, as well as certain proponents of the analytic tradition of philosophy are twin efforts to adopt this broad basis for a philosophy of nature and scientific rationality. For these philosophers, the philosophical understanding of science retroactively asserts a pre-scientific “common core” of human understanding of nature, upon which Aristotelian categories are validated, as set out in the more strictly philosophical writings, including Aristotle’s *Posterior Analytics*, the *Physics* and *Metaphysics*.³⁵ As the early article “Philosophies of Nature” seeks to show, McMullin identifies highly problematic assumptions that frame contemporary and recent neo-Aristotelian efforts to understand science exclusively on the basis of Aristotle’s metaphysical categories whose intention was to explain rudimentary Greek science.³⁶

It is clear from this 1969 article that while working within the neo-Aristotelian and neo-Thomist traditions, McMullin is aware of serious shortcomings within these traditions. The significance of his awareness of the limitations of this tradition are twofold. First, whatever reservations McMullin has regarding the neo-Aristotelian tradition, they are based in an attentive, yet general inquiry regarding the relationship between science and philosophy. As later work on Aristotle’s *Posterior Analytics* would clarify, these reservations are based on a reading of the works of Aristotle from the vantage point of this general inquiry.

Second, therefore, McMullin’s reservations concerning an *a priori* philosophy of nature in neo-Aristotelianism pre-date and contrast the flurry of analysis and appraisals of Thomas Kuhn’s *The Structure of Scientific Revolutions*. This is an important point because it means that

McMullin's emphasis on scientific practice precedes the particular interpretation of Kuhn that arose in the historicist traditions. McMullin's later explicit engagement with the history of science, as it concerns the claims made by Kuhn and others, is formulated on this wider basis. His philosophical reasons for adopting a modified realism stand somewhat independently. philosophically speaking, as an appropriation, interpretation and criticism of the Aristotelian tradition itself:

"The abstracting of general concepts from everyday experience simply does not furnish a strong enough base for the ambitious constructions of a deductively-interconnected system. Furthermore, the whole ideal of a "demonstrative science" of nature is wrong."³⁷

In connection with this, McMullin has distanced himself from other neo-Aristotelians over the so-called "continuity thesis." In short, this thesis asserts a basic fundamental pattern of scientific inquiry from Aristotle through modern science as definitively worked out between demonstrative science that yields *episteme*, certain knowledge, on the one hand, and *doxa*, mere opinion, on the other hand.

This thesis is most clearly set forth by J.H. Randall's *The School of Padua and Early Modern Science* (1961), and it has been effectively argued more recently by William Wallace. The issue that divides McMullin from adherents to the continuity thesis tradition is the exact status of hypothetical argument in scientific reasoning. McMullin does not believe that something less than demonstration (i.e. any argument that relies on hypotheses and theories as constituting knowledge in some way by themselves) should be excluded as the explaining feature of science. As a defender of the demonstration thesis, Wallace thinks science provides an ideal form of knowledge. It constitutes an implementation and interpretation of the Aristotelian tradition. However, according to McMullin, Wallace also suggests that the positing of

hypothetical inferences, for example in Galileo's work, amounts to the charge that Galileo used fallacious reasoning.³⁸ McMullin wants to defend the reasonableness of hypothesis. Hypothesis is not reducible to demonstration.

What does this debate concerning the continuity thesis yield? While it is not popular now, it is a serious philosophical position concerning scientific history. I think it shows that a realist affirmation of the knowledge of the universe ought not to rely on simplistic distinctions in types of knowledge, such as the distinction between science as demonstration of observable entities versus opinion as the type of knowledge acquired in probabilities and hypotheses. The activity of science, especially since the advent of seventeenth century T-science, includes and amplifies the meaning and intelligibility of the existence of *unobservable* as well as observable entities. Inheritors of the Aristotelian tradition have been too wedded to the observable character of scientific entities. However, it is inherently difficult to square a scientific understanding of unobservable things with the demonstrative focus on observable proofs for a hypothesis.

In view of this, McMullin critiques Wallace by calling for an attention to the kind of reasoning Galileo actually used, not the form of reasoning that Galileo thought he was using. This is what McMullin notes is his key difference with Wallace. The biographical dimension of Galileo is what Wallace highlights as a strategy to explicate the demonstrative intention of scientific activity, S2. But, this argument of Wallace's contains an illusion. It mistakes the claim that one understands the key element in the progress to a unified scientific method as equivalent to a better demonstration of empirical facts.³⁹ Rather, as McMullin says, *both* "hypothetical-deductive" as well as demonstrative methods were operative in Galileo's work. This complexity renders problematic the view that Galileo's use of theory or hypothesis was the employment of

opinions on the way to a more certain definitive knowledge.⁴⁰

The question that this raises is why Wallace would want to interpret the Aristotelian tradition as a regulative source for a philosophy of science. Though McMullin does not say so explicitly, the thrust of his comments on this issue concern the ability of a single tradition to respond thoroughly and accurately to the turbulent historical record. Historical study is bound to destabilize, to some degree, the effort to account for a single narrative thread based on the priority of one particular ideal as encompassing an understanding of natural process. The point of his comments highlight not only the inadequacy of the demonstrative ideal in the philosophy of science, but also to the connected exigence of identifying what actually occurs in the operations of scientific investigations. Given Kuhn's paradigm picture of scientific history, the temptation for those like Wallace is to contrast this understanding through a picture of science in terms of what a scientist says he or she does in order to lay out how science follows a different norm. In this case, Galileo, whose methods and discoveries were responsible for breaking down old paradigms is regarded as a historical figure who used the logic and the language of the old paradigm. But, as can easily be seen through Wallace's viewpoint, the selection of Galileo's demonstrative logic is a selection with particular presuppositions.

McMullin asks the further question: what really happened? Besides what he says he did, what did Galileo actually do? It is a question of deliberating upon the evidence that is relevant to this question that overturns a commitment to any particular ideal that purports to represent what happened. In the case of the modern neo-Aristotelian philosophy of science, the metaphysical tradition idealizes rather than attends to the scientific process itself.

And so, understanding science is a process of thoroughly appraising the historical

dimension. That is, it means taking into account the previous successive efforts to understand a component or entity in nature. The understanding of performance, in light of the enormous and occasionally deceptive influence of particular historical and philosophical contexts is a key element of critical realism. In light of McMullin's critique of a figure such as Wallace, the epistemological question is brought to bear on the historical context. The critical aspect of critical realism needs to be brought to bear on the relationship between the explanation of a particular scientific theory and the means by which the act of explanation is undertaken. This needs to take place without recourse to an *a priori* theory of scientific explanation and the knowledge that it affords. If there is an *a priori* theory of scientific explanation at work, then we are speaking about two different realisms.

2.6.2 Realism and Antirealism: McMullin's "A Case for Scientific Realism"

Having situated McMullin within the neo-Aristotelian tradition through his critical stance on a particular issue, the next step is to identify the elements and strategies that make up McMullin's position of scientific realism. This analysis will help to contextualize the meaning of retroduction his explicit theory of scientific rationality in terms of the wider issue of existence and its meaning.

With scientific realism, philosophers and scientists are employing a phrase with a precise set of terms and meanings that cannot be so easily transferred into critical realism. In summary, scientific realists are drawing on various forms of reflection, beginning with Aristotle, that affirm sets of mental acts used to interpret the world, which form the basis for successive schemes of knowledge. As a result, there is an implicit judgment that the existing world is real. The reality of the world is neither contingent upon social constructions of human language. Neither is it entirely

resistant to the new meanings that language brings to an understanding of the world. As the earlier quote from Ladrière shows, the question of reality appears at a critical juncture in the phenomenological tradition's notion of experience as well.

Scientific realism is a philosophical approach that incorporates insights from twentieth century logical positivism, idealism, empiricism and historicism. The connections and lines of inquiries between each of these latter philosophical schools are important for understanding certain implications for the dialogue between the sciences and theology. It is still clear, however, that the virtual consensus around critical realism noted with respect to the Gifford lecturers invites a sustained analysis of the realist tradition itself. Such an analysis needs to pay attention to the modifications of the term in light of pressures from other schools of thought. McMullin's particular engagement in the dialogue from his more developed understanding of scientific realism is therefore a critical step in defining critical realism. This is not to suggest that other philosophical strategies are unimaginable in linking critical and scientific realism. Others, who demonstrate an interest in religion and theology from the vantage point of a modified realism include William Alston and Hilary Putnam. Their modifications are significant.

McMullin affirms scientific realism by establishing a verifiable theory that defines science itself as intentionally realist by virtue of the acts of the scientist. This theory indirectly makes claims about the essential character of the universe. So, in this context, to clarify the similarities between the philosophy of science and a theology that begins from an understanding of the world are very important for the theologian. If nothing else, a theological reflection that makes claims about the 'character' of the universe must at least face questions that arise from a discipline whose challenges to theological claims have been forceful.

It is worthwhile to begin with the text of McMullin's used by Barbour and Peacocke in identifying themselves as critical realists. This text, like most of McMullin's work in the field is written in the form of an article. It is entitled "A Case for Scientific Realism", and was published in 1984.⁴¹ In the first part of the article, McMullin outlines an array of historical and philosophical sources that are marshaled by what McMullin calls 'antirealist' philosophers. These perspectives are critical of realism, though they stem from a variety of concerns and traditions. This first section of this article is, in fact, a capsule of McMullin's thought in the areas of philosophy and history of science. As such, it links the negative assessments of anti-realist philosophy implicitly made by the Gifford Lecturers. The Gifford Lecturers refer to McMullin's assessment, but this study explores how and why McMullin's assessments go some distance beyond their summary of his argument. McMullin's attention to scientific history that is contained in this article, among others, is the key to deepening the critique of anti-realism.

Another reason for beginning with this text is that it has been frequently cited by other thinkers in the theology-science dialogue as a seminal text that defines contemporary realism in the philosophy of science.⁴² The article itself is structured dialectically in order to decipher a plausible form of realism from the caricature of realism described by antirealists. It begins with a summary of the historical sources of "antirealism." In its contemporary form, antirealism is defined as a loose philosophical movement that was reignited in the wake of the "Kuhnian revolution" in the philosophy of science. In summary, antirealists claim that belief in the actual existence of the entities that are theoretically conceived and scientifically investigated is dubious, due to a fundamental underdetermination of empirical findings with theoretical constructs.

The sources of antirealist philosophy are twofold: i) from historical examples in science

and ii) from an interpretation of the philosophy of science. In the preliminary section of this article, McMullin spends considerable effort covering historical events that realists and antirealists disagree over. The first example comes from Newtonian classical mechanics. Drawing on his earlier study of Newton, McMullin recounts the philosophical reaction to Newton's discovery of force:

"The Cartesians, Leibniz, and later Berkeley, charged that the new mechanics did not really *explain* motion, since its central notion, *force*, could not be given an acceptable interpretation. Newton was sensitive to this charge and, in the decades following the publication of *Principia*, kept trying to find an ontology that might satisfy his critics. He tried "active principles" that would somehow operate outside bodies. He even tried to reintroduce an ether with an extraordinary combination of properties..."⁴³

Newton's eventual failure to ground his empirically verified discoveries within the previously defined metaphysical/alchemical context epitomizes the kind of event that antirealists highlight in their critique of the realist position. Newton's misguided quest typifies the dissonance, according to antirealist argument, that exists between empirical findings and ontological referents. McMullin, however, lays out a different interpretation of events from the antirealist interpretation:

"It might seem...that the gradual laying aside in mechanics of questions about the underlying ontology was, in effect, an endorsement of antirealism. This would be so, however, only if one were to suppose the realist to be committed to theories that permit interpretation in familiar categories...Naïve realism of *this* sort is, indeed, easily undermined."⁴⁴

There are echoes in this statement of the Galileo debate about which McMullin, as I have already indicated, has clarified the impropriety of traditional realist categories. The key to establishing a legitimate search for ontological extension of scientific findings lies in making a distinction. On the one hand is a realism of unrevisable theories that purport to represent physical reality, and on

the other hand lies a realism that embraces theoretical revisions that tend, in spite of their revising intent, to cluster over time to account for reality as unified and intelligible.

McMullin shows how the search for ontological implications and further interpretive strategies are actually positive elements in understanding the Newtonian example in realist terms:

“Newton’s ether *might* have worked out; it was a potentially testable hypothesis, prompted by analogies with the basic explanatory paradigm of the earlier mechanical tradition. The metaphor of “active principle” proved a fruitful one; it was the ancestor of the notion of field, which would much later show its worth.”⁴⁵

In summary, the Newtonian search for further intelligibility in terms of asking further questions of an ontological nature was, therefore, not a fruitless exercise. The issue of a possible ontological reference that McMullin emphasizes with regard to the case of Newton illustrates the fact that, in order to be meaningful, successful philosophical interpretation must await the emergence of further discoveries. Indeed, these often occur much later, perhaps through insights in fields other than the field in which the original interpretation is initially directed. A final comment of McMullin’s concerning Newton’s place in the realist/antirealist debate is worth quoting in support of this emerging interpretation of scientific history:

“There was no way for Newton to know that attempts to interpret force in terms of the simple ontological alternatives he posed would ultimately fail, whereas the ontology of “insensible corpuscles,” which he proposes in *Opticks*, would prosper. Each of these ventures was “metaphysical” in the sense that no evidence then available could determine the likelihood of its ever becoming an empirically decidable issue. But it is of such ventures that science is made.”⁴⁶

The reason for beginning this discussion of McMullin’s recollection of features of Newton’s career is to highlight the incredible importance of the seventeenth century scientific revolution for scientific realism. This will be discussed further in chapter three. Its significance is hard to downplay. More than any other event, the scientific revolution catapulted science,

theology and philosophy apart from one another along different trajectories of inquiry in autonomous pursuits.⁴⁷ What emerged in the 17th. century was a widening time gap between empirical discoveries and the theoretical constructs used to interpret and connect discoveries to a broader picture of the universe. Judging by McMullin's observations of Newton's work, this seems to be a plausible source for the systemic doubt about an ontological philosophical framework which became culturally prevalent at this time, notwithstanding the intentional philosophical contributions of Descartes and the legacy he left. This "ontological doubt" only accelerated during the following three centuries. But it did so along a path set by the shift to theory established by the scientific discoveries of this century. The implication that needs underlining here regards the context for setting a theory of scientific rationality. A modified realism is possible once we declare our patience with simultaneous and successive investigations that do not yield immediate metaphysical warrants.

The next subject McMullin examines in his taxonomy of antirealism is the historical dispute between Einstein (a realist) and Bohr (an anti-realist) which anti-realists suppose was won by Bohr to the detriment of realism. What McMullin points out is that it was not Einstein's realism that was cast into doubt. Rather, it was his refusal to distinguish between the systematic determinacy of the "macroworld", as McMullin calls it, and the quantum, unsystematic "microworld" which is "partially indeterminate."⁴⁸ Bohr, as it happens, was not advocating an interpretation of quantum mechanics as the Copenhagen school later articulated it in terms of a strict *indeterminism*. Rather, Bohr "is arguing that what can be inferred is entirely at odds with what the classical world view would have led one to expect."⁴⁹

Both the wave and the particle are required to account for photons and other sub-atomic

particles in their respective explanatory contexts. Einstein initially allowed the determinist character of classical mechanics to direct his search for an “underlying reality” in quantum systems, a search not unlike Newton’s unsuccessful quest for an overarching explanation for force. The difference between a scientific realism and Einstein’s stubborn refusal to grant indeterminacy to quantum reality is captured by McMullin as follows:

“Recall that realism has to do with the existence-implications of the theoretical entities of successful theories. Einstein’s ideal of physics would have the world entirely determinate against the mapping of variables of a broadly Newtonian type; Bohr’s would not.”⁵⁰

Ontology and the immanent intelligibility of the world are not ruled out, only the possibility of a systematic invariance at the micro-level as a basic determining feature of a uniform universe, analogous to the organization of systems at the macro-level.⁵¹

The third instance McMullin cites in his retinue of realist/anti-realist conflict is the case of elementary particle physics, which entails the debates concerning the Heisenberg Uncertainty Principle, a principle that seeks to make an antirealist interpretation out of the fact that one cannot determine the mass and the momentum of elementary particles with any fixed spatio-temporal reference point as a guide. Once again, McMullin refines the realist claim concerning reality thus:

“The realist claim is that the scientist is discovering the structures of the world; it is not required in addition that these structures be imaginable in the categories of the macroworld.”⁵²

This leads McMullin to conclude, on the basis of these three examples, that realism is *not* a strategy or a “regulative principle” that separates “the good from the bad among proposed explanatory models.”⁵³ A further two examples from recent physics (Einstein’s eventual abandonment of ontological forms of explanation in formulating the General Theory of Relativity

and Heisenberg's "restriction of matrix mechanics to observable quantities only"⁵⁴) are identified by McMullin as linchpins to antirealist arguments. First, remembering what the realism/anti-realism debate is regarding,

"[t]he...debate has to do with the assessment of the existential implications of successful theories *already in place*. It is not directed to strategies for *further* development, for deciding among alternative formalisms with respect to their likely future potential."⁵⁵

McMullin then proceeds to address other forms of antirealist critique in the history and philosophy of science literatures respectively. One of the chief reasons this article is so illuminating for a study of McMullin's contribution is the summary treatments he provides of the Kuhnian revolution in the history of science and the critiques of leading figures in the philosophy of science such as antirealists Larry Laudan (in the history of science), Bas van Fraassen (following the empiricist tradition in the philosophy of science), Richard Rorty (in the pragmatist tradition in the philosophy of science) and lastly, Hilary Putnam, whose stance is vaguely defined. Summarizing this group, McMullin classifies them according to four overlapping anti-realist categories: general, limited, strong and weak.⁵⁶

What can be inferred from this assessment of anti-realism? The main characteristic of McMullin's critique is his retrieval of historical sources from the very historical periods which traditional realists have significant difficulty interpreting according to their philosophical dispositions. But, in doing this, McMullin undermines the supposed strengths of the anti-realist philosophical position. According to anti-realism, the contingency of scientific knowledge is its one trustworthy characteristic. This position has been formulated in response to the perceived traditional realist weakness in being able to account for revolutionary change in scientific knowledge.

This is precisely the account that the Gifford Lecturers leave aside in their citation of McMullin's assessment. But it needs amplifying with reference to McMullin's other articles and essays in order to expand on the contents of the first part of this article. In following this analysis of McMullin's work, I hope that the distinct thrust of scientific realism will be clarified with respect to the meaning of critical realism.

2.6.3 Scientific Realism: A Definition

I will summarize McMullin's defense of scientific realism from the second part of "A Case for Scientific Realism" before expanding on the insight that forms the basis for his retrodution theory of rationality. As I have already stated with regard to McMullin's interpretation of the Newtonian episode in the history of science and the problems involved with the continuity thesis, there is a key distinction that is necessitated to communicate realism credibly. It involves avoiding a portrayal of science constructed on unrevisable principles and "literally true stor[ies] of what the world is like...."⁵⁷ McMullin returns to everyday experience, that priority for phenomenologists, as the basis for a philosophical realism in the natural sciences. The question for realists to address is why the realist position was formulated in the first place:

"The original motivation for the doctrine of scientific realism was not a perverse philosopher's desire to inquire into the unknowable or to show that only the scientist's entities are "really real." It was a response to the challenges of fictionalism and instrumentalism, which over and over again in the history of science asserted that the entities of the scientist are fictional, that they do not exist in the everyday sense in which chairs and goldfish do."⁵⁸

So, McMullin's definition of scientific realism, stated in this article and expanded elsewhere, is "the long-term success of a scientific theory (giving) reason to believe that something like the entities and structure postulated by the theory actually exists."⁵⁹ This sentence is the clearest

indication of McMullin's most important contribution, and abounds with clues and qualifications of McMullin's general position, only some of which have been picked up by the Gifford Lecturers in their citation of this passage.⁶⁰ Words such as "long-term", "success", "theory", "structure" and "exists" are all hallmarks of McMullin's particular approach.

He goes on to list particular elements that comprise a successful argument for scientific realism. One of the most sophisticated elements is the focus on *structural explanation* in (T-) science. This begins with the affirmation that over the last two centuries, there has been

"a progressive discovery of *structure*...This structure is taken to account causally for the observable phenomena, and the theoretical model provides an approximation of the phenomena from which the explanatory power of the model derives. This is the standard account of structural explanation, the type of explanation that first began to show its promise in the eighteenth and early nineteenth centuries in such sciences as geology and chemistry."⁶¹

Another element of McMullin's case for scientific realism involves a nuanced description of the fertility of metaphors and theories, which heuristically operate to extend scientific investigations in the provision of answers to questions. However, the existence of metaphors and theories in science requires an assessment of how they are accepted. This is far more empirically accessible to evaluate than an evaluation made in terms of truth per se. Clearly, this is a major way in which McMullin revises the strict realism of traditional philosophies. The focus in this modified realism is on 'acceptance' rather than truth, which connotes a certain degree of pragmatism, which is important to note as a potentially problematic influence that must be negotiated, but which will be somewhat clarified later.

According to McMullin, the broad success of theories, their cumulative structuring and metaphors for the purpose of providing explanations is evidence for realism that anti-realists

cannot account for. The “fit” between “the structures of theory and the structures of the world”⁶² is rough and contingent upon the features of the history of science. Yet, theoretical explanation “has resources of suggestion that are the most immediate testimony of its ontological worth.”⁶³

The importance of McMullin’s approach, cautious though it may seem, consists in his identification of *indirect* relationships by which these realist ingredients work to affirm knowing what one knows in knowledge that is fully realized in ontological statements.

Impelled by this reference to ‘structure’ in scientific realism, I turn specifically now to McMullin’s own theory for how structural explanation gives rise to a belief in realism. This is the theory of scientific knowledge that he terms ‘retroduction.’

2.7 Retrodution

Retrodution is the ‘inference that makes science’ to borrow from McMullin’s title of his 1992 Aquinas lecture. He borrows the term from the work of Charles Peirce. It identifies the “moving backward in thought from observed effect to unobserved cause.”⁶⁴ Unlike Peirce however, McMullin calls it retrodution, not just abduction. He understands it not so much as an inference like deductive or inductive inferences, but in terms of something more, as a movement of invention.⁶⁵ In engaging anti-realist arguments about the status of scientific understanding, McMullin appeals to historical examples from specific scientific sources to outflank anti-realist arguments. At first glance, this might appear to highlight McMullin as a strictly historical interpreter of science. However, McMullin’s interpretation of scientific history does not establish scientific realism on the strength of an aggregate of case studies alone.

Instead, he proposes a theory to account for why realism is the best philosophical account for science. His theory of retrodution is intended to account for science in a new way. Does it

account for all scientific activity? McMullin asks the question in terms of types of scientific inferences: “[h]as a new model succeeded the older axiomatic and inductive ones?”⁶⁶ His answer sets the stage for his theory:

“I suggest that one has, but must immediately warn of the qualifications such a claim requires. There are deep disagreements among philosophers of science about where the challenges of the Kuhnian era have led; no single orthodoxy, comparable with the logical positivism of the earlier era has taken hold. Nevertheless, one can discover some widely-shared points of agreement sufficient to constitute at least a rough outline of one alternative. It is a model with underdetermination built into it.”⁶⁷

It is drawn from those investigations that McMullin terms the ‘structural’ sciences: “From the history of the structural sciences...there is a single form of retroductive inference involved throughout.”⁶⁸ Again, its basis from a reading of scientific history is not to be confused with a more facile style of interpretation:

“What the history of recent science has taught us is not that retroductive inference yields a plausible knowledge of causes. We already know this on logical grounds. What we have learned is that retroductive inference *works* in the world we have and with the senses we have for investigating that world. This is a contingent fact as far as I can see.”⁶⁹

The specific feature being singled out as contingent here is the nature of reason in this universe, not the particular contents of certain theories in certain historical periods, but reason itself. though contingent in the positive not the negative sense of the word. Further on, McMullin stresses the link between retroduction and the contingency of scientific investigation that works according to this theory: “(t)here could well be a universe in which observable regularities would *not* be explainable in terms of hidden structures, that is, a world in which retroduction would not work.”⁷⁰

Several facets in McMullin’s use of the term ‘retroduction’ deserve to be mentioned at the beginning, especially since they highlight this key notion of structure in both theory and

nature that warrants the affirmation of scientific realism. It is important to keep in mind that understanding retrodution is a way to resolve a dispute in philosophy of science through an advertence to a generalized theory of scientific rationality. If this philosophical goal can be attained, by way of accounting for the realist/antirealist disagreement, a theological stake in its reflection on the character of the universe is gained without becoming preoccupied with the *minutiae* of that disagreement.

Retrodution is first used in a significant way by McMullin in a 1978 article entitled "Structural Explanation."⁷¹ Structural Explanation is the basic result of T-science.⁷² It is the primary, unavoidable feature of scientific investigations into the natural universe structured through theoretical inference. Structures are sets "of constituent entities or processes and the relationships between them."⁷³ Theories are linked hypotheses about these constituent entities/processes that test ideas through a "set of propositions, explanatory in...intent."⁷⁴ This hypothetical form of proposed explanation produces models, conceptual applications of functioning systems. As an integrated whole, this form of modern explanation in science is what McMullin terms "hypothetico-structural" (HS) explanation.⁷⁵

The key to understanding this type of explanation is in judging whether or not it is successful. Success is a meta-criterion for the verification of the theory in its judgment of the existence of the *explananda* or theoretical entities.⁷⁶ As the general form of explanation in the natural sciences, structural explanation is different from, yet it builds on "nomothetic" explanations (explanations based on "an empirically determinable regularity, a 'law.'⁷⁷) and "genetic" explanations (explanations about the origins of particular structures or behaviors specifying a historical sequence of development.)⁷⁸ Structural explanation is not merely intended

to “organize experience in such a way as to make it explicable.”⁷⁹ It

“not only accounts for the *explanandum* by showing it to be deducible from the *explanans* (as does nomothetic explanation) but also warrants a hypothetical assertion about the elements and relations constituting the explanation.”⁸⁰

McMullin goes on to call this structural explanation a triumph of contemporary science, since it consists in a ‘penetration’ of the “invisible realm,” a phrase first coined by Newton.⁸¹ This penetration of the invisible realm is a particularly complex form of abstraction, one that involves retroductive inference. Against simple induction, which extrapolates from particular data to a general law, retroduction also involves a “leap” that occurs in the explanatory success of a hypothesis, causally based in theory. Furthermore, retroduction is the mode of inference that “allows the scientist to conclude that his theory is warranted.”⁸²

This warranting is based on the explanatory success of theory, and is evident in structural types of explanation. This is the key to retroduction. It is by virtue of a theory’s success that scientific rationality holds together the theory and the empirical world of natural processes. It is exemplified in the most famous discoveries of contemporary science, including Crick and Watson’s discovery of DNA in the biochemical structure of the chromosome, and in the discovery of tectonic plates in geology. As these two examples show, success is the most plausible interpretation of empirical data that is verified over and over again.

The only *a priori* at work in this interpretation over the longer term is the Principle of Sufficient Reason. In the last part of the article “Structural Explanation,” McMullin draws some important conclusions on the basis of the widespread presence of retroductive inference that produces structural explanation. They are 1) the consequent *ability* to make ontological claims, 2) the value of structural models for allowing the human *imagination* to extend its range of

intelligent inquiry, 3) the incorporation of rejected data and models into a larger domain as empirical residue that remains available for investigation along another line of inquiry, 4) the implications of these conclusions in forming the basis for a realist position, and 5) the foundational character of retroduction to any account of progress in the natural sciences.⁸³ Obviously, these conclusions, though listed without extensive justification here, are enormously important. The variety of implications of retroduction impacts scientific rationality in many ways.

Retroduction is an explanation of scientific rationality that encompasses the complex, diversified and multi-faceted methods that make up T-science. The ascendance of theory has occurred because the prominence and heuristically foundational role of hypotheses have outstripped the previously dominant ideals of deductive demonstration and inductive generalization as two competing means of explanation. The significance of demonstration, in particular has been fully sublated, a shift that is concomitant with the decline in the knowledge attained through insights based exclusively on strict observation. The invention of the telescope is perhaps the most forceful example of the diminished role that demonstration based on observation plays.

Retroduction's success as a theory of rational explanation not only complements demonstration, with its accent on direct knowledge, as a theory of rationality itself. It subsumes it as a theory which still grants the existence of "causal explanation [and] the discovery of natures" as demonstration did before T-science.⁸⁴ The sheer ampliative force of this account of reasoning leads McMullin to conclude (again, with the anti-realist or instrumentalist arguments in mind):

“(T)hose who argue for the variability in principle of scientific rationality rely on the

premise that what counts as *explanation* has varied widely over the history of science.”⁸⁵

Science, on the anti-realist account, is best understood as simply the search for understanding itself, a criteria that seems as general as retrodution, but which excludes explanatory knowledge:

“The notion of understanding (unlike that of prediction) is sufficiently indefinite (it is argued) that it could be a light constraint to satisfy. Yet, there *is* a real constraint here on what may count as natural science in the future. It will have to provide an understanding of natural process [...] What makes scientific knowledge ampliative, what finally enables it to transcend the limits of the here and now, is its successful employment of retrodution. The criteria of theoretical explanation are sufficiently well-determined to enable us to infer from effect to unobserved cause. Predictive accuracy reappears here as a means, rather than as an end.”⁸⁶

Ultimately, the elements of retrodution (the raising and testing of hypotheses, the role of imagining theories that advance understanding, and the goal of affirming theoretical entities) provide a fully explanatory theory that is verifiable according to the history of science.

“Predictive accuracy”, the term that McMullin employs to denote an empiricist or pragmatist minimalism, is present in the goal of reaching scientific understanding. However, it is oriented, because of its place in the broader range of explanation and retrodution, toward the goal of real knowledge.

One can go further by suggesting that understanding retroductive explanatory inference leads to a grasp of human rationality itself. This reflective self-knowledge is so vital, that none of the elements of scientific realism that McMullin speaks about is possible without it. Together, theories, models and hypotheses point to a deeper harmony that is operative in the ongoing acts of investigation into the world. This not only implies a confidence in the act of investigating the world through science. It is the key issue that sets apart the anti-realist from the realist, once she/he is aware of the critical aspect of self-knowledge to an account of the world. Reflective

knowledge gained by an understanding of the acts of scientific knowing is a different philosophical level of knowledge. Its uniqueness is the basis for McMullin's distinction between S1 and S2, which together serve as the coherent basis for unity of science. The question is whether or not McMullin's reflections on structure and the theory of retroduction are empirically verifiable in scientific history. This is the topic for chapter three. But, retroduction can still be further expanded in terms of two additional elements that McMullin has examined: the notion of virtue (or value) in science, and the grounds for affirming ontology.

2.8 Retroduction: Fertility and Virtue in Science: Affirmation and Judgment

McMullin's discussion of virtues in science undergirds the success or the explanatory power of verified scientific theories. He thus distinguishes his account of realism from *both* the traditional realist and the instrumentalist accounts of scientific investigation. Successful scientific practice, according to McMullin, is based in the explanatory power of the multi-staged inference of retroduction.⁸⁷ The element of success or power that McMullin stresses is the basis for the realist warrant for unobserved causes, theoretical processes and entities. However, there is also the key notion of validation or verification in a successful explanation. Theories and hypotheses are verifiable as much as induction and demonstrative deduction are verifiable even though the presence of verification in the procedures is less immediately evident.⁸⁸ The form of verification present in retroduction is not, however, exercised through rules, as logical positivists emphasize in deductions. Rather, it is the longer term 'fruitfulness' of the theory measured in the ongoing process of experimentation, theorizing and investigation that is the measure of explanatory success.

Fruitfulness is something that McMullin discusses in relation to the *virtues* of scientific

theories. While words such as fruitfulness or success seem interchangeable or vague, I believe they help identify additional complexities of the theory of retroduction, especially the relationship between retroduction and truth. The claim that theory verification involves some sort of fundamental values is a strong claim. The philosophical notion of truth is dear to the realist cause, especially in the science-theology dialogue, but its range is very general. In order to communicate its meaning, a theory of scientific theories such as retroduction points to the evidence of virtues in verifiable theories.

Without this kind of grounding or justification for a role for judgment in the natural sciences, there would be no reason to establish either the success of a theory, its verifiability or the significance of progressive reason directed toward nature. The presence of virtues in science may strike some as an inherently subjective form of justification. In a sense this is true, but it is subjective in a way that the search for truth is sought in terms of the coherence of one's experience of reality. Though McMullin does not use this kind of language per se, this is one plausible interpretation of explanatory success in the context of a wider philosophical attention to subjectivity. This interpretation extends what Ladrière is discussing in terms of the limits of explanation and the mere act of coming to terms with experiencing reality.

In an article intended to develop his realist position based on the theory of retroduction, McMullin lays out an argument that connects theory with truth.⁸⁹ Beginning with the centrality of theory in T-science, McMullin distinguishes retroduction from simpler forms of inference according to the key criterion of explanatory success based upon the role of human imagination, and the pursuit of plausibility in the contents of theories. Because of its comprehensibility in reasoning, T-science builds on the values of a theory, not the logical rules so familiar to the

sylogisms of deductive and inductive reasoning. A theory's success is judged on the multiple interconnections of 1) empirical adequacy (deductive accounting for all relevant data), 2) theory fertility, 3) unifying power (the compatibility of previously disparate domains of facts) and 4) consistency (or correlation) with other theories. These four criteria of virtuous theories make up the basis for terming a theory successful in the evaluative stage of a retroductive inference. These criteria, it should be carefully noted, are not criteria formulated in a pre-apprehension or *a priori* epistemology, but rather because they are simply employed by the scientist (in S2 science).⁹⁰ According to McMullin, truth is suggested by successful theories, which cluster over time in developing schemes of recurrence. Realists who prefer to directly infer truth on the basis of verified theories tend to ignore the possibility of further developments in the field that might occur in related inquiries, through which already extant successful theories are, in spite of their explanatory success, subject to radical modification.

Truth is at stake in the validation or judgment of scientific theories, but not as it was in earlier realist positions. It is involved, in a broader context of successful theories and a growth in knowledge in pattern of probability.⁹¹ Again, truth cannot be directly inferred in discussions of theory, successful theory, explanatory success, retroduction or even realism taken by itself. A quick route from scientific explanation to truth is not available simply because science is an ongoing activity. Truth is affirmed by confirming clusters of successful theories that converge as validating hypotheses and theories.

The pragmatist notion of success that McMullin takes over and incorporates with virtue and imagination in his realist position is further justified by reference to the particular virtue of fertility in the process of verification. Theory fertility, as the list of the four virtues shows, is only

one of several virtues that assists theory verification. But, in terms of the dialectic between realists and anti-realists, the issue of theory fertility is very important, which is why McMullin mentions it.

McMullin highlights fertility's importance in an article for a *festschrift* in his honour.⁹² Theory fertility is a *diachronic* issue that describes the definitive advance in the growth of knowledge over time, a linchpin factor in scientifically realist accounts. Unlike the virtue of empirical adequacy whose importance belies an association with van Fraassen and the empiricist philosophical position, theory fertility is a virtue that predicts *novel* facts and anomalies.⁹³ This demonstrates the capacity for insight that operates when the human imagination at work in the natural sciences. Due to the search for an understanding of explanations, the notion of fertility supplements and largely fulfills the single criteria of "empirical adequacy" that characterizes van Fraassen's position.⁹⁴ McMullin seeks to go beyond van Fraassen's proposal by showing that scientists in fact employ a broader range of virtues in practice rather than the single criterion of whether or not the theory is empirically adequate to the data.

Fertility is one of three different criteria which he terms 'diachronic.' The other two are continuity and consilience.⁹⁵ In a more recent article, McMullin has further revised his set of terms concerning theory appraisal. He outlines a typological distinction between internal, contextual and diachronic virtues that are explanatory in intent, and complementary to van Fraassen's minimalist criterion of 'empirical fit' or 'adequacy.' What McMullin calls diachronic virtues are *the most significant class*. These are the virtues of a theory that show themselves over a period of time. This cluster of three types of virtues or value descriptions for a 'good' theory express what McMullin has repeatedly suggested in other ways what the realist position is. The

'career' or emergence of a theory's truth or explanatory power is the affirmation of a realist. A theory expresses a measure of this truth or power when it

"displays just the sort of resources over time that one would expect of it if it were (approximately) true...[giving] a *prima facie* case for supposing that it is, in fact (approximately) true."⁹⁶

Yet, the meaning of a theory's fertility goes beyond the diachronic. As McMullin suggests in an earlier article, the fertility of a theory is 'past oriented', not future oriented as the term might suggest. However, based on past success, the future of a theory is fertile if it promises new and novel findings, but not in any *a priori* fashion. The connection between McMullin's emphasis on a theory's fertility and his emphasis on a modified realism in response to traditional realism is unmistakable:

"(I)t is *proven* fertility (P-fertility) that confirms the truth-value of a theory, not its as-yet-untested promise (U-fertility)."⁹⁷

A theory is thus appraised (in the second evaluative phase of a retroductive inference) not in the positivist sense of it as conforming to a logical set of propositions, but rather as a more abstract set of propositions in accord with a model.⁹⁸ With the emergence of structures that are postulated by theories, we have the explanatory success that I have already spoken of, the kind of success that is even further supported by the other two diachronic virtues: continuity and consilience.

What does this discussion of fertility imply? The answer to this question lies in the final section of the article "Epistemic Virtue and Theory Appraisal." McMullin introduces a form of reasoning akin to Ockham's Razor in order to judge the inadequacy of quasi-instrumentalist positions in the philosophy of science. According to McMullin,

"critics of realism are reluctant to accept the instrumentalist label; the inadequacy of instrumentalism is too well documented historically. And so they present themselves as

agnostic[...] Someone who denies that the explanatory success of theory gives a warrant of any sort for asserting the existence of the sort of entities postulated by the theory seems forced to hold that the function of theory is to serve as an instrument of prediction, no more.”⁹⁹

Strategies of argumentation that are positioned critically toward realism, as in van Fraassen’s work, straddle an uncomfortable middle ground. In light of the significance of theory to knowledge gained of theoretical entities, McMullin suggests that anti-realists are obliged to say “act as a realist would in theory assessment, but don’t ask why it works.”¹⁰⁰ This critique is enormously significant. It recognizes that the crux of the realist position bears on the capacity and the *willingness* to ask further questions. As a result of asking why something ‘works,’ the realist seeks and is guided by the epistemological coherence that emerges through the process of pushing the meaning of a theory to its limits with the accumulation of virtues over time. The historical practice of scientists has tended to yield the cumulative virtuous features of theories, “features that can best be understood from a realist viewpoint.”¹⁰¹ So, realism is a position that merely advocates for a harmony that results from a willingness to ask further questions in light of the emergence of structure in widening explanations of natural process. Retroduction captures the spirit of realism while remaining true to what occurred in fits and starts historically, while seeing the smooth trajectory of inquiry being forged by the incredible success of the human imagination.

2.9 A Note on Dialectics Relevant to the Science-Theology Literature

One line of analysis McMullin makes that is of significant interest to participants in the science-theology dialogue lies in the second part of his 1976 article on fertility and the appraisal of science. In that article, he reconfigures the arguments of Karl Popper and the rationalist/ positivist/ Vienna Circle school. McMullin tackles the well known concept of ‘falsification’ that

underpins this school in the philosophy of science. Through a careful analysis of thinkers such as Carl Hempel, McMullin shows that the criteria of fertility in theory assessment is actually present in the deductive or strictly logical interpretations of the philosophy of science much like McMullin's analyses of Aristotle's work in astronomy (see chapter three). Such thinkers as Hempel, according to McMullin, had to make serious allowances for looser virtues such as fertility in their later work. This is especially true in the post-1960 period when more historical interpretations of the philosophy of science became very popular. Such allowances became more necessary as the positivists felt obligated to respond to the historicist critique. Noting these concessions, McMullin emphasizes the unpredictable nature of theory, and its characteristic basis in human imagination to "predict novel and unexpected results,"¹⁰² something out of step with logical positivist tradition. Yet, in the end, neither the positivists nor the historicists are able to recognize the criteria of fertility as part of a general retroductive-like theory of inference in making appraisals and judgments. Each school of thought, for their own reasons, stopped short of asking about how to "understand what it is that makes it possible to separate ad hoc theories from good theories."¹⁰³

Surprisingly, McMullin's analysis is also salient in the science-theology dialogue because of his analysis of Imre Lakatos, a thinker who has managed to capture the attention of some theologians, especially Nancey Murphy and Philip Clayton.¹⁰⁴ But, since Lakatos's work involves a historical interpretation of scientific history, this study concentrates on McMullin's critique in chapter three which addresses the history of science. On McMullin's theory of scientific rationality, there is a greater harmony in the act of knowing as a basis for understanding critical realism, not a nominalist or historicist understanding.¹⁰⁵

2.10 Ontology and Scientific Realism

One of the most fascinating and important facets of McMullin's treatment of scientific realism and a theory of retrodution is his affirmation of philosophical ontology. The issue of the existence of entities lies at the heart of the realist/antirealist debate.¹⁰⁶ Since the task of theorizing implies the act of assessing both human understanding and a judgment of reality simultaneously, McMullin affirms the ontological dimension of philosophy. This affirmation is qualified by the indirect method that McMullin works out in his philosophy of science. Nevertheless, an ontological dimension to scientific realism as it is affirmed through retrodution can be laid out.

With regard to this issue of ontology, McMullin offers a formulation of scientific realism with three key elements. First, there is the affirmation of the intelligibility and existence of unobservable, theoretical entities. Second, these entities are affirmed at the heart of what McMullin calls 'structural explanation.' Third, by highlighting the persistent fertility of good theories measured by their respective virtues, McMullin is able to contrast his own realist position with the antirealist one by identifying the latter as inherently instrumentalist. The ontological dimension to McMullin's version of scientific realism is thus quite different from the classical form of realism that proposes metaphysical understanding as a layer of philosophical discourse detached from the actual process of scientific explanation. From an early date, McMullin treats explanation and its diachronic empirical success as the foundation to all ontological understandings:

"It is only the continued success of structural explanation (and the failure of the substance-quality model) over several centuries of scientific progress that indicates where our ontological bets should lie."¹⁰⁷

In an effort that expands on Polkinghorne's teleological approach to metaphysics, and in

response to a specific ontological proposal by Milton Fisk, McMullin agrees that a revised ontological framework of “parts and wholes” is viable.¹⁰⁸ In a 1971 article, he grapples with the careful critique that Fisk makes about the ontological frameworks of other realist philosophers. But, Fisk’s aversion to “dispositional” parts and properties in entities is questioned by McMullin, who points out that

“The concepts of contemporary science are incurably dispositional...it is not at all clear that the distinction between dispositional and non-dispositional, between capacity and property (in Fisk’s sense) can be satisfactorily drawn...”¹⁰⁹

The problematic status of an entity’s ‘nature’ or ‘capacity’ (the kind of philosophical categories that are the object of so much anti-realist critique) is reformulated by McMullin. He does so on the basis of what scientists actually do (S2) in contrast to Fisk’s modified neo-Aristotelianism, and in contrast to the ontological minimalism of the logical empiricist philosophy of science.

The insight McMullin extends to this discussion of ontology is that no understanding of science can be separated from what scientists and philosophers do in the act of scientific explanation. Only with this insight can the success of the empiricist tradition be authentically engaged through attention to the act of explanation in science. After all, this is what empiricists and other anti-realists think forms the strength of their position.

In a most revealing text that ends his response to Fisk, McMullin lays out his understanding of ontological parts and wholes using the terms set by Fisk and to a lesser extent, the Aristotelian tradition:

“...instead of an ontology of parts, properties and natures, in which capacities are regarded as secondary and reducible precisely as were Locke’s “powers”, we are proposing an ontology of parts and properties, in which the dimensions of capacity and nature are already contained in the notions of part and property. The causal necessities [Fisk’s chief concern] are rooted in the natures of the parts and properties themselves, regarded as

parts and properties.”¹¹⁰

McMullin is alert to at least two issues at stake in the proposal of an ontological framework for scientific activity. First, he warns of the danger of postulating an ontology in categories or levels of reality separate and distinct from scientific practice and scientific discovery. Again, this is the issue of avoiding the pitfalls of a neo-Aristotelian categorical system.

Second, and following from the first point, McMullin transposes the Aristotelian elements of potency, form and act conjoined with substance and accident to rework these elements in a network such that potency and form (capacity and nature) are not separate essences apart from the actual, investigated physical reality in question. The ‘necessity’ Fisk proposes is redefined so that it is sublated within a moving system that is always larger, and in some sense beyond the necessity of any one part or property. Necessity is not a final category to which other ontological elements are disposed: “There is thus a necessity *in a sense unaccounted for* (italics mine) at the end of every physical explanation.”¹¹¹ The unaccounted aspects of ontological necessity are accounted for by the moving heuristic system itself that is itself ‘pre-dispositioned’ to ask further questions relevant to the status of the theory in question or some related scientific data, to use the teleological language present in Fisk and McMullin.

Furthermore, whereas Fisk seeks to transpose the realist, Aristotelian framework in order to affirm a philosophical ontology based on the insight that non-reductive “complexes” function as explanatory, McMullin does something different. Relying on the “appeal to the practice of physical explanation”, McMullin affirms a physical “nature,” though it is a “nature as exhibited in the dependable regularities of causal succession at all levels equally, that of complex as well as part.”¹¹² A reductionism to the ‘whole’ does not offer a solution to ontological inquiry. Though

different from most contemporary forms of reductionism, it would still be a reduction.

There is a traditional Aristotelian character to McMullin's chosen ontological terms and relations. He emphasizes disposition, succession and the teleology of an ontological result for scientific explanation. What is startling however, is the way in which he concludes this article by rejecting excessive metaphysical qualities for such ontological constituents as 'capacities' or 'natures' "over and above parts and properties." At the same time, McMullin holds onto the time-honoured distinction between potency, form and act in substances and accidents as the best available form of ontological explanation:

"No such components seem to occur either in science or in pre-scientific explanation. Nor are they required, provided that the other explanatory elements called upon (part and property) are regarded from the beginning as 'natural', as interacting 'by nature' in a regular and dependable way within complexes, in the context of which alone can their capacities be fully exercised."¹¹³

The three stages of 'nature', understood as potencies, forms and acts is a strategy designed to account for the universe by appealing to the natural character of that which is scientifically investigated and reflected upon through philosophical questions. Adding unnecessary categories in order to define the real would, on my interpretation of McMullin, constitute an over-abstraction. It would be a metaphysics that would be too distant from scientific operations, especially imaginative strategies that seek theory verification. So, he avoids excessive abstracting of the results of structural explanation. Retroduction is not a recourse to an ontological layer of understanding that pertains merely to the act of explaining. The empirical warrant is that the supporting virtues of theory verification are born in the capacities of nature to be explained as part, property or another element in a scientific explanation.

The appeal to metaphysical categories that would exist apart from the explained nature of

physical systems in their multi-staged realities would neither conform with the historical trajectory in the natural sciences. Science has repeatedly thrown up insoluble difficulties to categorical metaphysics. One need only think of Leibniz's "monads" or even Bergson's *élan vital*, whose communicative ability has faded in the wake of scientific advances. Even though his corrective to Fisk's approach is brief, McMullin clearly distances his own ontological intuitions from a categorical framework. This is immensely helpful for natural theology, which has tended to make what in hindsight appears to be arbitrary selections from ontological systems in order to make analogical arguments for the existence of God. McMullin's approach, on the other hand, avoids the likelihood of an alliance with idealist or conceptualist philosophical frameworks. Unfortunately from the perspective of this investigation of McMullin's thought, this is one of the few occasions where he presents a full metaphysical interpretation of his theory of scientific rationality and scientific realism. Nonetheless, there exist other indicators that McMullin affirms the ontological conclusion to such reflections, and this is what this investigation must follow.

2.11 Conclusion

McMullin offers something different in both his epistemological evaluation of scientific knowing and the nature of the known itself. Even though he has not elaborated an ontological framework, he does show what an ontology is not. Rather, he focuses on a theory of explanation in the light of trying to understand what actually goes forward in the questions of scientific investigations, along with analysis of concrete historical events that show how this retroductive theory operates.

If, in contrast to an empiricist/positivist/instrumentalist interpretation of the sciences that exclude the question of God from consideration, theologians have recourse to a mere idealism,

systematic theology starting from nature would be incoherent. Ongoing investigations of physical reality have shown, since the seventeenth century, an increasing malleability to outflank theological interpretations of the world. The sciences have an enormous potential to repeat this move if theologians base their natural theology on a particular category or concept that is insufficient in capturing the essence of ontological complexity. Theologians err if they seek to say more about nature than an understanding of scientific explanations permit. The 'nature' in natural theology needs to be more attentive to the act of explanation rather than imposing a limited ontological interpretation of reality. The stages of existence in parts and properties and the growth in knowledge affirmed with respect to explanation itself in the theory of retroduction is a much more reliable indicator of how nature is to be understood. With this strategy, theology is not captured by one particular component, category or ideal of reality, to which the theological question might happen to be most suited at this or that moment.

In establishing McMullin's own use of ontology and his particularly subtle, modified rendering of a metaphysical view based on an account of scientific knowing and knowledge, I argue that we have a solid foundation for what connects scientific realism with the broader notion of critical realism. On McMullin's account, critical realism is made possible from this secure theory of scientific knowledge, because of the peculiarly indirect and cognitively attentive account of scientific explanation. This account takes theories, models, hypotheses and their assessment as intentional and as empirically verifiable activities that combine to advance scientific knowledge over time. Moreover, this account is broader than the 'flat' account of the instrumentalist or positivist ones. It permits an understanding of what these explanations mean in terms that are more familiar to a broader philosophical outlook that encompasses a multi-faceted

appeal to the structure of knowing in the human subject. By attending to this account of the structure of knowing, the step from scientific realism to critical realism is clarified.

Critical realism cannot be understood as a philosophical position that attempts to merely expand what the Gifford Lecturers maintain at a more descriptive level. With McMullin's work in remedying persistent misunderstandings in the philosophy of science, I would argue that critical realism could become an explanatory term based on the distinct promise of its cousin term, scientific realism. This kind of realism would operate not just to explain how the sciences and theology can cooperate toward an integrated understanding of the world. It also explains the dynamism and finality of rational inquiry itself, as it moves from questions through multiple, varied and structured forms of knowledge to an affirmation of reality. If the purposeful and successful elements of structural explanation and retrodution are true with respect to scientific realism, critical realism might prove a richer notion to develop. It would not merely consist as an intermediate position between the historicist, subjectivist or empiricist/instrumentalist positions on one side and the logical, positivist and traditional realist position. Rather, it could communicate how it is that we know that we know. It would then be a metaphysical position. It would use scientific realism as a model in demonstrating how this works in the act of understanding scientific explanations and in particular, by shedding light on what scientists do in verifying theories about some aspect of natural reality.

With scientific realism established through retrodution, the unity and reality of the world is understood in light of the variety of forms in which human knowing is manifest, not in spite of them. On McMullin's account, scientific explanation has been understood to grasp the world as real successfully in certain domains, especially with regard to the success of theories in structural

explanations in disciplines such as geology. But, what about other domains, especially those where contemporary anti-realists, and other thinkers suspicious of theological claims as rational, point out as arguments against realism? Clearly, quantum mechanics and particle physics, fields in which a radical indeterminacy is evident, challenge the realist interpretation of reality. In these areas, further investigation to test the realist position is needed.¹¹⁴

On the other end of the scale, cosmology and large-scale physics are also implicated arenas for debate in which differing philosophical interpretations of reality are associated with significant aggregates of astronomical discoveries, which themselves suggest some sort of more immediate theological interpretation. Due to the ensuing cosmological controversies, and because cosmology is a more readily accessible subject for philosophers, I will address cosmology in chapter four. The contents of this field will complement the emphasis on method and the operations of knowing that were the focus of concern in this chapter. Once an application of McMullin's scientific realism has been investigated with regard to one discipline in particular, we shall have an empirical basis for proceeding with a fuller definition of critical realism.

In summary, McMullin's theory of retroduction and his defense of scientific realism appeals to the progress and philosophical justification for the growth of scientific knowledge. The growth itself is evident in the increasing number and complexity of theoretical and unobservable entity structures. These structures are really well understood by incorporating the classic methods of deductive and inductive inferences in retroduction. Retroductive inferences successively highlight the indispensable role of theories and hypotheses that imaginatively and heuristically operate with the intention to explain. When verified with regard to entities, truth is suggested. The realist takes the meaning of this process of explanation to be adjudicated by the

virtues of other relevant theories, especially the diachronic virtue of fertility.

Without a doubt, we are dealing with a complex series of interrelated analyses, each of which is directed towards diverse issues in the philosophy of science, and directed towards a variety of thinkers from a broad array of traditions in philosophy, some of whom have engaged McMullin on these issues in a sustained way.¹¹⁵ The complexity of McMullin's contributions stem in part from the fact that he has addressed a diversity of issues in such a variety of fora, and with suggestive presuppositions contained in many of his works that are based only partly in other work he undertakes elsewhere. His writing in ontology is the clearest example of this: he has addressed the issue only formally in one article published in 1971. Yet, all his writings since that article on scientific realism and explanation presuppose some sort of ontological dimension that is similar to the tentative outline he puts forward in that article.

In making the interpretation outlined here, one can see that McMullin's treatment of metaphysics is more implicit than explicit. He indicates that a metaphysic is available, but not specifically what it is beyond ontological constitution. This indicates an area where his scientific realist position could be further strengthened. Nevertheless, questions such as the historical reading of science and cosmology are two fields which McMullin has addressed extensively. Insights into the relationship between these areas and scientific realism can verify his theory of retrodution. If retrodution itself is verifiable, we can be confident that certain implications for natural theology can be made. The key to the natural theology undertaken by the Gifford Lecturers can be extended, once investigations into the key historical and cosmological issues have been considered.

Endnotes

1. The most important articles are: "Epistemic Virtue and Theory Appraisal" in Igor Douven and Leon Horsten, eds. *Realism in the Sciences: Proceedings of the Ernan McMullin Symposium, Leuven, 1995*. (Leuven, Belgium: Leuven University Press, 1996), pp. 11-34; "How should cosmology relate to theology?" in Peacocke, Arthur, ed. *The Sciences and Theology in the Twentieth Century* (Notre Dame, IN: University of Notre Dame Press), pp. 17- 57; "The Nature of Scientific Knowledge: What Makes It Science?" in McLean, G. ed. *Philosophy in a Technological Culture* (Washington, DC: Catholic University of America Press), pp. 28-54; "Is There a Philosophy of Nature?" in *Proceedings of the 14th. International Congress of Philosophy*, Vienna 4 (1969), pp. 295-305; "Capacities and natures: an Exercise in Ontology" in *Boston Studies* 11 (1971), pp. 6 3-82; "Structural explanation" in *American Philosophical Quarterly* 15 (1978), pp. 139-47; "Is philosophy relevant to cosmology?" in *American Philosophical Quarterly* 18, pp. 177-89; "A Case for Scientific Realism" in Lepplin, J., ed. *Scientific Realism* (Berkeley: University of California Press, 1984), pp. 8-40; "Realism in theology and in science: A Response to Peacocke" in *Religion and Intellectual Life* 2 (1985), pp. 39-47; "The Fertility of Theory and the Unit for Appraisal in Science" in Cohen, R.S., ed. *Boston Studies* (Lakatos Memorial Volume) 39 (1976); *The Inference that Makes Science* (Aquinas Lecture) (Milwaukee: Marquette University Press, 1992). Other articles will be employed to supplement the kernels of insights found in these articles.
2. Jean Ladrière, "The Role of Philosophy in the Science-Theology Dialogue" in Niels H. Gregersen., Ulf Görman and Christoph Wassermann eds., *The Interplay Between Scientific and Theological Worldviews, Studies in Science and Theology*, vol. 5 (Geneva: Labor et Fides, 1997), p. 225.
3. *ibid.* p. 234.
4. Peacocke alludes to these debates in his narrative history of the question in *Intimations of Reality*, as mentioned in chapter one.
5. Nancey Murphy, *Anglo-American Postmodernity: Philosophical Perspectives on Science, Religion and Ethics* (Boulder, CO.: Westview Press, 1996), p.3.
6. For example, see the critique by Wentzel van Huyssteen, "Postfoundationalism in Theology and Science: Beyond Conflict and Consonance" in *Rethinking Theology and Science: Six Models* (Grand Rapids: Eerdmans, 1998), pp. 13-49. Doubts about the efficacy of critical realism are confirmed in the weaknesses of its defence by Kees van Niekerk's claim in "A Critical Realist Perspective on the Dialogue Between Theology and Science" (in *Rethinking Theology and Science*, pp. 51-86) that metaphysical realism is a presupposition for critical realists. The logical fallacy here is akin to the way that naive realists put so much stock in sense experience *per se*.
7. Cushing, J.T., Delaney, C.F. and Gutting, Gary M., eds. *Science and reality: recent work in the philosophy of science: essays in honor of Ernan McMullin* (Notre Dame, Ind. : University of Notre Dame Press, 1984) and "Epistemic Virtue and Theory Appraisal" in Douven, Igor and Horsten, Leon, eds. *Realism in the Sciences: Proceedings of the Ernan McMullin Symposium, Leuven, 1995*. (Leuven, Belgium: Leuven University Press, 1996), pp. 11-34.
8. "Insight and the Meno" in *Continuum* 2 (1964), pp. 369-73.
9. From a personal communication.
10. (Grand Rapids: Eerdmans, 2000).

11. McMullin is mentioned in the book *passim*, notably and most frequently with regard to the significance of the critical realist position..

12. (Cambridge University Press, 1996).

13. He even goes so far as to cite McMullin as an opponent of metaphysical realism, because of McMullin's focus on scientific realism without the *a priori* support of metaphysical realism (p. 139). This interpretation, while it may seem viable from a consideration of one isolated text of McMullin's, does not do justice to McMullin's appreciation of wider philosophical implications worked out over the course of his career, as we shall see.

14. McMullin. "History and Philosophy of Science: A Taxonomy" in R. Stuewer, ed. *Historical and Philosophical Perspectives of Science* (Minneapolis. University Press, 1970) pp. 12-67.

15. *ibid.* p. 15.

16. *ibid.* p. 16.

17. *ibid.*

18. McMullin. "The Nature of Scientific knowledge: What Makes it Science?" in George McLean, ed., *Philosophy in a Technological Culture* (Washington, DC: Catholic University of America Press, 1968) p. 29.

19. *ibid.* pp. 30-31.

20. See "The Goals of Natural Science" in the *American Philosophical Association Proceedings and Addresses* vol. 58 (1984), p. 52.

21. *ibid.* p. 37ff.

22. "The Goals of Natural Science". p. 40.

23. *ibid.* p. 41. D-science is particularly associated Aristotle's fourfold division of causes.

24. Yet, in contradistinction, some view the scientific revolution and the Enlightenment as a turn to the *vita activa* away from the *vita contemplativa*. See, for example, Alexandre Koyré, *From the Closed World to the Infinite Universe* (Baltimore: The Johns Hopkins University Press, 1957), p. vii where he describes the shift in terms of an alleged "conversion of the human mind from *theoria* to *praxis* [...]" which transformed man from a spectator into an owner and master of nature [...]" What Koyré refers to here should, on my reading of his interpretation of the scientific revolution, is the dissolution of a metaphysical worldview in favour of a more experimentally controlled method. As we shall see, the vaulting of theory onto center stage in this method is a hint that metaphysics could not be ultimately rejected.

25. See p. 51: "The notions of theory and theoretical entity are thus central to this newly emerging model of science, which we can call *T-science*. In *T-science*, the predictive power of *P-science* blends with the explanatory force characteristic of *D-science*. There can no longer be a science which merely predicts, or one which merely explains."

26. "To direct the same term 'science' to all of this diversity is not to render the term equivocal.", p. 52

27. "The Goals of Natural Science", pp. 53-4.

28. *ibid.*, p. 56.
29. *ibid.*, p. 57.
30. *ibid.*
31. *ibid.*
32. See "The Nature of Scientific knowledge: What Makes it Science?", especially pp. 31-38.
33. For a recent analysis of science in the Aristotelian tradition, see Patrick Byrne, *Analysis and Science in Aristotle* (SUNY Series in Ancient Greek Philosophy (Albany: SUNY Press, 1997).
34. McMullin, "Philosophies of Nature" in *New Scholasticism* 43 (1969), p. 30.
35. *ibid.*, p. 55.
36. Three reasons for the wane of neo-Aristotelianism are noted as a result of this critique: 1) how can a "pre-scientific" philosophy of nature be epistemologically justified in light of the discoveries into force and time? 2) A "common core" of experience is difficult to advance in light of linguistic and cultural analysis, 3) a philosophy of nature that is prodded into serving a more generalized function risks obscurity and triviality, and 4) Aristotelian concepts such as substance and prime matter are, in light of contemporary advances, ontologically non-determinative. See *ibid.*
37. See "The Nature of Scientific Knowledge: What Makes it Science?", p. 33.
38. See McMullin's discussion of Wallace's *Galileo and his Sources* in *The Inference that Makes Science*, pp. 58-63.
39. See *The Inference that Makes Science*, p. 64.
40. *ibid.*, p. 65. See also McMullin's critical review of Wallace's notes that accompany his commentaries on the translation of Galileo's *Tractatio de Praecognitionibus et Praecognitis* and *Tractatio de Demonstratione* (Padova: Editrice Antenore, 1988) in *Journal of the History of Philosophy*, 30, pp. 608-612.
41. "A Case for Scientific Realism" in Leplin, J., ed. *Scientific Realism* (Berkeley: University of California Press), pp. 8-40
42. Cf. the articles by Niels H. Gregerson ("A Contextual Coherence Theory for the Science-Theology Dialogue", pp. 181-231) and Wentzel van Huyssteen ("Postfoundationalism in Theology and Science: Beyond Conflict and Consonance", pp. 13-49) in Gregersen and van Huyssteen, eds. *Rethinking Theology and Science* (Eerdmans, 1999).
43. "A Case for Scientific Realism", p. 10.
44. *ibid.*
45. *ibid.*

46. *ibid.* p. 12.

47. Certainly, McMullin has written much about the scientific revolution and he assumes a similar evaluation of the rift that developed between science and philosophy.

48. *ibid.* p. 13.

49. *ibid.* p. 12.

50. *ibid.*

51. This is the notable reason behind why Lonergan classifies scientific investigations as basically twofold: classical and statistical. Statistical investigations are those associated with chaotic systems, such as weather patterns or micro-level material behavior that can be known only through recourse to probability.

52. *ibid.* p. 14.

53. *ibid.* p. 15.

54. *ibid.*

55. *ibid.* p. 16.

56. *ibid.* p. 25.

57. quoted by McMullin, p. 35 from Bas van Fraassen, *The Scientific Image* (Oxford: Clarendon Press, 1980), p. 8.

58. *ibid.* p. 24.

59. *ibid.* p. 26.

60. See Peacocke's citation of McMullin in *Theology for A Scientific Age*, p. 12.

61. *ibid.* pp. 26-27.

62. *ibid.* p. 35.

63. *ibid.* p. 36.

64. "Truth and Explanatory Success", p. 214.

65. "Models of Scientific Inference", p. 6.

66. "Determination and Underdetermination in the Natural Sciences" in Sdravko Radman, ed., *Horizons of Humanity: Essays in Honour of Ivan Supek* (Frankfurt am Main: Peter Lang, 1997), p. 43.

67. *ibid.*

68. *ibid.* p. 29.

69. *ibid.*

70. *ibid.*

71. Cf. *American Philosophical Quarterly* 15, pp. 139-47.

72. See section 2.5 earlier in this chapter.

73. "Structural Explanation", p. 139.

74. *ibid.*

75. *ibid.*

76. *ibid.*

77. *ibid.* p. 143.

78. *ibid.*

79. *ibid.* p. 145.

80. *ibid.*

81. *ibid.*

82. *ibid.*

83. *ibid.* pp. 145-47.

84. *The Inference that Makes Science*, p. 98.

85. "The Shaping of Scientific Rationality: Construction and Constraint" in *Construction and Constraint: The Shaping of Scientific Rationality* (Notre Dame, IN: University of Notre Dame Press, 1988), p. 41.

86. *ibid.*

87. Explanatory success and explanatory power are seemingly interchangeable. The latter phrase is employed for example, in "Enlarging the Known World" in J. Hilgevoord ed., *Physics and Our View of the World* (Cambridge:Cambridge University Press, 1994), p. 104.

88. On my reading of McMullin, I would extend William Stoeger's understanding of retroduction, to include a full appreciation of verification occurring over time as a structuring element of inference. Stoeger states that retroduction *complements* deductive and inductive reasoning. (See Stoeger, "Contemporary Cosmology and the Science-Religion Dialogue", p. 246, note 23.) But, in the article of McMullin's cited by Stoeger ("Models of Scientific Inference" in *CTNS Bulletin*, vol.8, n.2), McMullin clearly identifies retroduction as a much more complex model, really a theory

of explanation that *replaces* and takes up the deductive and inductive models by encompassing these types of inference in a single meta-inference that explains explanation itself.

89. See "Truth and Explanatory Success" in *Proceedings, American Catholic Philosophical Association* 59 (1985), pp. 206-31.

90. *ibid.* p. 214.

91. The phrase emergent probability is a related phrase that metaphysically accounts for the objective pole, the *explananda*. This is borrowed from Bernard Lonergan's extensive employment and definition of that term in *Insight: A Study of Human Understanding* (London: Longmans, Green and Co. Ltd., 1957) and Frederick E. Crowe, and Robert M. Doran, eds., *The Collected Works of Bernard Lonergan*, vol. 3 (Toronto: University of Toronto Press, 1992). This thesis does not so much deal with emergent probability as the conditions in a theory of scientific knowing that positively allow for the affirmation of reality as emergent and probable. The issue of truth and probability is aptly summarized by Lonergan as follows: "But if empirical science is no more than probable, still it is truly probable. If it does not attain definitive truth, still it converges on truth." (See *Insight*, p. 328).

93 "Epistemic Virtue and Theory Appraisal" in Igor Douven and Leon Horsten, eds. *Realism in the Sciences: Proceedings of the Ernan McMullin Symposium, Leuven, 1995*. (Leuven, Belgium: Leuven University Press, 1996), pp. 11-34.

93. "Truth and Explanatory Success", p. 214.

94. Bas van Fraassen's most developed positions are developed in *The Scientific Image* (Oxford: Clarendon Press, 1980).

95. It is interesting how a discussion of scientific virtues carry popular meaning in contemporary studies. Consilience, to choose an example, is the subject of a wide-ranging book by E.O. Wilson intended to address the convergence of investigations in the natural sciences. See E.O. Wilson, *Consilience* (Vintage Books, 1999).

96. "Epistemic Virtue and Theory Assessment", p. 26.

97. See "The Fertility of Theory and the Unit for Appraisal in Science" in Cohen, R.S., ed. *Boston Studies* (Lakatos Memorial Volume) 39 (1976), p. 400.

98. *ibid.* p. 401.

99. "Epistemic Virtue and Theory Assessment", p. 29.

100. *ibid.* p. 30.

101. *ibid.* p. 31.

102. "The Fertility of Theory and the Unit for Appraisal in Science", p. 403.

103. *ibid.*

104. Interestingly enough, the Gifford Lecturers (seemingly as an exceptional group within the larger ensemble of thinkers) have chosen to illustrate and extend their methods of critical realism without depending on the thought of

Lakatos. The lack of engagement with such a historical philosophy of science by the Gifford lecturers would seemingly be rectified by employing the thought of a figure like Lakatos. However, with McMullin's approach, I argue that there is a deeper engagement with realism and the historical record.

105. However, the adherence to critical realism by those who work with the thought of Lakatos seems to advocate a form of nominalism, and is thus unsystematised in its intent. For an example of a theological treatment of Lakatos' thought, see Duane Larson, *Times of the Trinity: Toward a Theistic Cosmology* (New York: Peter Lang, 1995), especially the last chapter. A more in depth engagement with Lakatos is made by Nancey Murphy in her work, but her approach also includes an explicitly post-foundational stance, something which puts into question the extent to which her work is actually critically realist.

106. See McMullin, "Enlarging the Known World", p. 79 and "A Case for Scientific Realism", p. 15.

107. See "Capacities and Natures: An Exercise in Ontology" in *Boston Studies* 8 (1971), pp. 77-78.

108. McMullin's response to Fisk should be viewed as a debate between two realist philosophers, and one in which McMullin's later developments in retrodution and structural explanation are not yet implicated. Fisk's ontological framework, as it is spelled out in his preceding article ("Capacities and Natures", pp. 49-62) and in his work *Nature and Necessity: An Essay in Physical Ontology* (Bloomington, Ind.: Indiana University Press, 1974) is a reworking of Aristotelian themes in order to provide a concrete empirical basis to counter the empiricist/post-Humean interpretation of physical reality. Fisk's effort seems to be based primarily in the resuscitation of the notion of necessity as a valid metaphysical concept that warrants objective judgments about the world. McMullin's realist strategy is far less convinced about the existence of necessity, and more influenced by something like finality or some sort of teleological purpose in reality. This strategy becomes clearer and bears fruit, in the end, when taken into consideration along with the discipline of cosmology. It is through cosmology, as we shall see in chapter three, that realism, meta-philosophy and theological concerns are issues that become joined.

109. "Capacities and Natures: An Exercise in Ontology", p. 79.

110. *ibid.*, pp. 80-81.

111. *ibid.*, p. 81.

112. *ibid.*

113. *ibid.*

114. Patrick Heelan has made substantial headway in this direction with his investigation of the Copenhagen interpretation of sub-atomic indeterminacy. See Patrick Heelan, *Quantum mechanics and objectivity: a study of the physical philosophy of Werner Heisenberg* (The Hague: M. Nijhoff, 1965).

115. In a book devoted to McMullin, James T. Cushing, C.F. Delaney and Gary Gutting have collaborated to produce a volume with contributions that treat themes proximate to the issue of scientific realism. See *Science and Reality: Recent Work in the Philosophy of Science* (Notre Dame: University of Notre Dame Press, 1984) in which Ronald N. Giere, Philip Quinn, Larry Laudan, Nancy Cartwright, Bas van Fraassen, Edward MacKinnon and Adolf Grünbaum among others are authors.

Chapter Three: Retroduction, Human Rationality and the History of Science

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3.1 Introduction

In this chapter, the question is whether it is possible to verify a theory of scientific explanation in response to the legacy of Thomas Kuhn. How can McMullin's theory of retroduction as a basis for scientific realism be taken up as the basis for a refined notion of critical realism? Many possibilities in the philosophy of science exist in this vein. Like theology, the philosophy of science possesses its own recent history of turbulence. As was indicated in chapter two, one event in particular stands out in this regard, as described by Patrick Byrne:

"The most significant event in recent philosophy of science has been the publication of Thomas Kuhn's *The Structure of Scientific Revolutions*. [...] the significance of the book comes down to this: philosophy of science from now on must be reflection on the history of science."¹

Although Byrne's short essay is intended to highlight the problems of pitting necessity against contingency in scientific method consistent with Eric Voegelin's recovery of unity in the face of paradoxical features of existence, he identifies a central problem in philosophy that underpins the epistemological and philosophical antinomies of the Gifford Lecturers:

"The consciousness of the modern scientist is indeed a participation in the community of being, a "something in a comprehending reality," but it is *not* principally a matter of intending a reality over against its embodiment."²

In light of the strategies employed by historic figures such as Newton and Einstein to explain the nature of physical reality, defenders of a naïve form of scientific realism have tended to defend conceptions of an embodied reality to which inquiry proceeds in the spirit of confrontation. In chapter two, McMullin's critical engagement with his own philosophical tradition was analysed in order to make this very distinction. Deductive or syllogistically framed philosophies of science resemble this kind of understanding. Like McMullin, Byrne wants to

incorporate a study of historical contingencies into a realist position, rather than leave these factors out of the equation. His purposes are more explicitly metaphysical than McMullin's, but they capture precisely the sense in which McMullin treats the general issue of the history of science. How does this counter-intuitive strategy work?

The connection between the epistemological analysis developed by McMullin that was covered in chapter two and the historical focus of this chapter is to verify what Byrne is suggesting. McMullin shows how retroduction is a theory of scientific explanation that is realist and also revealing of the richness of human rationality in general. This feat sets the stage for understanding the existential and theological significance of existence in general, particularly through the discipline of cosmology. Cosmology's special role will be examined in chapter four. The benefit of employing McMullin's thought is to see how a theory of successful scientific explanations geared to producing a scientific realist position is established on the actual historical record. Moreover, it extends to the most contemporary limit discipline imaginable - cosmology.

It is conceivable that other lines of analysis could focus on the notion of truth or, for example, the role of language in legitimately arguing for a realist theory of rationality. But, the historical study of science has provided the scientific realist with an unprecedented opportunity to support realism with a grasp of the historical factors that led to the initial breakdown and re-emergence of interdisciplinary linkages. At the same time, retroduction's chief credential is its ability to explain scientific history without glossing over the forms of scientific breakthrough or decline that might otherwise disprove the theory. Retroduction is inherently historical. It therefore provides for its own verification.³

The distinction between the strictly epistemological and the historical has already been recognised by K. Niekerk as the key operative distinction underlying the analysis and development of critical realism in science-theology discourse.⁴ This is certainly true in terms of the philosophy of science, since historical studies and philosophical studies have apparently gone their separate ways. Nevertheless, new perspectives in both epistemological and historical investigations are the fruit of the enthusiastic response to Kuhn's most widely read work, *The Structure of Scientific Revolutions* (University of Chicago Press, 1968).⁵ Kuhn's "revolution," in which the notion of paradigm became normative in successive studies, followed on the heels of other twentieth century developments in historical consciousness in the human and social sciences.⁶

Given the case for scientific realism made by McMullin, the question becomes how progress in the sciences, understood as a growth in understanding natural processes, can be verified as factual. First, it is necessary to investigate the changes in the natural sciences over time in different contexts. Then, the question may be posed about what this progress signifies. Since this subject has already been covered in terms of what McMullin describes in scientific explanation, I will first turn to his discussion of various contingencies involved in scientific explanation, followed by his historical analyses where he sees scientific rationality as operative.

3.2 The History of Science: Background to Constructing Critical Realism

In a recent article on the determinative capacity of theories to explain in various fields in the natural sciences, Ernan McMullin has diagnosed a problem in the way that the sciences are interpreted and understood in contemporary culture. The problem arises insofar as these acts of interpretation are carried out with the aid of philosophers, and moreover, in light of the impact of

different social contexts that comprise multiple combinations of active “psychological, economical, political and other factors”:

“The cumulative effect of all these challenges to assumptions of determination is obviously considerable. It has led many philosophers of science (but few, if any, natural scientists) to one or other form of relativism [...] There is ample material here for the sociology of science; in particular, it would be important to know what social or political interests influence the judgments of those who maintain the omnipresence in scientific work of social or political interests. The debate itself underscores the importance of the issue of scientific realism [...] the various sources of underdetermination outlined here do not, in the end, undermine the objectivity of natural science though they encourage, indeed require, a healthy caution on the part of those who interpret its results.”⁷

In light of this indirect intersection between the position of scientific realism and the critique of the sciences in terms of a basis in the humanities, McMullin adds the startling claim that

“Those who press the challenge of underdetermination may easily find themselves rejecting scientific realism, *leaving themselves mute in consequence about much that is of human concern* (italics mine).”⁸

Although this quotation significantly foreshadows the conclusions that will later be drawn from this discussion of scientific realism, it is introduced here for two reasons in connection with the socio-historical critique of science.

First, McMullin reverses the usual logic by suggesting that a strictly historical approach to science is itself a form of imposition of “human concerns” too early in the investigation of science. This has the ultimate effect of distorting the real concerns that the socio-historical critique of science and other progenitors of postmodernism legitimately raise. This occurs through what can be described as an unintentional diminishment of human rationality through the intentional diminishment of the importance of scientific realism. If the affirmation of a real world through the effort to comprehend it is impossible, an impoverishment of human comprehension severs our own self-understanding, even when this occurs indirectly.

Second, the socio-historical critiques themselves raise a set of questions that help explain the actual difference between scientific realism on the one hand, and critical realism on the other hand. To repeat what was said earlier, there is a distinction that needs to be clear between the cognitional and epistemological issues that address scientific realism, and the more 'external' historically and sociologically oriented critiques of the natural sciences which pertain to critical realism. The determination and extension of this distinction foresees critical realism as a position that intermingles historical and epistemological understandings. Critical realism does not take away from the intention to account for truth in scientific explanation. It adds to its meaning in a more interdisciplinary framework that takes the differentiations or differently operative realms of meaning fully into account. The question is whether there is consistency or contradiction between scientific and critical realism. If historical analysis reveals scientific realism as a credible epistemological position, then critical realism can be advocated without thinking that the sweep of historical data will overwhelm epistemological analysis.

Critical realism, on a reading of McMullin's theory of retrodution, should be taken as an expansion of scientific rationality into a general theory of human rationality by its accounting of historical contingencies. As such, critical realism is both a general framework as well as a position on historical progress in knowledge. However, it is best suited as a philosophical position because of the way in which the breach between science and philosophy since the eighteenth century has impacted conceptions of interdisciplinary co-operation. As such, we begin to see the promise of retrodution's historical component in response to the contribution of Arthur Peacocke, who emphasizes interdisciplinarity without the requisite historical analysis behind his realist position. Whereas scientists ask about the world, philosophers pose the

question of the significance of such questions.

Whether inadvertently or not, Kuhn established an unbinding of science from a philosophical theory of rationality. According to McMullin, there is another option worth following. It is this option which I think best articulates the distinction being alluded to:

“We may still be able to construct a philosophy of science that derives *both* from the learning that has gone on in history *and* from a more general logical and epistemological framework.”⁹

The elements of epistemology and history are irreducible to one another in a philosophical position that takes both seriously. Moreover, they do not form a duality of opposition, as that between subject and object. It is a duality that merely distinguishes between scientific and critical realism. This duality refers to the operations of scientific reasoning of the scientist, and the understanding the significance of that reasoning beyond the confines of science. It does not fall into the problematic stance of interpreting critical realism where human rationality just extends a dialectical idealization of scientific rationality between the known object and the knowing subject. The implications of making this kind of connection is a skewed theological appreciation for rationality. The difference between the two theories of rationality parallels to some extent, the distinction that Ricoeur, among others, has highlighted as the difference between explanation and understanding. The positions of knowledge that I associate with scientific realism and critical realism neatly parallel other hermeneutical traditions that see similar distinctions in knowledge from the perspective of language and phenomenology.¹⁰

Taking up McMullin’s scientific realist position using his theory of retroductive inference, it should be reiterated that critical realism does not involve a turn to historical sources in order to demonstrate the fact of contingency. Rather, the historical subjective pole of a realist

framework is equally anticipated in a retroductive theory of scientific rationality as the objective pole. Moreover, this is not a detriment to the ontological conclusions that emerge in interpretive schemes of explanatory accounts. Instead, contingency of historical events is an indispensable basis upon which any theory of rationality could hope to function, because of the way imagination and values operate at the heart of scientific explanations.

The rethinking of the science-theology dialogue of this critical realist account of rationality welcomes the socio-historical perspective. It positively identifies that perspective with a possible occasion for scientific realists to authentically communicate the meaning of the realist position that naïve realists have been unable to achieve. This pertains, in the end, to the human concerns that McMullin speaks about at the end of his recent article on “underdetermination” in the natural sciences.¹¹ The result is a realist perspective that is critical, not because there is a lack or a decrease in knowledge, but because a historically verified interpretation of scientific knowledge is reached. The historical critique of scientific rationality, in light of the combined progress of science and the contingencies of theory creation and evaluation is an act of interpretation grounded in the empirical *telos* of science itself.¹² This will become clearer in chapter four’s treatment of cosmology.

3.3.1 A Philosophy of the History of Science: Thomas Kuhn and Critical Realism

By way of arguing for the scientific realist/critical realist distinction, it is best to go over several historical issues that McMullin has used to defend scientific realism and retroduction. What McMullin does is to analyse socio-historical factors in science by engaging other philosophers of science whose own work emerges from insights in these analyses. What they show is that a theory of scientific rationality yields the possibility of ontology as the result of

historical verifications of scientific theories, while acknowledging all of the various contingencies such as cultural context, conceptual limitations, technological barriers and other forms of bias, including cognitively rooted bias that shape any investigation. Below, I will examine the most salient points of McMullin's engagement with four figures: Kuhn, Lakatos, Galileo and Newton. The engagement with these different figures, two twentieth century philosophers, and two Enlightenment scientists, helps elaborate the significance of retrodution by demonstrating its capacity to clarify what was going forward in history.

The value of McMullin's work is poignantly evident through his engagement with the history of science literature, including and especially Kuhn's *Structure of Scientific Revolutions* (heretofore, *SSR*). McMullin takes up Kuhn's philosophical legacy and its indirect theological implications.¹³ Paradoxically, McMullin's work extends his reflections on scientific realism, but it has not received an adequate examination by the Gifford Lecturers or in other works of natural theology.

While much can be said about the reception of Kuhn's corpus and the differences between his early and later works, as well as the differences among his interpreters ranging from sympathy to antipathy, I will begin with an assessment in terms of how Kuhn was welcomed. I begin with McMullin's re-statement of a widely perceived fact:

"Kuhn's influence on the burgeoning anti-realism of the last two decades can scarcely be overestimated. His views on theory change, on problems about the continuity of reference, are reflected in the work of such notable critics of realism as Arthur Fine, Bas van Fraassen and especially Larry Laudan."¹⁴

But, McMullin identifies a disjunction within the Kuhnian enterprise that opens up an opportunity for scientific realists such as himself:

“Kuhn’s way of securing scientific rationality by focusing on the values proper to theory choice might well have led him (I argue) to a more sympathetic appreciation of realism.”¹⁵

Against the instrumentalist/anti-realist view of science that construes scientific history as a history of puzzle solving, McMullin cites Kuhn’s own study of the Copernican revolution in cosmology where it is clear that other values besides the empiricist’s favourite, “predictive accuracy,” led to the defeat of the Ptolemaic system. In a conclusion to an incisive article on the meaning of the Kuhnian legacy, McMullin describes it thus:

“The Kuhnian heritage is thus a curiously divided one. Kuhn wanted to maintain the rational character of theory choice in science while denying the epistemic character of the theory chosen. The consequent tensions are, of course, familiar to every reader of current philosophy of science.”¹⁶

What could this divergence between rationality and realism be about? In another article that touches on concerns proximate to the socio-historical contingencies which Kuhn highlights, McMullin discusses the role of rhetoric and the art of persuasion in the communities of scientists that Kuhn demarcates in terms of paradigmatic incommensurability. The issue of persuasion and authority is an issue about the relationship between a discovery or achievement on the one hand and scientific authority on the other hand. McMullin concludes “that[...] is what Kuhn’s book is all about [...] there can be no doubt that rhetorical concerns manifest themselves on every page.”¹⁷ Could Kuhn’s equivocation concern the role of human judgment in science? Assuming McMullin is correct on Kuhn’s concentration on linguistic concerns, it may be that the prominence of rhetoric and metaphorical language in communicating scientific theories has shrouded from view the value laden trajectory of theory evaluation. Thinking in terms of retrodution, this may simply reflect Kuhn’s unease with the complex intertwining of values at

this stage of theory evaluation. Either way, we have a plausible explanation for why he is ultimately not a realist in the sense that I am using the term. This would not be surprising from one point of view, given that theory evaluation is the less elegant, more painstaking task of waiting and judging the most plausible candidate among several competing theories.

But, according to McMullin, the linguistic concerns which Kuhn and his anti-realist followers have highlighted may not be the case against realism that they have assumed. In order to argue his case, McMullin draws on the historical evidence concerning the character of persuasive language or rhetoric. The background to this analysis is twofold. It implies the linguistically-centered critiques of contemporary philosophy of science. It also raises the interesting fact that theory plays the central role in relation to scientific history and in defining science as a communal enterprise. But, does the fact that convincing others of a theory's worth involves one in language-laden rhetoric weaken the significance that is eventually attached to that theory, once accepted? If so, can this significance be understood in a way that is not instrumentalist? Yes, the role of scientific rhetoric, given science's theoretical and hypothetical character, is not simply an addendum to the body of scientific knowledge due to its peculiar function of nurturing what McMullin terms the 'philosophical faculty'. Rhetoric possesses "the capacity for perceiving analogy, for creating lively metaphor [...] [and] requires the fortifying of imagination and memory."¹⁸

In light of contemporary ambiguity surrounding how rhetoric determines scientific rationality, McMullin identifies three ways that the language of scientific realism fits with a theory of scientific rationality. Rhetoric is defined in terms of one of three meanings 1) contrasted with logic, 2) linked with logic as part of the argument or 3) neutral with regard to the

flow of scientific explanation. If rhetoric is neutral, it can either be associated with a) the epistemic legitimacy of the *argument*, b) the non-epistemic efficacy of the *technique* or c) both and therefore intertwined. In the first two conceptions of scientific rhetoric, there is a narrow range of possible references for persuasion: either it is separate from the logical process of constructing a scientific consensus, or else it is an extraneous parallel to logic in the neo-Aristotelian sense given to logic as good argument. Neither of these approaches, however, does justice to the complex realities of the way in which language forges or denies agreement in scientific investigations. Relying on Putnam's phraseology, McMullin identifies the question at stake with the Kuhnian critique in mind:

"is the consensus brought about by the techniques of persuasion within the scientific community itself constitutive of the truth of theory, or are there conditions on how the persuasion itself is brought about?"¹⁹

The depth to which persuasion is intrinsic to scientific argumentation is significant for McMullin, because he also wants to defend particular types of values in theory choice, the 'subjective' linchpin to his theory of retrodution. The situation under scrutiny is commonplace:

"When a scientist wishes to persuade his or her colleagues to accept a particular theory in preference to other alternatives, the standard procedure is to urge that the theory possesses certain virtues."²⁰

The question remains how one can properly distinguish between the epistemic and the non-epistemic aspects of the rhetoric being used. Picking up on one of Kuhn's positive contributions, McMullin agrees with the citation of values over logic as the way in which theories are chosen and accepted. But, at some point at the level of what McMullin terms "second-order" values, there is a limit to how far these values may be understood in strictly rhetorical or social terms. If the pendulum swings too hard away from positivism toward a form of pragmatism, the resulting

position “interposes no barrier to ideology; it sets up no effective truth requirements for the considerations that are permitted to govern theory choice.”²¹ McMullin’s problem here is that he wants to preserve the epistemic character of scientific theory without confining the epistemic values merely to first-order “empirical adequacy” as van Fraassen demarcates it. The “ontological status” of the constructs of scientific theory is secured, according to McMullin, by welcoming the higher viewpoint of values brought in to evaluate theory (i.e.: theory fertility, coherence, simplicity etc.). This allowance to “second-order” values also explains the actual procedures of scientists.

The result is an enriching view of how language relates to scientific rationality. A general picture of human rationality is suggested by this investigation, which merely pays attention to the grounds for persuasion. Are the grounds internal or external? What is the difference between external grounds and values that, while not empirically internal to the investigation, nevertheless bear on how a theory is chosen. Accepted theories apparently require a middle range of values that hover between being internal and external. The development of scientific communities require such ‘pragmatic’ virtues in order to avoid what McMullin refers to as the “underdetermination” of theory. Empirical adequacy is simply not adequate for theory acceptance and therefore not sufficient for explanatory success.

What is the significance of McMullin’s citation of these second order virtues? McMullin refers to these values “external” to science in order to follow Kuhn’s own judgment that science proceeds according to certain values rather than sets of rules. What is remarkable here is how McMullin is able to decipher oversights in Kuhn’s analysis in a way that leads to a greater appreciation of the merits of scientific realism (in the way McMullin formulates it). In an essay

on scientific rationality, he notes:

“My aim is to note a conservative aspect of Kuhn’s analysis. He focuses mainly on changes in first-level science: in theories, in instrumentation, in textbooks and so on. He does not say much about changes in scientific rationality itself, in the second-level principles according to which the scientific undertaking itself would be directed [...] Indeed, he appears to suppose that in what he calls the “mature” sciences there is a common rationality marked by such shared values as predictive accuracy, consistency, simplicity, and so on.”²²

McMullin notes that in his later work *The Essential Tension*, Kuhn discusses criteria and values in theory choice as “fixed once and for all...”. These are “permanent attributes of science” according to Kuhn, to which McMullin comments that

“This is not, I dare say, the position one might expect someone to adopt who has so often been criticized for undermining the rationality of science.”²³

McMullin proposes a congruence between the belief in values that are both external and scientific and Kuhn’s embrace of more than mere logic in the make-up of scientific rationality. But McMullin’s discussion of select ‘external’ values, especially fertility, is an essential step in distinguishing such epistemically controlled or core virtues from within “social, political and other factors that influence theory decision.”²⁴ What I am suggesting is that a heuristic or guiding orientation at the heart of human rationality steers the epistemic and empirical control of science. The work of the imagination is the most obvious way in which this pursuit of knowledge is manifest.

On a reading of McMullin’s arguments, especially in light of his analysis of recent work of pragmatist philosopher of science Philip Frank, empiricist Bas van Fraassen and the contribution of Michael Friedman, the effort to examine rhetoric in scientific theory ultimately involves uncovering the realist/anti-realist disagreement in a fresh, significant way. In short, there

is no single set of pragmatic factors at work in science. Rather, partly due to our imaginative powers in modifying theories, there is a distinct set of historically evident “second order” factors at work in science. There are therefore two sets of external value factors at play in scientific investigations. There is a socio-historical set of values operating external to the process of explanation. There is also a more epistemologically set also operates closer to the process of scientific explanation, with theory fertility occupying a privileged place at the centre of this group of factors.

While McMullin does not necessarily say so, his distinction between this group of scientific external values is a key development in developing a notion of critical realism. It verifies the historically conditioned scope of the theory of retrodution. In distinguishing two basic sets of values at work in the employment of scientific rhetoric, McMullin features a scientific imagination that is radically unhindered, while at the same time, he does not rule out the historically evident influences on science, understood as influences operating beyond the strict parameters of scientific explanation.

With the value of fertility highlighted as particularly important, we can see how a connection can be drawn between the philosophy and history of science and the portrait of human rationality that mitigates against a Kuhnian deterministic theory of incommensurate paradigms of rationality. Furthermore, McMullin’s account of rhetoric in theory acceptance and science generally upholds a certain irreducible character to human inquiry that runs along a unique trajectory through and beyond scientific explanation. This trajectory of patterned searching intelligence is made manifest in science, and cannot be constrained *a priori* by rhetorical devices or related conceptualizations.

Moreover, this emergence, as it meets with success, stands as a historical unfolding that is probabilistic not certain though still teleological in a loose sense of that word. This is not *necessarily* opposed to a view of different scientific paradigms. Indeed, defenders of paradigmatic science sometimes affirm that successive paradigms build upon one another as advances in progress, however tangential the variety of theory verifications and reversals seem at first. The probability that sets of validated scientific theories reveal is itself an underlying reality when viewed as a single thread of successful scientific theories within and even among different disciplines.

If a critical reading of Kuhn and the socio-historical critique of science has lessons for deepening our understanding of the term ‘critical realism,’ it is that an analysis of rhetoric can lead to the satisfying position of being able to say how it is possible for any theory to be evaluated according to the human ability to imagine, choose and judge from among different values. That is, while socio-historical factors seem to play a role in determining scientific progress, they are not determinative of that progress without an account or an appeal to a theory of rationality in which imaginative and evaluative operations secure a radical human freedom that transcends historically contextualized factors.

Although McMullin does not say so here, this drive to understand parallels the “unrestricted desire to know”, a phrase with a metaphysical legacy dating back to Aristotle’s well known first statement in his *Metaphysics*. The empirical evidence of the pursuit of knowledge, including an understanding of the significance of that knowledge, is the basis for affirming the essential difference that exists between scientific realism, with its focus on the truth of entities and existence on the one hand, and critical realism, with its wider focus on the historical subject,

and the quest for meaning and historical understanding that is unique to human living.

McMullin's identification of particular values that inform science is an appeal to a dimension underpinning critical realism unconstrained by linguistic and socio-historical concerns, but which is nevertheless thoroughly informed by those concerns, insofar as they highlight and impact the specific operations of scientific rationality. It is this particular perspective on critical realism that justifies the discussion in the previous chapter on his theory of scientific rationality. Once this theory is set against the historicist interpretation of scientific values, there emerges an appreciation of McMullin's more confident appraisal of historically contingent subjectivity in science. This view of historical contingency is one in which we are ultimately unconstrained by the variety of relevant contexts in spite of the many forms of contingency that are apparent. At the heart of contingencies are experiences and events that are equally a part of a wider story of science. Indeed, by turning Kuhn's portrayal of scientific history on its head, one can justifiably point to the fact of successive scientific revolutions as evidence for a continual and enduring restlessness of human inquiry. Given no convincing evidence to the contrary, the case can even be made for a neo-foundationalist philosophy of science.

Going on McMullin's insight into T-science covered in chapter two, a reflection upon successive scientific revolutions reveals a view of scientific rationality that becomes self-conscious in the seventeenth century. Complementing the radical break that Einsteinian physics made from Newtonian physics, there is also the inescapable thread of continuity between the two, a thread better known in terms of understandings of space-time, but which I am highlighting at a more methodical level of scientific operations. Following the emergence of T-science, a higher viewpoint emerges, involving "a change in what [counts] as a good theory, in the procedures of

justification themselves.”²⁵ Retrodution and critical realism converge on this point of reflective self-consciousness. This convergence pinpoints the sheer givenness of values that shape theory evaluation and make us aware of the complexities of human abstraction in a scientific explanation. Values, operating externally and somewhat autonomously in scientific explanations are a key to a view of scientific knowledge. But, contrary to the historicist view, they are not determinative of scientific investigations. These complexities, if the inspiration of the scientist-theologians is any indication, appear to have been misrepresented. They have become associated with other evidence marshalled to support a fundamental antimony between the enduring critical bases of human subjectivity, and the reliable objectivity of scientific investigations. This antinomy is well represented in the work of Edmund Husserl’s examination of the philosophy of science in the phenomenological tradition.²⁶

For the purposes of identifying the points of contact between scientific and critical realism, it is significant what McMullin uncovers. Kuhn has advanced the study of scientific rationality, but stopped short of affirming scientific realism due to a pre-emptive conclusion, in spite of his own insights into the historical shape of scientific rationality, that the history of rhetoric renders scientific judgments contingent knowledge. The insights into the historical grounds of the scientific enterprise have, until now, led to the view of science as fundamentally disparate, as a collection of incommensurate paradigms. However, the opportunity is now available to take the continuity and presence of values in science as a clue to raise historical contingencies beyond this view into a critical realism that places a basic confidence in human rationality.

3.3.2: Imre Lakatos: Idealist Scientific Realism

As a student of Karl Popper, Imre Lakatos took up the insights into scientific explanation offered by the logical positivist school of thought in the philosophy of science in light of the radical discontinuities in scientific method brought to light by Kuhn and his followers. The combined force of these influences resulted in Lakatos's theory of scientific rationality that he terms a "'research program' or a series of interconnected theories, rather than a single theory."²⁷ The research program is a unit that simultaneously identifies and evaluates theories in a general way, and this is the basis of a unity to Lakatos' methodology in a discipline that has moved toward the incommensurability of events, theories and discoveries: "the unit of appraisal itself is the sequence [of theories]."²⁸ This theory underscores Lakatos' commitment to the idea of progress in science, no less so than for other more orthodox adherents in the positivist or fallibilist school. This idea of progress is not *ad hoc*, given the requirement that the theoretical and the empirical be corroborated in the discussion of novelty in scientific practice. Novelty is the reality of new facts in a series of interlocking theories. The hope Lakatos expresses through this theory is that Kuhn's notion of paradigm can be captured within a more scientifically controlled constellation of categories in the act of appropriating the history of science for the express goal of explaining the significance and the operations of scientific rationality.²⁹

In criticizing Lakatos' methodology of scientific research programs (MRSP), McMullin puts forward a key element in the link between scientific explanation and the history of science that is very helpful in highlighting the importance of a critical realist framework. I would identify this key element as the pivotal significance of theory itself, taking a cue directly from his theory of retrodution. In contrast to the notion of a research program that is dedicated to mediating scientific paradigms and the deductive ideal of some scientific explanations, McMullin retains a

focus on theories that are appraised according to two different types of fertility: epistemic and heuristic appraisals. Epistemic appraisal pertains to what McMullin develops in his theory of retrodution with regards to “the past record of a theory.” The “research-potential for the future” of a theory is judged according to a different criteria of potential fertility measurable, so to speak, in terms of a theory’s future heuristic possibilities.³⁰ The distinction McMullin raises is an important way to extend, through a critique of Lakatos’ idealistic MRSP, the chiefly empirical reference point of a theory, and at the same time, the radical openness that the data potentially accord insights that lead to future theories, hypotheses and facts. Moreover, it is a strategy that simultaneously connects the wide-ranging powers of the human imagination operative in the natural sciences in such a way that attention to the concrete universe is maintained without the disadvantages of the kind of pre-determining logic entailed by Lakatos’ MRSP.³¹

In short, this critique represents a refusal to acquiesce to a theory of scientific rationality that necessitates a philosophy of history which absents itself from empirical data. It refuses to be caught by a pre-determined logic that imposes concepts like hard core and auxiliary hypotheses onto whole series of theories.³² The relevance to critical realism, as McMullin notes with regards to Popper’s later modifications, is whether or not the scientist’s connection with reality is positive or negative.³³

Drawing upon a complex set of interlocking analyses of the work of Lakatos, McMullin concludes that major ambiguities and missteps in his work seriously weaken his ability to fruitfully overcome Popper’s positivist theory of science in being able to faithfully account for ‘actual scientific practice.’ For Lakatos, the history of science is idealized and rendered explanatory in terms of sequences of logically pre-determined propositions that make up sets of

theories that are themselves understood free of developmental aspects.³⁴ Contra Lakatos, the continuity represented by the history of science lies not in the ideal of unfolding research programmes *per se*, but rather in the “entity that is being appraised”:

“[...] the scientist engaged in appraisal is most interested in...the manner in which the resources of the original theory have lent themselves to continuous and fruitful exploration. ‘Research program’ is thus a bad choice of label. ‘Theory’ is still a much better one. It is the scientist’s own choice, for one thing.”³⁵

The point under dispute that is the key to the significance of verification is the historical situation of science. The significance lies in the positive evaluation of scientific theories themselves, as they evolve in supervening historical modifications that are themselves made possible through acts of scientific imagination. The kind of critical realism attempted by Lakatos is, once again, a strictly *dialectical* conception of the term, a *via media* between the core insights of the logical positivists and the historicists that tries to establish itself according to another logical scheme, which is not surprising given Lakatos’ philosophical formation under Popper. Its resemblance to Barbour’s and Peacocke’s conceptions of critical realism are interesting. What emerges from Lakatos’ MRSP theory, which McMullin astutely notes, Lakatos does not call a theory at all, is a partly accurate description of how science progresses.

The problem with this description is that it is unable to shed light on the attention to the concrete entities in scientific practice (S2). A philosophy of science, informed by history ought to ideally follow more closely the history of actual theories and the conceptualizations of components of physical process without imposing a critical philosophy of dialectical succession into the heart of scientific rationality. As I have mentioned already concerning McMullin’s critique of Kuhn, such a concept of scientific history leads to the popular but misleading

characterization of knowledge, whether scientific or not, that an essential opposition between subjectivity and objectivity cannot be overcome, and that the attempt to do so is necessarily based in naive realist or idealist/instrumentalist philosophical inclinations.

3.3.3 Galileo: Scientific History and the Centrality of Theory and Empirical Data

It is prudent, at this point, to highlight an important contribution that McMullin makes in his own extensive historical studies of science. With these studies, he effectively elaborates on the critical interpretations of Kuhn and Lakatos's historicist philosophies of science. If nothing else, retrodution can succeed in clarifying what actually went forward in the history of science. As a reflective theory, retrodution can address the fact that

“it is notorious how far some of the pioneers of science (Descartes and Newton come to mind) departed in their own practice of science from their manifestos or method.”³⁶

McMullin's focus on the historical record in search of how scientific method gradually came into its own, yields his notion of imputed rationality that he employs in trying to understand the general shape of scientific rationality.³⁷

Galileo and Newton are two figures McMullin has examined in this light, and I will summarize his analysis here to make the case that retrodution's power is in understanding historical events and figures, without which we would not have enough material to justify a position of critical realism.

Following McMullin's critical treatment of William Wallace's account of Galileo regarding the “continuity thesis” that I mentioned in chapter two, there is further evidence to show that Galileo eludes a simple characterization of scientific practice according to any preconceived ideal. According to McMullin, Galileo's scientific investigations follow *no* pre-

conceived ideal, whether in a neo-Aristotelian mould or according to a pure paradigm break away from that mould in which all future science might accord with that identifiably different paradigm. McMullin elaborates on this point in an article on the conception of science in Galileo's work by speaking about analysts of Galileo who believe Galileo abandoned the search for causes in favour of a higher science of mathematically ideal mechanics: "This reading of Galileo has something of Descartes in it and prefigures much of Kant [...] It is not a good reading."³⁸

This study argues that Galileo's importance possesses a wider significance than the historical exemplification of a realist understanding of scientific rationality: an importance that is captured by the theory of retrodution. As Mary Hesse has indicated in an insightful essay, Galileo's scientific work is of central importance to the subject/object split in modern philosophy, to which critical realism addresses itself. This concern was crystallized in an early and extensive section of Husserl's *The Crisis of European Sciences and Transcendental Phenomenology*. Galileo plays a pivotal role on the scientific side of a broad philosophical debate over epistemological issues, and his contribution marks, as Husserl says:

"the surreptitious substitution of the mathematically structured world of idealities for the only real world, the one that is actually given through perception, that is ever experienced and experienceable - our everyday life-world."³⁹

This "mathematically-structured world" contains its own distinct method with tendencies to do what Husserl refers to as the "technization" of the natural sciences, a "many-sided transformation and covering-over of its [science's] meaning."⁴⁰ Thus, Husserl concludes that

"the idea of nature as a really self-enclosed world of bodies first emerges with Galileo [...] the way is thus prepared for dualism, which appears afterward in Descartes."⁴¹

As evidence for this judgment, Husserl points out that “Galileo *abstracts* from the subjects as persons leading a personal life; [Galileo] abstracts from all that is in any way spiritual, from all cultural properties which are attached to things in human praxis.”⁴² It is worth repeating these charges against Galileo to account for a certain antipathy towards science not only in various philosophical traditions, but also, and especially, from figures whose interests in critical thought are relevant in defining a critical realism. This understanding of Galileo’s contribution is worth going over for how it diverges from the analysis of the conception of science in Galileo’s work, and which McMullin has closely analysed. What emerges from a closer examination of Galileo’s scientific work is considerably more complex, and cannot be understood strictly in terms of a heritage that pre-figured Cartesian dualism. Nor does a Galilean stress on abstraction merely presuppose modern “post-classical” science to which socio-historical critiques have made such strenuous critiques.

Viewing Galileo strictly through the intellectual lens of later developments obscures the operations and actual tendencies that marked Galileo’s scientific career. By representing Galileo as the paradigmatic figure for scientific positivism or mathematical idealism, Husserl limits the scientific progress that occurred in the wake of the Galilean discoveries. Contrary to Wallace’s reading, an inductive “law-centered” approach accentuates, as Husserl’s critique points out, the inductive type of inference. Similar to Wallace’s deductivist reading however, an exclusively inductivist interpretation of Galileo simplifies historical material that is germane to understanding the relationship between the sources of the scientific revolution and its significance. An accurate understanding of the historical framework of ‘critical realism’ is crucial for a correct understanding of a broader conception of science.

The complexity in Galileo's conception of science can nevertheless be summarised, according to McMullin, in terms of the theory of retrodution, which he develops in response to what he sees as a "deep ambiguity in the conception of science underlying Galileo's mechanics [...]"⁴³ On the one hand,

"Galileo was no inductivist. True, he performed repeated experiments with inclined planes, charted the positions of the Medicean planets [...] He made use of rules of inductive method [...] But he was not patient. He leaped quickly to generalization[...]"⁴⁴

On the other hand,

"The phrase *ex suppositione* [that Galileo uses in describing the procedures of his *Discorsi*] to confer demonstrative status on his mechanics, despite the obvious tension between this and the method of confirmation-by-observation that he uses."⁴⁵

Thus, there exists an abiding and vexing ambiguity at the heart of Galileo's scientific method.

This ambiguity characterizes the dichotomy mentioned in the previous chapter with regard to Galileo's expressed belief that his mechanics was demonstratively true according to the presence of necessary premisses, while at the same time pursuing his search for mechanical explanations in accord with *hypothetical reasoning* where

"[...] the supposition may or may not apply to the physical situation he is trying to understand, and that the only way to discover whether it *does* apply is to test it by means of experimental confirmation."⁴⁶

The problem with hypothetical reasoning is the apparent risks it involves for those, like Husserl, who fear, for whatever reason, the world of explanation and abstraction. However, as even Galileo was reluctant to recognize, the act of abstracting has a specific heuristic purpose. It is not an end unto itself. It is contingent on a further stage of verification, a provisional step that must await empirical confirmation, something that may be delayed for a significant time, thus opening up the possibility of doubts regarding the efficacy of the method.

However, there are also those who fear not the absolutist tendencies of hypothetical reasoning, but rather the Platonic character of this type of inference. Wallace is, once again, a prime exponent, though not the only one, of this tradition. McMullin analyses this tradition's reading of Galileo thus:

"Wallace is unwilling to allow that this sort of reasoning could be "hypothetical" because (like Galileo) he takes this term in a pejorative instrumentalist sense which would equivalently make Galileo's mechanics a fictive construction akin to Ptolemaic epicycles were its propriety to be conceded. But this is *not* the sense in which "hypothesis" has been used in recent centuries, nor is it the sense in which "hypothetico-deductive" is used today."⁷

With Galileo therefore, we are speaking about the work of a scientific figure whose contribution to realism is profound, despite his lack of self-awareness regarding the differences between his style of reasoning and that of other scientists of his time. Galileo appears to develop a scientific method that simultaneously hinges on a profound appreciation of Platonic idealizing, including his conducting of thought experiments, and a simultaneous embrace of the Aristotelian search for causes through explanatory deduction, albeit in a more cautious mode of explaining. His mode of explanation is patient and awaits the results from experiments interpreted with the indispensable assistance of theoretical hypotheses.

Perhaps more profoundly, these combined ambiguities concerning Galileo's conception of science and his unaware adoption of hypothetical reasoning becomes clearest in Galileo's treatment of cosmology and the "macro-world." Ironically, Galileo ventures into this field, the very area where pressure was exerted from theological and philosophical quarters. It is from these authorities that an explicitly 'demonstrative' proof for the heliocentric universe was demanded. Galileo, of course, was never able to provide this kind of proof. The intrigue of the

Galilean controversy, which followed his alternative rationale for defending the Copernican worldview, should not work to obscure the connection that needs to be made between cosmology and retroductive reasoning. This connection stands as one of the chief lessons of the Galileo controversy, and McMullin states his case for it in light of the overwhelming difficulties of causal reasoning in cosmology for Galileo:

“[...] his reasoning becomes explicitly (and often elegantly) retroductive [...] many examples [...] stand out: his discussions of the lunar surface, of sunspots, and of comets.”⁴⁸

Most of McMullin’s analysis deals with the question of the lunar surface in Galileo’s writings, especially in the *Dialogo*, and the *Starry Messenger* text. On this question in particular, Galileo

“Looks for likely points of resemblance, and checks to see whether they are found (method of analogy). He tries to interpret observed lunar phenomena by supposing them to be explained by a known causal process similar to one obtaining on earth (retroduction). And he *tests* (or at least claims to test) his hypothesis that the gross features of the lunar surface are similar to those of earth by inferring how the *earth* would look from a distance, and then checking to see whether something like this is found in the case of the moon (retroductive or HD testing).”⁴⁹

When it came to the most significant cosmological debate regarding the Copernican hypothesis, Galileo was forced to retreat, ironically, to his traditional defence of science as demonstrative. As McMullin says: “[...] he commits himself to a *demonstration* of the earth’s motion on theological grounds[...]

”⁵⁰ Employing the Augustinian hermeneutic principle whereby features of natural process that specifically contradict the scriptural account should nevertheless be judged correct, Galileo found himself, in the end, caught:

“He could not, as a scientist, accept the implications of [Pope] Urban’s use of “hypothesis” for the Copernican view. Yet in order to argue against it, it would suffice to urge Copernicanism as a good “hypothesis” in Galileo’s *own* sense of that term (i.e.: as a plausible and even perhaps the best-warranted account). What was needed was a fully *demonstrative* account in order to overcome the Augustinian objection he had himself

acknowledged.”⁵¹

Therefore, for reasons rooted in the controversy of the time, and owing to reasons above and beyond the strictly theological/hermeneutical ones, Galileo was forced into a weak methodological position on the question of the Copernican thesis. There were simply too many barriers to the idea of extending retroductive-type reasoning from the cases of the lunar surface and mechanics as singular fields of inquiry into the more prominent arena of the earth’s motion that would have involved a conjunction of these scientific inquiries with philosophical and theological factors. In short, according to McMullin, there are two competing scientific methods at work in Galileo’s thought. His contribution, a famous one, to developing a new scientific method, cannot be understood through a single prism in the philosophy of science due to the nuances that historical studies of Galileo reveal. Nevertheless, Galileo’s reliance on hypothesis, as a reliable yet provisional tool in making scientific claims according to a more complex structure of inference, is not to be denied:

“Galileo aimed when he could at demonstration, in the sense of conclusive proof. But when this was not available, he would settle for as high a degree of probability as the evidence would warrant, showing no inclination to regard the resultant merely as “opinion.” He used consequential modes of argument all the time, but never formulated a “method of hypothesis” [...] in other parts of natural philosophy, in optics, in chemistry, there was a growing realization that hypothesis is not only unavoidable, but even respectable [...]”⁵²

What are the consequences of this for the discussion of critical realism? The most important point, I believe, is that scientific method is, going on the example of one of the scientific revolution’s foremost practitioners, extremely difficult to describe in terms of a single concept, type of inference or a single expression of how this impacts our interpretive rationale of nature. Galileo’s example is also evidence for why it is difficult to understand scientific method

exclusively in terms of a continuity or discontinuity with medieval or modern science. His work happens to elude such simplistic generalization. At the same time, a deeper appreciation emerges for the simultaneous provisional and truth-oriented character of scientific theory, expressed in theories and hypotheses.

Indeed, both the mental imagination that is responsible for controlled thought experiments and a renewed, expanded search for causes come together to characterize Galileo's chief contribution as a deepening of both the subjective and objective poles of the scientific enterprise. This expansion, that is typified in Galileo's work, is indicative of the kind of insight into T-science that begins to emerge during the scientific revolution. This is indeed a revolution that should be seen as an originating principle for almost all scientific investigations since then.

Second, Galileo's tentative use of retroductive inference already shows evidence of the employment of values in conjunction with an integrated pursuit of causal explanation and idealized abstraction. His example is very instructive for an outline of a critical realist understanding of science. Galileo's pursuit of scientific knowledge has, in fact, been cited as a good benchmark for a theory of the growth of knowledge in order to counter the concessions made to historicism since the publication of Kuhn's *SSR*.⁵³

The significance of McMullin's analysis here is to identify the creative thread that unites otherwise disparate aspects of Galileo's scientific writings. It is this thread, in addition to the actual contents of his discoveries, that justifies to a certain extent the appellation credited to him later as the "father of modern science." What is peculiar, if anything, is the fact that an analysis of Galileo's method with an eye on the essence or core of his achievement has not been taken up by others amidst the plethora of contemporary historical, textual, interpretive and

interdisciplinary treatments of the Galilean corpus.⁵⁴ Nevertheless, it is the identifiable emergence of a single method in Galileo's work that historically anchors a critical realist viewpoint because of the way Galileo methodically unites disparate strategies of seeking scientific knowledge without fully realizing the disparate nature of what he was doing. Galileo's method, as tentative and fractured as it presents itself on examination, contains *in potentia* elements of the following six criteria that make up the theory of retroduction:

- 1) the search for causes in physical process with the aim to explain causality,
- 2) a deliberate process of abstraction and employment of thought experiments based on the permanently creative work of the scientific imagination,
- 3) the drawing of analogies between and among cases or sets of phenomena at different levels of reality,
- 4) the reliance upon the conducting of experiments (or at least awaiting the possibility of experiments) as the empirical verification of theoretical insights,
- 5) the resulting affirmation of the reality of theoretical and physical entities, especially theoretical entities with their unique ontological status (e.g.: planetary orbits) and
- 6) the reliance, in principle, on the *fertility* of certain data and theory from one domain (which could be called the empirical residue) to serve as a helpful basis for successful investigations in another domain (e.g.: the existence of unified projectile motion in mechanics as an explanatory heuristic for explaining particular astronomical phenomena).

T-science, with its generalized elements of scientific method, is first achieved in a tangible form by Galileo. The reason why this revolutionary figure is so pivotal to a critical realist understanding of the natural sciences is due to the confidence with which Galileo pursues

scientific knowledge in a simultaneous continuity and discontinuity with previous scientific methods. This is an anticipation, in fact, of the probabilistic and emergentist features of scientific inquiry that would only become fully realized in a self-conscious way in modern developments, in such breakthroughs as Darwin's Theory of Evolution and twentieth century quantum theory.

These key developments are anticipated particularly well by Galileo's approach to cosmology and large-scale problems, where retrodution, as a theory of scientific explanation, achieves it first notable (unrecognized) success. In this way, Galileo's achievement marks the ability for scientists to call on new powers of imagination and abstraction in order to probe the intelligibility of empirical data without much substantial doubt that the act of abstracting and physical process are mutually exclusive domains of existence. This is, however, the course of philosophical thinking that would proceed the Scientific Revolution in light of other movements and schools of thought - in the form of idealist, empiricist, linguistic and later, postmodern anti-metaphysical philosophies. These developments, while originating in the context of other concerns, did involve, either explicitly or implicitly, crucial interpretations of the natural sciences.

Galileo's scientific method rather neatly illustrates how a revolutionary figure still possesses enough confidence in the explanatory scope of scientific method such that contemporary realists may transpose that confidence in positively overcoming the positions of incommensurability, instrumentalism and historicism. Moreover, by overcoming these positions in the philosophy of science, a theological strategy for understanding the God-World relationship (in a way that respects the range of meaning associated with religious experience and the reading of scriptural texts) becomes possible in culture. Likewise, Galileo's ad hoc approach to the

utilization of distinct types of inference that McMullin characterizes as two competing conceptions of science, goes some distance toward casting considerable doubt on the efficacy of Lakatos' univocal MRSP as a theory of science that could wed scientific progress with a more general epistemological framework.

3.3.4 Newton: Hypothesis and Induction

Newton is another excellent example in what McMullin terms an exercise in testing his theory of scientific rationality against "the imputed rationality of a selection of major episodes in the history of science."⁵⁵ For obvious reasons, Newton is a critical figure in the advent of 17th century T-science. One of the central features of the Scientific Revolution is

"when Newton created a dynamics for planetary motions that explanation and prediction could finally be brought together in a single structure."⁵⁶

His achievement in bringing together previously separate fields of scientific understanding through the development of such notions as force was mitigated, however, by his reluctance to embrace the retroductive implications of the role of hypothesis and theory in scientific investigations. Newton's understanding of his own work is best summarized through his reference to the "experimental philosophy."⁵⁷ The fact of the matter is, however that Newton's work exposes a "collision," as McMullin puts it, between various currents in scientific methodology. Whereas this collision forced Galileo to seek methodological guidance in the traditional ideal of demonstration, Newton opted for something closer to a new ideal of induction through experiment and straightforward deduction from the phenomena. As a result, Newton's work leaves a highly ambiguous impression on the modern reader in spite of the obvious credit that must be given for his uncovering of the existence of force and the discovery of gravity. The

contradiction between Newton's inductive method and the *Principia*, his best known work, is that the three Laws that are contained in that work are tests of predicted hypotheses. They are not inductive generalizations.⁵⁸

Explanatory power, for Newton, could not be associated with hypothesis. Like Descartes, explanation had to be secured in something more certain, though Newton could see the multiple and various ways in which Cartesian philosophers used mechanics and mathematics alternatively to justify a pure, certain scientific methodology based on principles of one sort or another. So, Newton was forced to defend the knowledge gained by empirical law, and experiments that confirmed (and actually did confirm in Newton's case) those laws. Though his critics pointed out that making general claims from induction was a hypothetical exercise, Newton was reluctant himself to admit this. His conception of science, though revolutionary because of the capaciousness of concepts such as attraction, force and gravity, appears to collapse the causal and explanatory elements into these descriptive concepts. This ambiguity, according to McMullin

“enables Newton to claim that he can determine forces directly from motions, and at the same time represent this as deducing causes from effects [...] Newton seems to have thought that the way ahead lay in finding the laws of force at each level [...]”⁵⁹

The mechanical philosophy that results from this conclusion is well known. The lesson of what transpired is less well understood, but just as important:

“[...] experience later showed this to be a premature suggestion. One has to find out something about the corpuscles first. And this would involve retrodution of the sort Newton had questioned, hypothesis that is warranted in an indirect and provisional way by its consequences and not by deduction from, or generalization of, the phenomena.”⁶⁰

Of course, Newton had many good reasons to resist the explanatory and causal form of understanding implied by the obvious difficulties in his time for discovering a cause for gravity.

This fact, more than any other, discouraged any further developments at the time of the Scientific Revolution in the direction of understanding retrodution as the inference that accounts for science, with all the implications, such as the embrace of probability that this would have involved.

It should be noted that the historical context of Newton's work is theologically pregnant. due to his inference from inductive natural laws to the provision of an omnipotent law-giver. Indeed, his hesitation to embrace hypothetical deductions, like Descartes before him, was partly for profound theological reasons. McMullin describes these reasons as a "theology of divine omnipotence" which led to

"the proposing of a new ontology of individuals linked by similarities instead of by common natures. A new sort of science was needed for such a universe, one based on an induction that takes the form of generalization from resemblances and issues in probable knowledge only."⁶¹

The theological thrust behind this science was the thirteenth century repudiation of Aristotelian concepts of nature and science, which were thought to rule out the freedom and power of the Christian God. To the extent that this theological motivation drove Newton into an official embrace of inductivism while acknowledging the significance of the role of hypothesis, he exemplifies, like Galileo, the rejection of retrodution as a theory, but not in practice.

Publicly, Newton advocated the inductive character of the new scientific forms of knowledge.⁶² McMullin notes that Newton's contemporary, Descartes, had tried to weld a deductive method that "substituted mathematics for the syllogism and clear and distinct ideas for the essences..."⁶³ Newton's strategy was markedly different, because he was willing to try hypothesis instead of certain knowledge as a benchmark for evaluating scientific knowledge, but

his willingness in this regard was limited:

“Newton [...] thought the rationality appropriate to science to be an inductive one, and became in the course of his career more and more reluctant to allow hypothetical constructs into science proper, although he was willing to admit them at the preliminary stage of his inquiry.”⁶⁴

Ironically, had Newton been more receptive to the role of hypothesis like his contemporary Huyghens⁶⁵, his success in joining explanation and prediction would have been matched by a conception of scientific method that would have been as remarkable. It is difficult, but not impossible to imagine that, in this hypothetical circumstance, Newton could have theoretically chosen to reject the deism that he did adopt to fit with his inductive portrait of science. If Newton had recognised his theological reasons for rejecting hypothesis he might have understood that his desire to avoid any non-empirical support for science was itself rooted in a misplaced theological nominalism.⁶⁶

While this is merely conjecture, it is not hard, from a reconstruction of historical events, to see that if the self-conscious thrust of retroduction and the acknowledgement of probable knowledge had been championed at a time when religion's cultural force was much greater, the separation between science and religion would have been much less acute by the time evolutionary biology and cosmology came into their own as retroductive, probabilistic disciplines. This is at least true of the English-speaking world if not elsewhere as well.

3.4 Rationality and Realism

Returning to the topic of critical realism, we can see that the term involves no inherent subject-object dialectic between the contingent historically verified basis of inquiry on the one hand and the epistemologically focused explanatory method on the other hand. Based on the

presence of elements of retrodution in key historical episodes, especially during the advent of T-science. one can say with confidence that there is a single “activity” of science that is under study, due to a historically continual thread among and between the goals of science, in spite of episodes of modification. I interpret this to mean that the realism of critical realism is normatively critical, and the critical component is normatively realistic by virtue of the fact that the same basic *goals* of science have been continually intended.

But, the identity of science as a single activity is not due to any one aspect of scientific rationality that stands apart from a more general account of human knowing, even while it offers a unique perspective on how we understand the world. The rationality of science pertains to critical realism by virtue of its own basis in reason itself. As McMullin says:

“The reasonableness we call on here is not the rationality of science but the more basic rationality that informs goal-directed human action. It is reasonable to modify the rationality of science if we can in consequence do better science, that is, attain the goals of science better by doing so.”⁶⁷

Doing “better science” is a pragmatic expression that helps to define what is at stake in understanding what is permanently achieved in the activity of science. The thrust of his comments here are again germane to elucidating the wider significance of the theory of retrodution with the debates in modern philosophy of science in mind.

Returning to the practice of science (S2) as the point of departure for developing a definition of critical realism, the “crucial question” for McMullin is whether the various formalisms of the variety of inference types “illuminate what the scientist is actually *doing*.”⁶⁸ In light of McMullin’s critical treatment of Kuhn and Lakatos, among others in the philosophy of the history of science,⁶⁹ one could reasonably expand his challenge a bit further by asking

whether or not *explanatory theories* of the varieties of historical investigations and inferences *utilized therein* illuminate what the scientist does. Since Kuhn relies on a dialectical tension between normal and revolutionary science, we would have to regard his contribution to developing critical realism as limited. The same would be true with regards to Lakatos for his reliance upon a logical ideal of core and auxiliary hypotheses as the basis for a construing scientific rationality as both predictable yet incommensurate over time. Change, on McMullin's account, is understood as *reasonable* as well as rational. An element of judgment is a required step in keeping with shifts in actual theories, and in turn, shifts in insight into empirical data. It is not a pre-determined state of scientific investigation which the more historicist philosophies of science have promoted so widely. Rather, for McMullin

“How can changes in scientific rationality themselves be rational?’ is easy to answer, once it be noted that the reference of the term ‘rational’ shifts within the question.”⁷⁰

The question that shifts the rational is the question concerning what goal is being pursued or achieved. But while the terms of scientific rationality can and do shift, there are also basic constraints on what it is and on what it is not.

The multiple issues that are implicit in the relationship between scientific realism and critical realism converge in a number of points McMullin makes at the end of his most comprehensive treatment of the socio-historical critiques of science. In his essay “The Shaping of Scientific Rationality,” McMullin identifies a key conclusion reached by analysts in this tradition:

“[...] those who argue for the variability in principle of scientific rationality rely on the premise that what counts as *explanation* has varied widely over the history of science, even within the same field of inquiry. To the extent that science be thought of as a search for *understanding*, then, one might infer that it would take very different forms in the

future. The notion of understanding (unlike that of prediction) is sufficiently indefinite (it is argued) that it could be a light constraint to satisfy.”⁷¹

In what might seem an obvious appraisal were it not for the idealist tendencies of the philosophies of science that he is examining, McMullin outlines the broad significance of what science’s limits are:

“[...] there *is* a real constraint here on what may count as natural science in the future. It will have to provide an understanding of natural process [...] in some systematic way [...]”⁷²

The forms of explanation will vary from “one part of natural science to another.” But there is one common bond:

“What makes scientific knowledge ampliative, what finally enables it to transcend the limits of the here and now, is its successful employment of retroduction.”⁷³

Here, retroduction is viewed from the perspective of the scientific disciplines as structures or domains of knowledge that take the concerns of the empiricist and the idealist philosophical traditions into account by weaving together understanding and explanation together while connecting the physical, empirical world with the theoretical, abstract world without opposition. The insight contained in the theory of retroduction centers on this harmonious link between the empirical and the theoretical. Both are real, and revelatory of the almost enigmatic creativity present in human consciousness. From the side of the natural sciences, we therefore have a theory that sheds light on the human as the point in which theology and science, as disciplines, are deeply connected.

Explanatory knowledge and an historical understanding of successive scientific explanations are symbiotic forms of knowledge in a critical realist position. This relationship is expressed by McMullin in terms of the identification of scientific rationality and scientific

realism respectively, and united by a critical realist epistemological position. This position underpins a kind of confidence that we can therefore expect to have in ourselves:

“How much have we learned? What degree of permanence can reasonably be attributed to certain theoretical structures (realism) or certain goals and procedures (rationality)? The connection, of course, is that it is the goals and procedures that have enabled the structures to be discovered, while it is the discovery of the structures that (in part, at least) assures us that the goals and procedures are appropriate.”⁷⁴

The lesson that this constructive symbiosis provides is the one regarding the special role played by the criterion of fertility in McMullin’s theory of retroduction. It is not, as my analysis in chapter two might imply, an *a priori* of a realist norm upon scientific rationality that might otherwise be conceived as successful without that criterion. In a stroke of strategic insight, McMullin applies the retroductive test to an account of scientific rationality itself on this very issue:

“Why is fertility an appropriate criterion of theory? Because if the world has an underlying structure, this is a feature one would *expect* theory to possess. Are we back to an *a priori* here? No, because we need the testimony of history to assure us that the world does indeed (at least over large domains) have an underlying causal structure. But once we know this (and this is where realism comes in) then the choice of the “rational” criteria for theory-assessment begins to sort itself out.”⁷⁵

It is in light of what rationality actually means in the real world of operative scientific methods, that we can deal openly and confidently with the socio-historical critiques of scientific rationality. Once we are more familiar with a careful reading of the testimony of history, the realist case comes into its own. The history of the seventeenth century, as the Galileo case shows, is the best opportunity for insight into the radically human character of this scientific achievement.

Therefore, to pose critical realism as a solution comprised of dialectically opposing

elements that meet in the middle to form an uneasy comparison of claims, or as a *via media* between these competing claims, is to miss the “morals of the story” as McMullin recounts them. To think of the contingent and the objective aspects of science as two separate features of science misses the lessons of the scientific revolution that were made explicit in the evolution of T-science and its theoretical entities. This seventeenth century achievement is certainly not without precedent or foreshadowing, as a cursory knowledge of Pythagorean mathematical principles or Euclidean geometry shows. The success of the scientific revolution consists precisely in the judgment that “no longer could prediction and explanation be sundered as they (had) been for so long.”⁷⁶

Two points are in order here. First, there is irony in the fact that the scientific revolution united an age old division between two competing conceptions of science, even though this unification was not recognized until much later. The irony is that this formidable achievement in the unity of scientific operations was creatively attained at the same time as the fragmentation of general knowledge of the world occurred in terms of science’s relationship with philosophy and theology, especially evident in the breakdown of sub-disciplines such as cosmology and metaphysics, and evident in the claims about science made by such philosophers as Hume, Kant and even Descartes.

The second observation concerns the character of the unity of science. I have derived an implication of this for critical realism in terms of the unity of science’s aims by scientists. However, this remains a preliminary judgment. The judgment is that a strictly dialectical conception of the term critical realism is unsatisfactory. Rather than merely explaining why the dominance of a particular school in the philosophy of science should be avoided or clarifying

what realism in science is not, we need to build on McMullin's "morals of the story" for their eventual theological import through the prism of critical realism. This will take shape later in chapters five and six.

3.5 Conclusion

With an analysis of Kuhn, Lakatos, Galileo and Newton complete in terms of a working philosophy of the history of science, I am arguing that a grasp of critical realism is within range. I have tried to shed some light on the possible dangers in approaches that either restrict the heuristic ability of scientific rationality or pre-determine the historical trajectories of future, unanticipated scientific investigations. The problem with either approach is that each tries to dispose of the central reference to the relationship between a theory and its empirical verification. That is, the relationship between an insight into natural process and a judgment of whether it is true as understood cannot be wished away. There exist certain inescapable cognitional events that unite the pursuit of understanding and explanation. As can be seen from the case of Galileo and Newton, recognition of these cognitional operations, in their case, the posing of theories and hypotheses, would have led to uncomfortable conclusions about the place of reason in a particular philosophical culture with certain possible religious ramifications.

Critical realism, following McMullin's different approaches in the philosophy of science, can be defined in contradistinction to the twentieth century judgements of Kuhn and Lakatos. It is a philosophical approach to scientific knowledge that can build on the epistemological and ontological foundations of scientific realism, based on the theory of retrodution. Once again, it is an approach that does not pit the act of knowing and the scientifically known world against each other. Moreover, it positively allows for openings in understanding both poles, in terms of

non-scientific patterns of understanding.

This view of reality, human and non-human, already emerges at the heart of scientific rationality, with its core of three components: creative imagination, the evaluation of theoretical knowledge according to certain values and a position of realism about the world, affirmed in the possibility of ontological discourse. It extends beyond scientific rationality however, once other patterns of experience and realms of meaning are evaluated in their participation in the scientific enterprise. It indicates a view of reality in general that I have thus far analysed with respect to scientific rationality as fully real yet at the same time as radically contingent, awaiting further investigation and development. It takes up critical realism as a position on the nature of scientific knowledge and places it along a tacitly metaphysical horizon. Having said that, I would nevertheless argue that critical realism is not a doctrine that stands apart from any particular discipline as an “out-there-now-real” epistemological *a priori* to which individual disciplines must strive to shape their findings. On this issue, more shall be said later since it pertains directly to McMullin’s criticism of Peacocke on this very point in relation to theology.

In suggesting that this particular understanding of critical realism opens up a metaphysical viewpoint, it is also being suggested that the scientific effort to understand reality is limited, but not in the way that Kuhn and Lakatos see it. In order to understand how critical realism opens up the possibility of a meaningful metaphysical viewpoint, it is necessary to complement the historical study with a scientific effort to understand how explanatory retrodution is also limited in what it cannot explain. These limits to scientific explanation are what clearly motivates the Gifford Lectures, in their turn to religious meaning to address certain problematic questions. Peacocke’s negative reaction to reductionism in his field of biology is a

clear example of this pursuit of non-scientific philosophical perspective that colours science. Polkinghorne's turn to the Creed goes one step further than this in announcing a positive theological programme.

In order to explain the meaning of the limits of science more precisely, we can turn to a consideration of the discipline of cosmology. Through an analysis of this discipline, we can complete the task announced at the end of our assessment of the Gifford lecturers in chapter one.⁷⁷ With a philosophical account of scientific history secured, we can move to finalize an explanatory theory of scientific knowledge that accounts for human rationality and the historical trajectories of science in the fullest possible way. With cosmology, it becomes possible to understand how a theory of scientific explanation reaches the limits of science itself. Metaphysics becomes an ever more possible and legitimate form of reflection. Cosmology possesses a unique status at the threshold of the natural sciences and philosophy. It is also an intriguing discipline due to its historical ties with theology. These ties were almost completely severed in the aftermath of the scientific revolution, but they have been increasingly re-appraised by theologians, among whom are counted the three Gifford Lecturers.

Endnotes

1. Patrick H. Byrne, "The Significance of Voegelin's Work for the Philosophy of Science" in Fred Lawrence, ed. *The Beginning and Beyond: Papers from the Gadamer and Voegelin Conferences Loneran Workshop Vol. 4, Supplementary Issue* (Chico, CA.: Scholars Press, 1984), p. 93.

2. *ibid.*, p. 95.

3. A full-fledged philosophy of the history of science cannot be considered sufficiently within this study. Still, some historical treatment of the issues is a key element to constructing critical realism's subjective orientation. A pragmatic, postfoundationalist view is thought by some to be the logical choice for a philosophy of the history of science because of the way that Kuhn's insight into scientific revolutions and paradigms places the accent heavily on the sheer contingency, social basis and subjectivity of scientific knowledge. But, this view renders science as a series of problem-solving exercises.

4. See Kees van Kooten Niekerk, "A Critical Realist Perspective on the Dialogue Between Theology and Science" in J. Wentzel van Huyssteen and Niels Gregersen, eds., *Rethinking Science and Theology: Six Models for the Current Dialogue* (Grand Rapids: Eerdmans, 1998), especially pp. 51-68.

5. For a precise account of how Kuhn's study has impacted other disciplines beside the philosophy of science, including and especially theology, see Paul Rigby, John van den Hengel, and Paul O'Grady, "The Nature of Doctrine and Scientific Progress" in *Theological Studies* 52 (1991), pp. 669-688.

6. See, for examples of this emerging genre of theological study Luke Timothy Johnson's *Religious Experience in Earliest Christianity: A Missing Dimension in New Testament Studies* (Minneapolis: Fortress Press, 1998). Within the science-theology exchange, the primacy and centrality of faith and religious experience has been introduced forcefully by Polkinghorne himself, though with the inadequacies that I have already mentioned. Stanley Jaki's work, especially his *The Road of Science and the Ways to God* (Chicago: University of Chicago Press, 1978) has been to do the same, though in Jaki's case, I am not sure whether he has considered the depth and the importance of the critical philosophies of science that begin with epistemologically and historically contingent factors as McMullin, among others, understands them to insightfully function.

7. See McMullin, "Determination and Underdetermination in the Natural Sciences" in Zdravko Radman, ed. *Horizons of Humanity: Essays in Honour of Ivan Supek* (Frankfurt am Main: Peter Lang, 1997), p. 53.

8. *ibid.*, p. 54.

9. McMullin, "The Goals of Natural Science", p. 57.

10. For a succinct statement of how this distinction identifies the operations of the human/social and the natural sciences, see Ricoeur, "Explanation and Understanding" in Charles Reagan and David Stewart, eds., *The Philosophy of Paul Ricoeur* (Boston: Beacon Press, 1978), pp. 149-166, especially p. 165.

11. "Determination and Underdetermination in the Natural Sciences" p. 140.

12. See James Pambrun, "Loneran and Ricoeur: Emerging Complementarity. Philosophical Approaches for Theological Views of Science" in *Loneran Workshop* 9 (1993), pp. 99-144, especially p. 103.

13. See Hans Küng and David Tracy, eds., *Paradigm Change in Theology: a symposium for the future* trans. Margaret Köhl (Edinburgh: T & T Clark, 1989), Rigby, van den Hengel and O' Grady, "The Nature of Doctrine and

Scientific Progress” (see footnote 4) and George Lindbeck’s own *The Nature of Doctrine: religion and theology in a postliberal age* (Philadelphia: Westminster Press, 1984).

14. “Rationality and paradigm change in science” in Horwich, P., ed. *World Changes: Thomas Kuhn and the Nature of Science* (Cambridge, MA.: MIT Press, 1993), p. 71.

15. *ibid.*

16. *ibid.*, pp. 75-76.

17. “Rhetoric and Theory-choice in science” in Shea, W. and Pera, M., eds. *Persuading Science: The Art of Scientific Rhetoric* (Canton, MA.: Science History Publications, 1991), p. 59.

18. *ibid.*, p. 57.

19. *ibid.*, p. 60.

20. *ibid.*, p. 62.

21. See p. 66. In this section of the article on persuasion in science, McMullin is singling out Philip Frank, whose pragmatism is not all that different from the earlier positivism in the sense that factors that are not “purely” scientific are lumped together without sufficient differentiations made among them. Some of these factors or values are much more important to the scientific argument than others however.

22. “The Shaping of Scientific Rationality”, p. 2

23. *ibid.*, p. 4.

24. *ibid.*, p. 71.

25. “Rationality and Paradigm Change”, p. 60.

26. Husserl’s landmark contribution is not well accounted for in the science-religion dialogue. But it is the starting point and insightfully handled by Mary Hesse in “Physics, Philosophy and Myth” in Robert J. Russell, William Stoeger SJ, and George Coyne, eds., *Physics, Philosophy and Theology: A Common Quest for Understanding* (Vatican City: Vatican Observatory Publications, 1988), pp.185-202, especially pp. 185-86. Cf. Husserl’s *The Crisis of European Sciences and Transcendental Phenomenology* (Evanston, Ill.: Northwestern Univ. Press, 1970).

27. This summary of Lakatos’ theory comes from McMullin in “The Fertility of Theory and the unit for appraisal in science” in Cohen, R.S., ed. *Boston Studies* (Lakatos Memorial volume) 39, p. 411.

28. *ibid.*, p. 413.

29. *ibid.*, p. 416.

30. *ibid.*, pp. 422-24.

31. *ibid.*

32. See "The Rational and the Social in the History of Science," p. 141.
33. *ibid.* p. 408.
34. *ibid.* p. 416.
35. *ibid.* pp. 419-420.
36. "The rational and the social in the history of science" in Brown, J. R., ed. *Scientific Rationality: The Sociological Turn* (Dordrecht: D. Reidel), p. 137.
37. *ibid.*
38. "The Conception of Science in Galileo's Work" in Butts, R. and Hintikka, J., eds. *New Perspectives on Galileo* (Reidel: Dordrecht), p. 224.
39. Husserl. *The Crisis of European Sciences and Transcendental Phenomenology* (Evanston, Ill.: Northwestern Univ. Press. 1970), pp. 48-9.
40. *ibid.* p. 48.
41. *ibid.* p. 60.
42. *ibid.*
43. "The Conception of Science in Galileo's Work" in Butts, R. and Hintikka, J., eds. *New Perspectives on Galileo* (Reidel: Dordrecht), p. 234.
44. *ibid.* p. 235.
45. *ibid.* p. 234.
46. *Ibid.* p. 237.
47. *ibid.*
48. *ibid.* p. 242.
49. *ibid.* pp. 242-43. Cf. *The Inference that Makes Science*, p. 62
50. *ibid.* p. 250.
51. *ibid.*
52. *The Inference that Makes Science*, p. 65.

53. See, for example, Joseph C. Pitt, *Galileo, Human Knowledge and the Book of Nature* University of Western Ontario Series in the Philosophy of Science, vol. 50 (Kluwer Academic Press: Dordrecht, 1992). Pitt stresses that "Galileo's most significant contribution to modern science [...] is his conception of the proper method for science" (p. 3). Cf. Chapter six, "Galileo's Epistemology as the Basis for a Theory of the Growth of Knowledge". Given McMullin's careful analysis, the conception Galileo employs might not be understood as *his*, in the sense that he was not fully aware of what he was actually doing.

54. McMullin's identification of the retrodution-like features in Galileo, while not a totally unique analysis, nevertheless seems to be a more insightful stage of reflective synthesis that builds on the pioneering work of the analyses by Koyré (*From the Closed World to the Infinite Universe*), Shapere (*Galileo: A Philosophical Study* Chicago: University of Chicago Press, 1974) and William Shea, (*Galileo's Intellectual Revolution* New York: Science History Publications, 1972).

55. See McMullin, "The Rational and the Social in the History of Science" in Brown, J. R., ed. *Scientific Rationality: The Sociological Turn* (Dordrecht: Reidel, 1984), p. 139.

56. McMullin, "The Shaping of Scientific Rationality: Construction and Constraint" in *Construction and Constraint: The Shaping of Scientific Rationality* (Notre Dame: University of Notre Dame Press, 1993) , p. 31

57. McMullin, "Conceptions of science in the Scientific Revolution" in David Lindberg and Robert Westman, eds., *Reappraisals of the Scientific Revolution* (Cambridge Univ. Press, 1990), p. 67.

58. "The Rational and the Social," p. 138f.

59. "Conceptions of science in the Scientific Revolution", p. 73.

60. *ibid.*

61. *ibid.* p. 30. The link here with the legacy of theological nominalism is striking, and for the probable philosophical linkage involved between the late medieval period and the Enlightenment, see Louis Dupré, *Passage to Modernity*, esp. chap. 7.

62. McMullin describes Newton's definition of science as "deducing from the phenomena and then making general by induction." See his "Models of Scientific Inference" in *CTNS Bulletin*, vol. 8, n.2 (1988), p.5. Cf. "Conceptions of science in the Scientific Revolution", pp. 67-74.

63. *ibid.* p. 32.

64. *ibid.* p. 33.

65. For a fascinating quote from Huyghens that McMullin convincingly suggests prefigures retroductive inference exactly, see *ibid.* p. 33.

66. For an authoritative account on the lasting impacts of nominalism on western thought, see Louis Dupré, *Passage to Modernity: An Essay in the hermeneutics of nature and Culture* (New have: Yale Univ. Press, 1993)

67. *ibid.* p. 26.

68. *Ibid.* p. 24.

69. It should be mentioned that McMullin also analyses, with considerable deftness, the work of Feyerabend, Laudan and Dudley Shapere, whose contributions have marked important milestones in the development of a philosophy of science that takes the socio-historical critique of science seriously.

70. "The Shaping of Scientific Rationality", pp. 25-6.

71. *ibid.*, p. 41.

72. *ibid.*

73. *ibid.*

74. *ibid.*, p. 42..

75. *ibid.*, p. 43.

76. *ibid.*, p. 50.

77. See p. 62.

Chapter Four: Cosmology and the Limits of Scientific Knowledge

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4.1 Introduction

The elements of a critical realist framework that can improve the mediation of the science-theology dialogue have now been outlined in two respects. The first stage affirmed the scientific realist position through McMullin's theory of scientific rationality - retroduction. The second stage affirmed how this theory is verified in an understanding of scientific history. It envisions how historical contingencies and the progressive revisions of explanations lead to an appreciation of the critical dimension of critical realism without undermining the affirmation of existence provided by a realist perspective. The result is a unified notion of critical realism, not a dialectical notion.

A unified notion of critical realism, however, meets a concrete limit. This limit is nowhere more evident than in the discipline of cosmology. In cosmology, there exists a blunt challenge for the scientist or philosopher in terms of the universe itself, in light of the success of explanatory knowledge claims. In this challenge, the role of the historical subject becomes central. The question about the significance of critical realism, as based on the theory of retroduction, shifts. It shifts to posing the question about what grounds any structure of scientific questioning. How is existence to be generally understood, once it is affirmed in differentiated scientific inquiries?

Having secured critical realism as an operative methodological framework, it is possible to begin deciphering the theological implications of retroduction as the most comprehensive theory of scientific rationality available. Tangible progress is possible with a philosophy of science that positively avoids both the positivist and the historicist arguments in the pursuit of a broader aim. That broader aim, however, is nothing less than an understanding of the universe.

The most suitable candidate to consolidate this framework is scientific cosmology. Cosmology involves the human subject in an existential quest, facing the positive limits of science that are grasped in a retroductive account of scientific rationality. This chapter completes a response to the question posed at the end of chapter one, by way of preparing for the theological implications that are set out in chapters five and six. In a unique way, a reflection on cosmology in its scientific and philosophical elements, is crucial for constructing a notion of critical realism that can serve as a wider philosophical framework. It helps fashion a view of critical realism as the mediating position between scientific rationality and theology, because it pinpoints the way in which the question about God emerges from science.

With the explanatory breadth of the theory of retroduction as a tool for understanding science in the light of contemporary cosmology, the aim of this study is brought forward to its climax. What cosmological data are important within this framework for deriving a theological analysis? What theological implications are drawn specifically from a critical realist framework, understood in the light of cosmology? The importance of this question in the science-theology dialogue lies in transcending a mere examination of the contents of cosmology to the search for theological significance within the confines of the contents of that discipline.

With the shift to cosmology, a critical realist framework is re-directed to understand the wider context of a critical realist framework. Only if it is clear that the framework can resolve concrete issues in the dialogue, is it possible to envision long-term resolution to practical concerns that are closely associated with the historic antinomies between science and theology. The connection between cosmology and critical realism is made, once again, with McMullin's interpretation of the philosophy of science. Seen through the prism of scientific rationality,

cosmology raises the ultimate meaning of critical realism.

The presence of theological problems as the result of an oversight of critical realism is widely evident. The treatment of particular issues, such as the anthropic principle and biological evolution, repeatedly appropriates particular categories, concepts or horizons. Interpretations are typically rendered in terms of a certain theological criterion, or in terms of the resources of a particular theological tradition, such as the neo-Thomism, scriptural hermeneutics, trinitarian thought, personalism, or a particular spiritual theology. In natural theology, the idealization of nature is the obvious risk that is incurred. There is the danger of presupposing a particular meaning to cosmology as a consequence of the need to affirm a particular character to the God-World relationship.

Given the goal of this study to develop a philosophical framework in theology in the science-theology dialogue, I want to avoid making such unmediated inferences. The variation in theological interpretations, from the use of neo-Aristotelian metaphysics to the more empirical Ptolemaic system of crystalline orbs surrounding the planet earth, is part of the history of systematic theology.¹ The variety of scientific and cultural contexts are a part of a meaningful and rich history of the communication of theological meaning. While many of the elements in these forms of natural theology are worthwhile, they have rarely succeeded in developing a strategy for engaging the natural sciences which escape the limits of a particular era's level of knowledge.

The cumulative impact of the theological need to update its ways of systematically communicating religious meaning has repeatedly come in the effort to construct a natural theology. This is especially true with regards to cosmology since the Copernican revolution and

the Galileo affair. Minor incidents since that time, such as Pius XII's hasty endorsement of Big Bang cosmology for its associations with a literal reading of the Genesis creation narratives confirmed a theological weakness. In connecting the world of meaning with the world of facts, this type of correlation has been theology's downfall. With the approach set out from McMullin's understanding of critical realism, I am proposing a different strategy. This strategy affirms what the sciences themselves seek to investigate. The universe has to be grasped as progressive and successfully understood object of human scientific inquiry, apart from direct or indirect theological implications that may arise at any point along the way.

To discuss cosmology as a discipline is a strategic choice. As a discipline, it is both an empirical science and a form of philosophy with a history of considerable theological resonance. In a very real sense, cosmology is a scientific discipline that unites the natural sciences by asking about the total nature of reality.² The reasons for that resonance are identifiable fairly readily. Cosmology simply considers the universe as a single object. From this vantage point, the leap to theological questions about the nature of its existence and fate is clearly possible. The connection between one's personal existence and the destiny of the universe is impossible to avoid. As a discipline, philosophical cosmology parallels the theological debate concerning the contingency versus the necessity of the universe, a debate that raged in the Middle Ages with the confrontation between Christian theology and neo-Aristotelian natural philosophy. It also runs parallel to the contemporary discussion of whether a certain design or teleological character of the universe exists. The latter debate is more prominent in Catholic contexts in terms of the visionary work of Teilhard de Chardin, for example. In Protestant theological contexts, the most prominent issue is the creation-evolution debate. Cosmology also carries with it a sense of the

wider range of possibilities than the debate concerning biological evolution, since it envelops and contains within itself the anthropic question. This question centers around whether the entire evolution of the universe is directional. Is it optimally equipped to yield human life forms? This question involves much more than just whether or not evolution is best understood as strictly a biological contingency or not.

The intention here is to reinforce the point that this argument does not intend to establish a Christian or trinitarian cosmology through a method of drawing implications directly from cosmology to theology.³ Theological reflections of this sort generally derive from the need to communicate the meaning of some kind of doctrinal theological position or belief. However, this exercise is fully dependent on the success of critical realism as a systematic framework with affinities and associations with natural theology. Indeed, I would want to argue that the success of doctrinal reflections is more dependent on the kind of portrait of human rationality that McMullin works out with respect to a self-conscious scientific rationality in retroduction and its historical verification made explicit in the realist position. In terms of developing the notion of critical realism as a philosophical framework within which to work, it is necessary to explore how a realist framework successfully comprehends the universe. I will explore how McMullin makes these connections possible in his own work in philosophical cosmology.

4.2 Cosmology as a Discipline

Of all the natural sciences, cosmology has potentially the most to offer contemporary philosophy and theology, especially in light of its recent ascendance as a discipline from near obscurity at the turn of this century, when it was even disallowed scientific and learned status.⁴ Cosmology has since arrived as a scientific discipline in its own right with credibility undreamed

of fifty years ago. It is a discipline that can operate in both an empirical and radically hypothetical modes simultaneously. The cosmic space-time continuum, since the discovery of universal relativity theories is accorded an intelligibility as a singular object. Its emergence as a science has also involved other specific discoveries, especially the discovery by Penzias and Wilson in 1965 of the Cosmic Microwave Background Radiation, which confirmed, to a great extent, the Big Bang Theory of universal origins. This discovery, among others, thrust cosmology back from its previous relegation as a branch of the philosophy of nature. The philosophy of nature itself was dominated by the German Idealists throughout the nineteenth century and since. The direct confirmation of the 'Big bang' theory of universal origins, with its accent on a temporal beginning of time, led to immediate associations with biblical cosmogonies.

Given cosmology's distinct scientific character however, the problem arises as to what sort of (indirect) link does exist between scientific cosmology and an explanation of 'totality.' The problem becomes more salient in discussing some of the philosophical conclusions that have been drawn as a result of the rise of cosmology. The proposal of a strong anthropic principle ("intelligent life in the universe is a necessary feature of the universe, given its initial conditions") and the search for a theory of everything are two notable examples of such strong philosophical reflections.⁵ Moreover, there is the question of what relationship exists between cosmology, taken as a scientifically defined discipline, and natural theology. This assumes that natural theology would be open to reflections beyond the sacred text or a culturally relevant narrative with a religious dimension.⁶ Again, if we take the option of allowing philosophy to mediate these disciplines, it would be helpful to quote from a philosopher of cosmology, Milton Munitz:

“The need to have a cosmology, an acceptable picture of the universe generally derives from two principal motives. One is curiosity, a purely intellectual craving and sense of wonder that prompts the asking of certain questions [...] These are questions about the temporal, spatial, compositional, teleologic properties of the universe [...] A second motive underlying the search for a satisfying cosmology derives from the human need to “situate” the life of human beings in the universe [...] The combination of these two motives has been the principal sustaining incentive in the pursuit of cosmology.”⁷

The distinction that Munitz draws between an intellectual or scientific cosmological inquiry on the one hand, and an existential or interpretive inquiry on the other hand, is helpful. It is an important distinction for theologians to keep in mind when appropriating cosmological data.

A natural theology that identifies itself in terms of scientific cosmology to the exclusion of an existential cosmology immediately would face problems with an empiricist, postmodern, or non-foundationalist critique in philosophy and the hermeneutical, post-liberal or doctrinal theology critiques from the theologians. Perhaps the best way to approach this dilemma is to ask what general features of contemporary scientific knowledge of the universe give rise to the philosophical questions that resist the charge of arbitrariness. The best account of this question as a starting point for establishing a connection between cosmology, philosophy and religion comes from William Stoeger. For him,

“Cosmology - and the areas of physics it embraces - does deal with many of the fundamental characteristics of physical reality in general, space and time, matter (mass-energy) and its transformations, causality and its physical roots, in a way which sometimes reminds us of philosophy...[L]ike other scientific disciplines, it examines particulars and their relationships and interactions in a dialectic of theory and experiment/observation. It is just that in this case these particulars pertain to some of the most general and universal features of physical reality; the focus is on these structures and particulars with the aim of uncovering their significance and relevance for the larger whole, the observable universe.”⁸

There is another key to understanding cosmology. This is its inherent relationship to philosophy:

“[...] physics and cosmology do not presuppose the conclusions of other disciplines - as

does biology relying on chemistry and physics, and chemistry relying on physics. When we step back from physics and cosmology to justify the assumptions and presuppositions we employ in pursuing them, we have nowhere to go, except to some sort of philosophical reflection.”⁹

This reflection upon universal realities is made “from the standpoint of how they are given to us as knowers [...] and of the role they play in the general structures of knowing and of being as we know it...” But the act of knowing is not something unique to scientific explanation, not even best exemplified in cosmology as an ultimate science: “This pervasive and general structuring to which philosophy is attentive is fundamentally pre-scientific...it is based on experience.”¹⁰ But, when philosophical questions arise from cosmological study,

“cosmology is also pervasive - but pervasive, so to speak, in its object, not in our experience or knowledge of the object. In philosophy, both the object and our experience of it are pervasive or general. Thus philosophy attends to the intelligible wholes and structures, and to their interrelations, which must be assumed or presupposed by the sciences”¹¹

It is on this question of utter pervasiveness and generality that cosmology and some sort of philosophical reflection are deeply connected. The connection is much closer than philosophy’s interrelations with many other scientific disciplines, including biology. The interaction that I am arguing for here is a methodological form of interdisciplinary integration, rather than a straight metaphysical account of what knowledge exists in a more particular way within cosmology. As such, the methodological connection between cosmology and philosophy is a connection that re-affirms the kind of strategy that McMullin advocates. It centers on the role played by rationality, and what we intend as knowers. The terms for doing so are defined by scientific and critical realism.

The affirmation of knowledge in scientific cosmology is philosophically significant in a

way that defers to philosophy the task of investigating what conditions of that knowledge allow for a judgment on whether it is true. This perspective is not one that puts cosmological knowledge into perennial doubt because of prior epistemological concerns. It merely takes up the questions about the character of cosmological knowledge that cannot be answered by cosmology itself.

Cosmology is an excellent example illustrating the difference in perspectives between the scientific realist position and the critical realist position. However, even more importantly, it highlights the limits of what science *qua* science can investigate. Philosophy, since it arises out of an empirical set of inquiries, both determines the exhaustion of the limits of those inquiries and aims further to account for other knowledge that does not simply arise out of “subjective” concerns but rather out of an inquiry into this empirically defined understanding of inquiry itself in a universe that is understood generally.

Inquiry into inquiry continues this creative unfolding of questions that exhibits a certain *telos*. To distinguish the line of thinking being outlined here, the suggestion is not that the *telos* is observable in the universe itself. This is a line of reasoning that is the focus of much of the debate in the science-theology dialogue, and it represents a common-sense approach of differing selections of scientific explanations assembled to attest to the existence of order and design on the one hand, and a form of cosmic chaos on the other hand. The best known writers and thinkers in this debate are Steven Weinberg and Richard Dawkins on the side of a principle of cosmic indifference with Polkinghorne, Nancey Murphy, Robert Russell and George Ellis arguing directly from the empirical sciences for a divine ordering of the universe. The *telos* being advocated lies in terms of an anthropomorphic viewpoint, since the data by themselves do not

convey a sense of purpose unless taken together with the fact that they are cumulatively intelligible through human inquiry. This inquiry is the leading edge of a teleological direction of the universe by pointing self-reflexively, inasmuch as we advert to the limits of the empirical sciences in cosmology and the implications of this limit in both philosophy and other disciplines that reflect on this renewed and broader notion of interiority and self-knowledge. In short, it takes up the methodological impact of cosmology and its limits as a source of knowledge about the directionality of intelligence in an intelligible universe.

4.3 Cosmology and Realism

It will not be sufficient to merely relate the two disciplines of cosmology and theology in terms of philosophy. As the analysis from the previous two chapters shows, it is also binding on a position with respect to the natural sciences to articulate a philosophical strategy that can be clarified with respect to a position on realism and a theory of scientific rationality. Rather than detour from this route in favour of a metaphysical category that would appeal to certain cosmological data, I will pursue what Stoeger outlines. This is an approach to philosophical ontology that is based in the act of scientific inquiry itself. This coheres with what McMullin explains in terms of how inquiries based in the fruit of the imaginative faculties can arrive at judgments of and about the real in full appreciation of the array of questions about the values that serve as criteria for explanatory success.

This approach bypasses the traditional charge made against theologians involved in cosmological interpretation, the charge of foundationalism. The problematic portrait of foundationalism here is in thinking of selected associations between different disciplines as a series of logical links by which to justify a theological argument. However, this approach affirms

a different set of foundations, one that threads through epistemological issues critically in no hurry to articulate a short cut to metaphysical knowledge of the cosmos. The approach I am taking is at first glance more modest. It affirms that in asking cosmological questions, there are answers available. Indeed, McMullin has contributed to showing the way on this point.

One of McMullin's first published articles in 1955 is entitled "Realism in Modern Cosmology," a taxonomy of early twentieth century approaches which comes to terms with the (then recent) technologically aided observations of a large-scale universe. In this article, McMullin outlines (in the context of taking up the traditional realist concerns of metaphysics and a philosophy of nature) his version of a 'qualified realism.' As stated in chapter two, McMullin qualifies his realism in light of the fact that a "demonstratively certain" knowledge of the physical world deducible from causes to effects is actually not viable. This question of limiting the epistemic simplicity of realism is designed by McMullin in this article as a perspective that offsets the weaknesses of two competing positions in what was then philosophical cosmology. The two perspectives, which he labels correlationalism and constructivism respectively, are epistemological perspectives adopted by scientists who face the inescapable dilemmas surrounding the available options, yet who want to pursue epistemological clarity.

The insight McMullin expresses here is not only the fact that quantum and relativity theories decisively broke down an unquestioning realism during the 1920's. More important is the realization that it is cosmology and theoretical physics themselves that have brought scientific investigation to this particular philosophical limit.¹² The early attempts to draw philosophical conclusions from within the strictly scientific realm rather than a more philosophically secure set of terms and relations were made with what McMullin terms "a defective analysis of the part

played by the observer in quantum experiments [...]”¹³ The resulting idealism did, however, at least substantiate the existence of a connection between the sciences and philosophy in a new way. This was due to the inability of scientists to absorb the impact of the new data in terms of the questions they found themselves asking. The limits of science that have been accounted for by modern physics since the 1950's were, moreover, limits based on questions emerging at both the micro-level of sub-atomic particles and processes as well as the macro-level of the expanding universe.

While it is the macro-level scientific cosmology that is the concern in this chapter, it is certainly conceivable to foresee other studies on the promise of critical realism in relation to micro-level investigations. In fact, a significant controversy has emerged among two groups of thinkers on this question. The first group view a form of divine action at work in the mysterious depths of the micro-world (Polkinghorne and Russell) while others disagree with this direct implication of scientific construction with natural theology (i.e.: van Huyssteen and Clayton).¹⁴ Why Polkinghorne opts for this understanding of divine action is somewhat puzzling, because I believe it obscures the theological point he presses in his Gifford lectures. In a response to Peacocke, he has clarified what he means.¹⁵ This clarification certainly sheds light on a problematic point of dispute that is an important issue at the interface among the new science, philosophy and theology.¹⁶

In an important article written in 1981, McMullin revisits the question of philosophy and cosmology with the added insights of his historical studies undertaken in the intervening 25 years, as well as the formulation of the theory of retrodution as the positive results of examining the fruits of science in light of his early negative appraisal of neo-Aristotelianism. At the

beginning of the article, McMullin notes how such prominent scientists as Stephen Weinberg and even Paul Davies treat philosophical and theological investigations.¹⁷ In contrast, McMullin begins with the actual existence of philosophical inquiries by scientists as the result of their discoveries of their own probing and the discovery of limits in these probes.¹⁸ Science becomes philosophy “at its most innovative point” and scientific cosmology’s posing the question of the unity of the universe is clearly “an interesting one.”¹⁹ To suggest that the sciences cannot answer these questions is not to admit a fundamental agnosticism about the universe’s character. Rather, admitting their philosophical character is to “recall that science itself cannot answer them without begging the question.”²⁰

The transfer of a line of inquiry from the realm of science into the realm of philosophy is a profound implication arising from the renewal in cosmology itself as a discipline that is thoroughly theoretical and therefore replete with answers to questions that are stated in terms of statistical probabilities. The scientific enterprise is not diminished by this limitation, but rather extended into the philosophy of science, conceived as a constructive, positive sub-discipline:

“[...] the fascination of cosmology for the philosopher is in part due to this; it is as much a testing-ground for the philosopher’s theories of science as it is for the physicist’s theories of matter.”²¹

Cosmology’s inherent philosophical structure reveals a cross-traffic between the disciplines that resembles the hazy relationship between mathematics and logic, where logic, like philosophy in general, is involved in the work of clarification. This task of clarification is itself significant. For example, in light of the new conception of space-time in relation to material reality, there has been an intensification of a historical debate in philosophy between “relationists” and “substantialists”: “this is a purely “philosophical” debate, but it is obviously not any the less

important for that.”²² The importance of philosophical clarification, moreover, is made concrete in terms of sorting through conceptual presuppositions, implications, consistency and frameworks. As science becomes more innovative, as it approaches a revolutionary stage (to use Kuhn’s terminology) at the anticipation of radical theory-change, “it is precisely conceptual issues...that can be crucial, as twentieth-century science has so often shown.”²³

Indeed, cosmology as a discipline exudes a tremendous amount of conceptual elasticity, and as a domain with such a broad philosophical appeal in this respect alone, it is clear why it possesses so much capacity for identifying a mediation between empirical intelligibility and abstract theorizing that potentially addresses existential questions. What is more deeply significant though is McMullin’s suggestive and consistent claim that

“retroduction can...establish the existence of structures and processes altogether different from any that lie within direct reach, and is limited only by the resources of the scientific imagination...*It is on this much more powerful pattern of inference that cosmology mainly relies.*” (italics mine)²⁴

Retrodution, as it works to explain scientific rationality operative in cosmology, is the tool which reveals a startling symmetry. This symmetry is the degree to which the most general theories of mechanics can provide coherent explanations of known cosmological data.” As the recent spectroscopically aided observations of the last decade shows, these theories are verified as successful in the accumulation of further empirical evidence.²⁵

What does this employment of retrodution in cosmology mean? In short, it leads to affirming the realist position concerning the universe as a single unified object:

“When the spectra of distant stars, or the velocities of distant galaxies, continue to be interpretable by schemas derived from terrestrial processes, confidence quite properly grows in the assumption that these schemas are not just conventions imposed for convention’s sake or because our minds cannot operate otherwise, but that all parts of the

universe are united in a web of physical process which is accessible through coherent and ever-widening theoretical constructs created and continually modified by us.”²⁶

I would emphasize, following the development of an understanding of critical realism from earlier chapters, that McMullin highlights the non-opposition of the act of knowing and the known cosmos. The universe discloses itself through theory, creative imagination and eventual verification that together constitutes a form of progress in the growth of knowledge. To repeat, a dialectical conception of cosmological knowledge is overcome by the sheer confidence in the modified and modifiable sets of theoretical constructs that germinate out from the extant body of interpretative schemas operative in terrestrially restricted sciences. The form of the disclosure of the universe is congruent with the peculiar imaginative schemes of theories and concepts that must await empirical verification, yet they remain valid heuristic tools that operate on occasionally simultaneous fronts to illuminate aspects of parallel investigations. The irreducibility of purposeful human subjectivity and cosmic intelligibility are confirmed through sets of operations in inquiry.

4.4 The Anthropic Principle

The affirmation of scientific realism in cosmology through retroductive inference, rather than particular categories or deductive schemes raises the thorny issue of the anthropic principle. First introduced by Collins and Hawking²⁷, coined by Brandon Carter²⁸, and interpreted by Barrow and Tipler²⁹, the anthropic principle has come to serve as a virtual lightning rod for promoters and dissenters of the presence of empirically based meaning in the universe.³⁰ The anthropic principle, on appearance, goes further than the more general, methodological connection between cosmology, philosophy and theology, which I have outlined so far in terms

of a theory of scientific rationality. The anthropic principle purports to provide an explanatory account for human existence due to the evidence of the delicate balance of energy and initial forces as conditions for a habitable universe to emerge. The implications of this explanatory account provide the grounds for a new form of the “teleological argument” for the existence of God.

Judging by McMullin’s strong arguments to defend the role of human creative genius in accounting for the real, crystallized in his theory of retroduction, it would be natural to assume that he might sympathize with the effort to grant significance to the anthropic principle. The assumption would be that the natural sciences have collaborated to uncover a key cosmological “meta-constant” that illuminates the rest of cosmology in a unique way that puts human intelligence at the centre of the universe by giving it purpose. But, in comparison with other philosophers and theologians who exhibit such enthusiasm for the anthropic principle, McMullin’s reflections are cautious and circumspect in comparison.

McMullin’s approach incorporates a different evaluation of the anthropic principle than Polkinghorne’s evaluation. Again, Polkinghorne appears to be persuaded that some form of the anthropic principle is worthwhile as a cosmological basis for discussing purpose in the universe, and so he proposes a “Moderate Anthopic Principle” in contradistinction to the Weak and Strong versions.³¹ McMullin does not even cede this much explanatory possibility to the anthropic principle, and this is due to his identification of the clear lessons to be drawn from historical antecedents of the anthropic principle, and the credibility with which alternative explanations enjoy. These other interpretations of the anthropic principle are summed up by McMullin as comprising an ‘indifference principle.’

The indifference principle is a contender to the anthropic principle, whose kernel can be put in the following terms: “whatever theory we propose for the early universe, it ought to be indifferent to (independent of) any particular initial conditions.”³² In spite of the fact that Collins and Hawking identified a significance to the discrete value of the initial energy field, manifest in the state of space-time 10^{-30} seconds after the Big bang, Alan Guth has revised the Big Bang hypothesis according to an ‘inflationary hypothesis.’ Among other things, this hypothesis includes as a possibility the radical plurality of universal dimensions, as the result of the inflation of an atom at the extremely early time of 10^{-50} seconds after the singularity. Advocates of many worlds theories have used Guth’s hypothesis to indicate a way in which a ‘superspace’ emerged during the phase of rapid inflation to give these theories viability. This would be responsible for the virtually disconnected causal connections between universes.³³ The result of understanding this competing interpretation to the anthropic principle is its potential de-stabilization. With such a plurality of universes, the significance of an anthropic universe dwindles. The existential implications of this substantial modification of the Big Bang theory are tangible. One of these implications is that the argument for the “fine-tuning of the initial energy-density [would become] unnecessary.”³⁴

In four different articles, McMullin treats the issue of the anthropic principle in terms of its merits and demerits as a scientific theory in light of the kind of challenges from the ‘indifference principle.’ As a theory that requires measuring against the other options, the anthropic principle requires a thorough examination that has not yet been fully carried out by theologians and theologically oriented philosophers. The anthropic principle’s tenacity as a theory for scientific scrutiny surely possesses theological implications even though its scientific

basis is difficult to jettison. The question is to specify what these are.

One of the theological implications might lie in a reflection on the fact that the Big Bang theory itself has only recently emerged as the victorious theory over the Steady State theory of Bondi, Gold and Hoyle. This cosmological breakthrough was made possible by the discovery by Penzias and Wilson in the 1960's of the cosmic microwave background radiation that courses through the observable universe at 3°K. This was clarified by Collins and Hawking's calculation from which they concluded that the likelihood of the emergence of this universe is extremely unlikely under almost any other arbitrary initial conditions. From this calculation emerged the anthropic principle due to the extraordinary flatness of the initial mass-density of the universe along a razor edge between runaway expansion and rapid collapse. McMullin cites how Collins and Hawking drew famous conclusions from their results: "The fact that we have observed the universe to be isotropic is therefore only a consequence of our own existence."³⁵ The kind of hermeneutic circle that the Strong Anthropic Principle implies would appear to be tautologous. However, McMullin retains his focus on the scientific import of this conclusion by asking: "[...] surely a necessary condition cannot function as an explanation?"³⁶ Collins and Hawking adopt the one option that is most available to them at this point in their argument by postulating (before Guth's inflationary hypothesis) the possibility of an infinite set of universes. Thus, the isotropy of our universe is possible to explain scientifically.

In analyzing the anthropic principle that grew directly out of these discussions, McMullin elaborates on a distinction that is made elsewhere between the weak and strong versions. He criticizes the misleading way in which the word 'principle' is used. In its weak forms (McMullin identifies two different variations of the weak version) the anthropic principle appears to be

either trivial or at least as restrictive as the earlier dominant ‘Copernican principle.’ In contrast to the earlier ‘anthropic agnosticism,’ a second variation of the Weak Anthropic Principle (WAP₂) seems to state that “humans cannot be located just *anywhere* on the cosmic time-line.”³⁷

McMullin clarifies the meaning of what is being proposed here:

“WAP₂ serves as a reminder that from Big Bang theory one can infer that the celestial array we observe is peculiar to the ‘observer era’ [...] But this does not mean that WAP₂ has somehow [...] served to *explain* something that was previously puzzling. WAP₂ simply reminds us to ask of *any* model what selection effects it imposes on present day observation [...] we seem to be dealing with normal empirical procedure, hardly worth dignifying with the honorific label ‘principle’.”³⁸

What about the Strong Anthropic Principle? In beginning with Carter’s formulation of it in 1974, it is clear that the intent of the SAP is explicitly explanatory. In its strong version, the anthropic principle proposes a necessary character to human existence derived from an interpretation of the restrictions on physical constants arising from coincidences in energy and mass levels in the universe. But, as McMullin notices in Carter’s accounting of the SAP, what ultimately purports to explain is the theory of many universes into which the SAP can easily collapse as meaningless:

“then the appearance within this ensemble of coexistent universes of one capable of bearing life might be regarded as (more or less) necessary [...] Because among all the (actual) universes featuring different constants, we (*of course*) will be found in one that permits our existence.”³⁹

But do “the many universes have to exist? Surely not.”⁴⁰ McMullin here shifts the focus in order to address more directly the kind of cosmic and philosophic knowledge that these anthropic principles are seeking to identify. If the strong version of the principle can be reformulated in terms of evidence of ‘cosmic fine-tuning,’ what do anthropic types of explanation actually explain? What is the *explanandum*? Fine-tuning, in its two basic forms of initial conditions, and

the actual physical laws themselves are taken to be those observed effects for which we are seeking an explanation following on the insight of the theory of retroduction. Prescinding from the possibility of fine-tuning in the actual physical laws, McMullin focuses on the initial conditions of the universe, specifically on what is called the ‘flatness problem.’

Two options are available, according to McMullin, as ways to forge true explanations of cosmic natural process. Either we opt to view this universe as simply the way it is due to its being insignificant in light of the plethora of other possible universes, possibly infinite number of universes.⁴¹ Or, the alternative is to ask whether a universe of this kind has a special significance in terms of some system of meaning, one that would suggest a likely explanation of the apparent parameter condition. Such an “explanation” would definitely be preferred instead of “leaving the coincidence *merely* a coincidence.”⁴²

In pushing the questions further in light of the creative desire for explanation, McMullin finds the question of intelligibility exhausted. But, intellectual resources from “systems of meaning” might potentially answer the question. In pushing inquiry forward, not only is philosophy *per se* being invoked, philosophy serves to dramatically reject Carl Sagan’s now infamous opening line to the well known book and television series that “The cosmos is all that is or ever was or ever will be.” Systems of meaning certainly implicate theological possibilities, or at least reflection on religious meaning. At this point, it is essential to recognize the indirect and non-linear way in which a theological ‘explanation’ is introduced as the unobserved cause of the cosmological effect, to alter the phrase of the retroductive explanation. The cosmic effect is known as the terms and relations of the universe’s initial or boundary conditions that are the *explanandum* requiring an *explanans*.

It is clear that to a certain extent, McMullin has followed the creative clues of the retroductive method, which is not reticent concerning the unobservable, because the unobservable is a condition of theory formulation in the first place. By speaking of “systems of meaning” moreover, McMullin is avoiding what I believe are the inherent difficulties with a close association between the anthropic principle and the proposition of a divinely caused and ordered universe. The route that McMullin clarifies for a God-World relationship, in light of the problems raised by the anthropic principle, is nevertheless an “anthropic” route of inquiry. The recourse to “systems of meaning”, as an alternative strategy accounting for the existence of initial conditions only comes on the heels of a meticulous procedure of laying out the series of problems and their interrelationships arising from a consideration of the anthropic principle. It is impossible to view systems of meaning as something separate from religious, mythical, social or psychological fields of inquiry, to which meaning is more commonly attached as something that is intelligible and investigated.

Again, following the lead that the theory of retroduction provides, can the systems of meaning that are introduced to explain the universe, in light of its boundary conditions, be verified as explanatory? By what criteria or values would this process of verification proceed and take shape? Since the answers to these questions lie at the intersection of philosophy and the human sciences (and theology), and outside the sphere of the natural sciences, the question is: is retroduction helpful at this point? I will attempt to deal more fully with the answers to these questions in the next chapter, and the final chapter where the insights of the Gifford lecturers are brought to bear on the nexus between an expanded notion of critical realism and the God-World relationship.

In summarizing McMullin's approach to the anthropic principle as articulated succinctly in his 1993 article "Indifference Principle and Anthropic Principle in Cosmology," one point in particular stands out in this regard, because it widens the range of implied questions raised by the anthropic principle. What is raised in the context of the anthropic principle is also relevant to the so-called 'indifference principle', not to mention other future possible cosmological interpretations that address the nature of the universe taken as a single object. The key here is the distinction between the empirical and the metaphysical as it pertains to both the pursuit of knowledge of unobserved theoretical causes and the acts of interpretation such knowledge allows. The importance of this distinction for cosmology is more apparent now than ever:

"Modern cosmology has been [...] directed by 'principles' whose credentials are remarkably difficult to assess. The degree of conceptual extrapolation is so extreme and the possibilities of empirical test are so slender that cosmologists often have to rely on the most elusive of intuitions [...] These intuitions derive from [...] sources that in many cases lie outside the confines of 'normal' science. This is why the boundaries between cosmology and metaphysics or even theology seem so permeable."⁴³

The critical point is that the theological impulse to execute an interpretation of the anthropic principle is not a uniquely metaphysical dimension in contemporary cosmology. As McMullin points out in reflecting on Guth's inflationary hypothesis, and more recent amendments made by cosmologist Andrei Linde:

"The fierceness of the commitment of some to the indifference principle and the openness of others to unorthodox anthropic hypotheses reflect broader metaphysical commitments."⁴⁴

Keeping in mind the discussion of values and truth criteria that arise in the context of retrodution, the problems that cosmology and the anthropic principle pose are therefore *not* problems about which metaphysical interpretation of cosmic reality is best suited for theological

interpretation. The question becomes one of how an ontological or metaphysical commitment best respects the particular stages of inquiry in the empirical investigations, especially once these investigations involve philosophical questions.

If the anthropic principle is very difficult to assess within a framework of scientific explanation, the explicit advertence to the field of meaning requires a concomitant admission of the inherent vulnerability of the anthropic principle, especially as an interpretable piece of data.

The anthropic principle, after all derives:

“from the claim (1) that the most basic structures of the universe might have been different from what they are; and (2) that the development of rational life in the universe depends on their being more or less exactly what they, in fact, are.”⁴⁵

The limitations of the anthropic principle are limitations with respect to scientific explanation.

McMullin seems to have no problem, however, with deriving meaning from the anthropic principle if it is clear that another form of explanation drawing on meaning itself is taken into consideration:

“If the universe is the work of a Creator [...] Reasons can be given in the traditional Judaeo-Christian perspective, why God *would* want man in the world. Thus, the explanation is not merely by the presumed fact of choice, but by some presumptive *reasons* for the choice. The anthropic principle, if fortified by the traditional doctrine of creation, does therefore give an explanation, though it is no longer, of course, a scientific explanation.”⁴⁶

In the next chapter, McMullin’s critical realism will be treated more explicitly as a way that allows him to integrate cosmology and theology through a distinction in terms of investigations into what is philosophically explicable. For now, I want to merely note how the anthropic example is one of a possible number of cosmological findings that reveal the fact that originally empirical questions within the discipline of cosmology tend to direct themselves almost

autonomously into the philosophical domain. McMullin clarifies the unique way in which contemporary cosmologists accomplish this movement thus:

“Cosmology of its very nature demands extrapolation, often quite daring extrapolation. Because its objects are distant and unfamiliar, it has always had to rely on indirect and precarious modes of reasoning.”⁴⁷

It is because of this essential feature of extrapolation, that cosmology goes beyond the bounds of empirical observation to attempt the verification of theories (such as the anthropic principle).

Thus, cosmology is structured in a way that defies pre T-science understandings of the discipline.

The distinction that Munitz draws between two different types of questions that guide cosmology are historically evident in both pre- and post- T-science, but their true unification did not occur until the relatively recent realization that a grasp of understanding the nature of extrapolation is itself a “logical” extension of the set of questions germane to natural process in an empirically dedicated line of investigations. As McMullin shows with respect to the Aristotelian legacy of cosmological philosophy of science, this self-conscious awareness of the act of extrapolating, as an extension of empirical inquiry, defies the pre-Galilean demonstrative ideal. This analysis draws a fundamental line of demarcation between pre- and post- T-science. However, as McMullin carefully shows with respect to Aristotle’s line of reasoning in the *Posterior Analytics*, the presence of retroductive technique at the heart of Aristotle’s supposedly pure deductive reasoning, is revelatory of the presence of at least an element of self-realization in understanding the foundations of a natural theology that interprets the universe.⁴⁸

4.5 Conclusion

Although empirically based, the mediating role of theory in cosmology is so extraordinary, and the urgency of the questions so clear, that the move to incorporate systems of

meaning (i.e.: creation) into a meta-explanatory framework is not the reversion to “mere” interpretation that one might presuppose. The fact that cosmology makes demands on the human imagination in a dynamic way, positively allows for the possibility of systems of meaning emerging from within the anthropic experience of consciousness to shape an understanding of the universe. On this account, however, the understanding is one of creation, a theological category. Where the terms and relations of meaning will fit depends on what McMullin refers to (only once) as a “meta-philosophy.” Such a philosophy might guide philosophy and cosmology:

“The problem in the end is one of metaphilosophy, of deciding on the sort of warrant that is appropriate to philosophic and to scientific claims, seen not as two entirely different sorts of intellectual pursuit, but as a continuum. What has made the issue more intractable is the pace of development of theoretical cosmology, a pace too rapid of late to allow metaphilosophy the time it needs to take stock.”⁴⁹

The significance and precise role of a meta-philosophy should be carefully noted. With the historical verification of explanation in the sciences aided by the human imagination, such a metaphilosophy called for by McMullin may be closer to realization than even he realizes. In the context of his theory of rationality, McMullin’s reflections in cosmology possess potent philosophical and theological suggestions. This term identifies a meta-philosophy with precisely the same concerns for the realist intent of human inquiry without setting up an *a priori* ontological framework. It is laid out with particular attention toward negotiating the fullest possible horizon of issues arising from twentieth century natural sciences, with particular concern to propose a philosophical realism that takes up the insights of relativity theory.

As stated at the beginning of this chapter, the reason for highlighting cosmology has to do with the need to assess scientific rationality at its philosophical limits. One way of accounting for the meta-philosophy that is still required is to follow Lonergan’s proposal of emergent

probability. This worldview holds great promise for allowing both an inquiry into rationality and the inquiries of various scientific disciplines to interrelate isomorphically and metaphysically. While there is not space in this study to pursue the meaning of emergent probability further, it does potentially provide a metaphysical verification of the possibility of a differentiated integration. The breach between an advanced analyses on the issue of rationality and investigations that draw on the actual contents of the different disciplines require such an integration.⁵⁰

This chapter has attempted to evaluate some material that is usually treated strictly as content. However, in light of the overarching focus on a theory of scientific rationality, the significance of cosmology lies in simply indicating that a surplus of meaning exists at the limit of scientific inquiry. A philosophical framework for science-theology dialogue cannot separate an understanding of cosmology from a thorough understanding of rationality. This chapter in cosmology should not, therefore, be seen as merely a counterpoint to the previous discussions of rationality. Rather, it fulfills those earlier arguments which hinge on the significance of imagination and self-aware rationality in science. The underlying goal is to suggest what I will argue in greater depth in chapters five and six regarding the thread that unites rationality with religious meaning.

The reality of imaginative extrapolation and the value-filled ways in which theories are verified permits a distinct anthropic stance to be taken in order to construct a framework for the science-theology dialogue. This framework would allow for the unique and positive contribution of contemporary cosmology to serve as the central heuristic for a natural theology. Yet, it does not need to necessarily rest on any one particular principle or theory. It is true, therefore, that the

contents of cosmology are implied in mediating the science-theology dialogue. However, they are implied as the scientific starting point from which the operations of consciousness are self-reflectively dedicated to understanding the connections that draw the scientific questions into philosophical and eventually theological questions.

Hence, cosmology's heuristic role in shedding light upon the rational yet imaginative character of rationality in its scientific form can emerge more strongly as congruent. What is clear is that the range of questions and reflections along a transcendent trajectory from within the heart of scientific inquiry extend to encompass other distinct operations of human reflection. Cosmology shows how empirically relevant are these elements of meaning, because they already arise out of the exigencies of creativity and imagination at work in the formulation and verification of scientific theories.

Cosmology does not necessitate additional reflections on the structure of interiority in terms of human creativity or religious desire. Neither does cosmology necessitate the spiritual horizon illuminated by theology and religious reflections. However, it does imply a positive heuristic limit to scientific rationality. It points to something beyond what is simultaneously scientific and rational. It points to further questions for interpretation, to which answers are given outside the sphere of science. These questions and answers nevertheless stand in need of some kind of structured relationship beyond a mere affirmation of interiority. This structure will be the issue dealt with in the next chapter as a basis for theological knowledge claims.

Endnotes

1. For an insightful overview of the question, see Jean Ladrière's "Faith and Cosmology" in *Language and Belief* (Notre Dame: University of Notre Dame Press, 1984), pp. 149-86.

2. For a thorough account of the religious and theological themes present in cosmological reflection, see the historical essays and the essay by Eran McMullin in Noriss Hetherington, ed. *Cosmology: Historical, Literary, Philosophical, Religious and Scientific Perspectives* (New York: Garland, 1993). For the theological parallels and history of interpretations, see N. Max Wildiers, *The Theologian and his Universe: Theology and Cosmology from the Middle Ages to the Present* (New York: Seabury Press, 1982).

3. For an example of this kind of natural theology that resembles what Peacocke, in particular, is trying to execute, see Duane Larson, *Times of the Trinity: A Proposal for a Theistic Cosmology* (New York: Peter Lang, 1996) where the trinitarian nature of God is defended with reference to cosmology's findings primarily on the basis of an appraisal of discoveries about time and eternity. I do not think that sufficient attention has been paid to the role of language and analogy in this work, however. See also Stratford Caldecott's "The Science of the Real: The Renewal of Christian Cosmology" in *Communio: International Catholic Review* (1997) where a similar argument is made with reference to the role and the function of the 'personal' in science and theology with reference to the work of theologian Hans von Balthasar. Again, while there is no *a priori* reason to rule out the validity of these sort of reflections, the possibility of their functioning is clearly dependent on epistemological strategies involved in working out the meaning of critical realism, and a strategy for outlining the conditions of possibility for making analogical arguments in a natural theology.

4. See a book review by Dick Teresi in the New York Times, in which he cites a revealing anecdote: "In 1966, when the cosmologist Edward Harrison accepted a teaching post at the University of Massachusetts, he was handed the Redbook, a manual for faculty members that explained what a university was, and what it wasn't. It cited two courses one wouldn't find in a curriculum of higher education: witchcraft and cosmology." See the following URL where this review is re-published: <<http://www.nytimes.com/books/99/08/08/reviews/990808.08teresit.html>>.

5. Thinkers who have pursued this theory include Stephen Hawking, Paul Davies and Steven Weinberg.

6. See the works of Brian Swimme and Thomas Berry, whose objectives are to coalesce side by side the narrative form of understanding together with scientific explanation for the expressed purpose of a cultural re-enchantment with nature. The spiritual dimension of this pursuit is more clearly outlined in the work of Teilhard de Chardin, mixed, as it is, with an interpretation of technology and human action. In both cases, strategies for a natural theology are put aside, either because understanding God through a religious tradition is judged disingenuous in an ecumenical context. In the case of Teilhard, the character of natural theology was so inextricably tied up with neo-Thomism and neo-Aristotelianism that to pursue the question of the cosmology in that context would have been even more difficult than the more inspirational and communicatively centred route that he pursued.

7. Milton Munitz, *Cosmic Understanding: Philosophy and Science of the Universe* (Princeton: Princeton University Press, 1986), pp. 5-6.

8. William Stoeger, "Contemporary Cosmology and its Implications for the Science-Religion Dialogue" in Robert J. Russell, William Stoeger SJ, and George Coyne, eds., *Physics, Philosophy and Theology: A Common Quest for Understanding* (Vatican City: Vatican Observatory Publications, 1988), p. 226.

9. *ibid.* p. 227.

10. *ibid.* p. 226.

11. *ibid.*

12. McMullin cites the well known admonition to adopt philosophical idealism by physicists such as Niels Bohr, Arthur Eddington and Carl von Weizsäcker in "Realism in Modern Cosmology", *Proceedings, American Catholic Philosophy Association* 29, p. 145.

13. *ibid.*

14. This issue is taken up within the boundaries of understanding the meaning of the term "divine action" with respect to the thought of Polkinghorne, Peacocke and William Pollard by Steven D. Crain in *Divine Action and Indeterminism: On Models of Divine Agency that Exploit the New Physics* (University of Notre Dame: unpublished doctoral thesis, 1993).

15. See *Scientists as Theologians: A Comparison of the Writings of Ian Barbour, Arthur Peacocke and John Polkinghorne* (London: SPCK, 1996), p. 40:

16. Besides Crain's thesis, there is Diarmuid O'Murchu's *Quantum Theology: Spiritual Implications of the New Physics* (New York: Crossroad, 1996), and an article by Edward MacKinnon entitled "Complementarity" in W. Mark Richardson and Wesley J. Wildman, eds. *Religion and Science: History, Method, Dialogue* (London: Routledge, 1996), pp. 255-70.

17. It bears repeating that since 1981 Davies has substantially modified his earlier position from the one he advocates in the 1977 article that McMullin cites. In repeating McMullin's citation, I am evoking his engagement with a genre of philosophy by scientists where the allegiance to the empirical reference of the sciences leads to an exclusion of other legitimate questions, inquiries that are subsequently understood strictly in terms of common sense approaches that emphasize opinion and taste.

18. See "Is philosophy relevant to cosmology?" in *American Philosophical Quarterly* 18, p. 181.

19. *ibid.*

20. *ibid.*

21. *ibid.*

22. *ibid.* p. 182.

23. *ibid.*

24. *ibid.* p. 180.

25. This point was highlighted for me by Prof. Edmund Bertschinger (Astrophysics, MIT) in a personal conversation in January, 1999. Bertschinger highlighted the evolution of cosmology over the past decade as a history of successful observations supporting a range of previously theoretical hypotheses. Cosmology is therefore not only intelligible in terms of a predictive capacity of certain good theories over others. It is, over time, empirically justified as well. The January, 1999 issue of *Scientific American* details some of these recent successes.

26. "Is Philosophy Relevant to Cosmology?", p. 181.

27. See C.B. Collins and S. W. Hawking, "Why is the Universe Isotropic?" in *Astrophysical Journal* 180 (1973), pp. 317-334.
28. Brandon Carter, "Large Number Coincidences and anthropic principle in cosmology" in M.A. Longair, ed. *Confrontation of Cosmological Theories with Observational Data* (Dordrecht, 1974), pp. 291-298.
29. John Barrow and F.J. Tipler, *The Anthropic Cosmological Principle* (Oxford: Clarendon Press, 1986)
30. The argument advanced by Nancey Murphy and George Ellis in *On the Moral Nature of the Universe: Theology, Cosmology and Ethics* (Minneapolis: Fortress Press, 1996) is a clear example of this association among others.
31. See *Science and Creation* (London: SPCK, 1988), chapters 1 and 2, *Reason and Reality* (London: Trinity Press International, 1991), ch. 6 and *Scientists as Theologians* (London: SPCK, 1996), p. 51.
32. See McMullin's discussion of the indifference principle in "Long ago and far away: Cosmology as extrapolation" in Fuller, R., ed. *Bang: the Evolving Cosmos* (Lanham, MD.: University Press of America), p. 135.
33. Many worlds or multiple universe theories possess some support from cosmologists including Lee Smolin, David Deutsch, Martin Rees and John Gribbin. J. Richard Gott has advocated a link between inflationary hypothesis and many worlds theory by virtue of the presence of "domains" or bubble universes in the inflationary phase. For a description of this linkage, see George Gale, "Multiple Universes" in Hetherington, Noriss, ed. *Cosmology: Historical, Literary, Philosophical, Religious and Scientific Perspectives* (New York: Garland, 1993), pp. 533-545, especially p. 539-40.
34. McMullin, "Long Ago and Far Away", p. 138.
35. cited in "Indifference principle and anthropic principle in cosmology" in *Studies in the History and Philosophy of Science* 24, p. 371. Cf. Collins and Hawking, p. 319.
36. *ibid.*
37. *ibid.*
38. *ibid.*
39. *ibid.*
40. *ibid.* p. 377.
41. *ibid.* p. 379.
42. *ibid.*
43. *ibid.* p. 387.
44. *ibid.*

45. "Is Philosophy Relevant to Cosmology?", p. 186.

46. *ibid.*

47. "Long Ago and Far Away", p. 113.

48. See McMullin's *The Inference that Makes Science* (Milwaukee: Marquette University Press, 1992), especially p. 19.

49. "Is Philosophy Relevant to Cosmology?", p. 189.

50. On the issue of rationality, see Mikael Stenmark, *Rationality in Science, Religion and Everyday Life* (Notre Dame, 1995) and the volume edited by Niels Gregersen and Wentzel van Huyssteen, *Rethinking Theology and Science: Six Models for the Current Dialogue* (Grand Rapids, MI: Eerdmans, 1997).

Chapter Five: McMullin, Faith and Rationality

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5.1 Introduction

Over the course of the final two chapters, this study will present and expand upon two basic movements contained in the thought of Ernan McMullin on the subject of a philosophical mediation of science and theology. In chapter five, the first movement will be presented on the main themes contained in McMullin's writings on the challenge coming from proposals such as Polkinghorne's on the relationship between faith and rationality. Essentially, faith and rationality are differentiated. While McMullin does not present the topic systematically, there are sufficient elements in his writing to indicate a substantial appreciation of a distinctive role for religious faith in light of natural theology.

McMullin upholds the distinction between faith and rationality partly reclaimed by Polkinghorne within the parameters of the Gifford lectures. Against fideism however, he holds out hope for the Augustinian idea of Divine Illumination, or the belief in a divinely created source for human reason. This is already potential in the acknowledged presence of values in scientific theorizing. It is expressed, according to McMullin, by seeing in the structure of the human imagination a twofold intentionality. It operates concretely on perceived objects and analogically on unvisualizable objects. In a theological light, the imagination is a manifestation of *spiritus*.

With regard to the notions of creation, the anthropic principle and evolution, McMullin explicitly draws a distinction between nature and history, in which theology functions to primarily illumine history in terms of redemptive categories. While accenting the soteriological basis for theology, he engages in sustained discussion with Alvin Plantinga in order to show that the reality of sin and evil does not fatally hamper the enterprise of natural theology. Augustine

emerges as an important theological source for dealing with related theological issues, especially the theological specificity of creation and the accent on development in natural process.

By way of arranging this argument in stages, this chapter will first consider the important context for the question of rationality: its role in configuring theological models for the God-World relationship. This problem is laid out with reference to the work of Philip Clayton. Next, by way of setting the stage for an expansion of Polkinghorne's contrast between faith and rationality, McMullin's disagreement with Plantinga is highlighted in order to show how a natural theology that accents creation leads naturally to a theology of revelation. Such a view does not lead to a necessary demotion of religious faith, as the chapter goes on to show with respect to the way in which McMullin understands the meaning of creation within a general Thomist framework, the anthropic principle as a philosophical thesis and the foundational salvation history reference point for theology. This leads to a discussion of McMullin's affirmation of an atemporal notion of God. This is the stance within which theology conveys explanatory knowledge. From this point, discussion turns to McMullin's adoption of Augustine as a source of theological tradition and is taken up with regard to several issues. The chapter concludes with reference to the imagination as the key element of human intentionality through which an Augustinian theory of Divine Illumination acts as a theologically coherent theory of knowledge.

From chapter four it is now possible to understand better the pivotal discipline of cosmology as it conforms to retrodution as a theory of scientific rationality. The central concern of this chapter concerns how this portrait of scientific rationality handles the challenge of religious faith in a providential God. This concern shifts this study away from the development of

a theory of scientific rationality in constructing a critical realist framework. The second major question of this entire study now comes into focus. Arising out of the initial reading of the Gifford lectures in chapter one, it was posed as: what elements make up a theological knowledge claim in light of how human rationality is operative in the understanding of natural process? Furthermore, is this a critical realist position in theology, when it speaks of God?¹ In light of the epistemological and historical elements that shape a renewed critical realism and its ultimate object understood through cosmology, what theological conclusions can we draw? This particular chapter will focus on the kind of distinction McMullin himself draws between faith and knowledge in contrast to the sharper fideist distinctions made by other thinkers on related questions.

At first glance, the theological implications would appear to be simply minimal, going on McMullin's caution regarding the establishment of theological conclusions from scientific knowledge. This is especially apparent from his thought on scientific rationality in connection with cosmology. Therefore, Polkinghorne's stance may be the kind of stance that needs to be nuanced and supported. But, over the course of the following two chapters, this study will propose an alternative view that is less cautious, while still holding up Polkinghorne's priority of faith as vitally important. Faith and rationality are not opposed. Faith is implied by rationality along a circuitous route of human self-transcendence. An integrative critical realist framework in the science-theology dialogue can nevertheless uphold the specificity of religious faith, and the nature of this distinction will preoccupy this chapter.

Such a bold distinction is undoubtedly a mark of confidence in theology and the power of religion to speak with a unique voice. For example, at the end of his important study *God and*

Contemporary Science, Philip Clayton states:

“[...] we have found that, despite many thinkers’ intentions to rely on the physical sciences alone, the bothersome problem of *the human dimension*, the so-called problem of consciousness, emerged repeatedly as the linchpin of the entire debate. Indeed, the role of this particular problem in the discussion between the natural sciences and theology is so central that it suggests a new thesis: until one is able to solve the problem of human mental causation - the question of how human intentions and desires get translated into events in the physical world - one will not be able to develop even a half-way adequate answer to the question of divine causality. Conversely, *if* one is able to conceive of human intentional action in a way that is compatible with natural scientific accounts of the physical world, then one will have done the bulk of the work necessary for a theory of divine causation.”²

Clayton clearly advocates a precise approach to natural theology, one that examines rationality for the purpose of making knowledge claims about God through the prism of the mind/body problem in philosophy. Clayton goes on to defend human intentional action in order to form a basis for analogical language about God. The term he chooses to describe his theological model is “panentheism with transcendence.” While this strategy for recovering analogical knowledge in theology possesses important advantages, Clayton’s choice to foresee theological language in terms of model reminds us of Polkinghorne’s emphasis on metaphor in theology in contrast to its diminished role in the sciences.³ While it is true that models are crucial for obtaining a concrete idea about how to imagine the supernatural and unobservable features of God, they do not exhaust explanatory potential in theology any more than in the sciences.

While he is willing to allow the need to affirm transcendence, Clayton does not explain how a reconciliation between the mind-body analogy to the God-universe relationship establishes the meaning and significance of self-transcendence in human rationality as identified by Peacocke in particular. Already, we can see through McMullin’s development of a broad critical realism from a basis in rationality, he provides a portrait of transcendence that is operative in

science. This pertains to why scientists Barbour, Peacocke and Polkinghorne, in particular, remain valued thinkers. They identify this experience of self-transcendence, to take Peacocke's insight as an exemplary one, as an experience that alludes to divine creative presence in the universe.

Going on the clues provided by McMullin's theory of retrodution and its verification in history and contemporary cosmology, the imaginative heuristic of scientific rationality, with its appeals to value and fertility in the study of nature, is the key to understanding self-transcendence. With Clayton, we can affirm a capacity for theology to speak about God from an account of nature. We can eventually affirm a theory of analogy in speaking of God's being and action. However, this should be handled without being confined to the mind/body construct of consciousness, as valid as that construct may be as an allied investigation to this one.

In contrast to Clayton's position however, models cannot be the only analogical tools that lead from rationality to God. Whatever model one would like to employ, the relevant insight from a reading of McMullin is that values, imaginative schemes and human judgment are more significant dimensions of human rationality. If rationality is to be employed as a human analogue in forming a natural knowledge of God, then this self-transcendent portrait of rationality is relevant. Scientific rationality is retroductive and imaginative, and therefore transcendent of science altogether once the cosmological limit is defined.

If we did not need a theory of human intentionality, McMullin's proposals might not have so much theological potential. Clayton's study shows that we do need a better shared understanding of human understanding, and so McMullin's work is highly rewarding. If it were not for McMullin's account of scientific rationality, his minimalist version of integration would

appear as merely cautious. Rather, McMullin's work suggests the very theory of human rationality that overflows with theological potential according to the layout that Clayton proposes.

In Polkinghorne's suggestive statement that "science and theology meet in the human." there is already a hint that a theory of human rationality supplies the key ingredient to working out a framework for dialogue.⁴ In this respect, he is repeating what Clayton concludes. Polkinghorne's suggestion is correct, though it is entirely descriptive. Presumably, one could interpret his suggestion as referring to the extensive interactions that recur in the ongoing investigations into self-transcending operations of inquiry. The epistemological and metaphysical dimensions of critical realism are uniquely realized through cosmological inquiry. As a direct result of this concrete limit to science combined with the intimations of self-transcendence in scientific inquiry, the possibility for affirming a religious meaning to the surplus that is experienced at this juncture becomes possible. It is not a rationally discontinuous move to then affirm the monotheistic doctrines of creation paralleled in contemporary cosmology. In light of the surplus of existential meaning identified first of all through Peacocke's proposal, this explanatory extension of Polkinghorne's statement emphasizes self-understanding in light of its cosmic context, corrects an impression that the act of self-reflection concerns only human intelligence.

More attention is paid to the imaginative and creative capacities of human rationality in the critical realist framework that has been sketched here. Self-reflection in scientific rationality in light of the surplus of existential meaning could bridge the gap between the natural theology of Peacocke and Barbour on the one hand, and Polkinghorne's virtually fideist view point. In short,

a philosophical framework can only account for the divergence that exists between these perspectives if it possesses a strong enough methodological programme to account for scientific knowledge of the world in giving meaning over to religious reflection.

A natural theology can work better with such a portrait of interlocking inquiries when nature is positively characterized in light of the elements of critical realism that were discussed in chapters two, three and four. This portrait verifies the stance Polkinghorne adopts. It also points to a positive discontinuity between rationality and faith. A danger lies in supposing that proposals in the science-theology dialogue must conform to either natural or revealed theology. While proposals function according to these different styles, there is no necessary reason to posit, on the basis of this distinction, a complete separation between natural theology and a theology of revelation. The key to unlocking Polkinghorne's point of departure in the milieu of a theology of revelation lies in identifying the insight that rationality is self-transcendent or heuristic. Natural theology can orient itself to a theology of revelation. This rapprochement is not assumed to be necessary, but merely possible, given the unity and the *telos* of human rationality itself. It is also possible in light of the limits to scientific rationality that are discovered in light of the findings of cosmology.

5.2 Faith and Rationality

Polkinghorne's stance represents a frustration with an interpretation of critical realism that ignores religious faith. As his own evaluation makes clear, the downplaying of faith is problematic in Barbour's process theism and Peacocke's systematic panentheism. The success of the alternative framework of this study hinges on closing the gap between subjectivity and objectivity, faith and rationality, meaning and truth, natural theology and a theology of revelation.

These gaps begin to be closed by attending to the elements of scientific knowledge. This re-invites serious consideration of the immanent indwelling presence of God in the process of divine creation. Creation is a unique theological affirmation that this study might support more directly, given the limitations of a methodologically oriented study. Natural theology and a theology of revelation share in a single theological task with a critical realist theory of scientific rationality serving as an indispensable explanatory tool.

The contrary view is well known. It puts considerable distance between the “God of the philosophers” and the active, living God of religious traditions. It also equates the “god of the philosophers” with natural theology. A variation on this separation of discourses is stated forcefully by Alvin Plantinga. His argument is articulated in terms of the traditional Calvinist suspicion of natural theology. For Plantinga, natural theology is simply “the attempt to prove or demonstrate the existence of God.”⁵ With Calvin, for example, there is a countering claim that

“God has created us in such a way that we have a strong propensity or inclination towards belief...[t]his tendency has been in part overlaid or suppressed by sin. Were it not for the existence of sin in the world, human beings would believe in God to the same degree...that we believe in the existence of other persons, an external world, or the past.”⁶

Sin and evil, it is argued, operate to thwart a religious worldview. The creating God is a precursor to the redeeming God. To adopt a worldview such as the one that this study has promoted through the elements of scientific rationality and self-transcendence is tantamount to attempting a “God’s eye view” of reality. For Plantinga, the underlying issue is the uniqueness of religious faith, and its utterly discontinuous relationship to reason. Is there not, according to Plantinga, a unique set of conditions that fundamentally limit our rational abilities to account for God’s nature and the nature of God’s relationship with the world? From Plantinga’s concise

statement. we encounter a simple deference to the theology of revelation. Plantinga opposes revealed theology to natural theology by emphasizing the former at the expense of the latter. His reflections and philosophical corpus mirrors, to some extent, the theological inclinations that led Polkinghorne to deliver a set of Gifford Lectures outside the traditional boundaries of natural theology.

This opposition is a theological problem, a version of the two-source or two-truth theory that characterizes several historically notable accounts of the relationship between faith and reason. The problem is not the distinction Plantinga makes between faith and rationality, but rather in lending support to a fideism that opposes the two. Plantinga's stance of opposition adds a complex layer to the problems associated with the break between historical contingencies and real existence that were noted in chapters two and three with regards to epistemology. It also extends, in a culturally significant way, the tradition of fideism that grew up in both historical Catholic and Protestant theological traditions.⁷

On Plantinga's interpretation of the relationship between faith and reason, which Polkinghorne's *The Faith of a Physicist* resembles, belief in God emerges in light of our confrontation with sin and evil. It rests on its own foundations, detached from whatever criteria of belief may exist for other objects. However, since Polkinghorne still holds out the possibility of a meaningful natural theology in his pre-Gifford lecture works, his unease with natural theology is qualitatively different from Plantinga's reservations. Polkinghorne prefers to complement natural theology and a belief in nature's intelligibility with a focus on scripture and religious meaning. The difference in Polkinghorne's work is based upon a more attentive account of critical realism, and its theological potential. McMullin's work is even more explicit than

Polkinghorne's work in determining what critical realism means theologically.

5.3.1 Critical Realism: McMullin's Theological Position

First, McMullin's engagement with theology as a discipline is not systematic, in the sense that it does not represent a comprehensive plan of investigation. This is due to the fact that his main area of work and expertise is in the philosophy of science. However, the writing he has undertaken in the science-theology dialogue contains various recurring themes and clues that stress particular insights about philosophical and theological solutions to these problems. Three broad themes summarize McMullin's theological position. They are expressed in distinct forays into the science-theology dialogue. In addition, there is an interrelation among these themes or claims taken with respect to different questions, which this study's interpretation will elucidate.

The first claim is McMullin's clarification of the meaning of creation. His claim is not totally different from some of the other more well known works in recent biblical theology and systematic theology concerning the doctrine of creation. However, the way in which McMullin applies its meaning is somewhat distinct. He brings a clear understanding of the notions of time and evolution to his reading of the theological and religious sources. His clarifications take up the issue of faith as it is emphasized by Polkinghorne. Faith is understood as a human reality of commitment to a personally known God in a friendly universe.

The second claim regards human origins in terms of both the anthropic principle already discussed in a philosophical perspective and human origins. Theologically speaking, aside from the more abstract tenets of the anthropic principle, there are signs and indications of a greater cosmic purpose to which faith is a unique carrier of meaning and purpose.

The third claim is McMullin's appeal to Augustine and the Augustinian tradition in order

to bring forward the scriptural, personal and revelation centred aspects of theology, distinct from other more philosophical ways of viewing the questions. Among other things, this retrieval of Augustine represents a distinct approach in the science-theology dialogue. At first, it might seem to resonate with the current 'post-liberal' or radical orthodoxy theological traditions in recent British and North American theology, well represented in the writings of John Milbank, George Lindbeck and Miroslav Volf. However, there is a specific scope to McMullin's reading of Augustine's hermeneutic that suggests this is not the case.

5.3.2 McMullin on Creation

In an often quoted judgment concerning the relationship between the Big Bang model of cosmology and a theology of creation, McMullin appears to embrace caution. This reflects to a certain degree, events surrounding the response by Georges Lemaitre to Pope Pius XII's endorsement of the Big Bang theory as empirical evidence of divine creation *ex nihilo* in a speech to the Pontifical Academy of the Sciences in 1951. McMullin concludes a section on cosmology and creation by noting that:

“What one cannot say is, first, that the Christian doctrine of creation “supports” the Big bang model, or second, that the Big Bang model “supports” the Christian doctrine of creation.”⁸

This conclusion has been criticized by William Dembski and Stephen C. Meyer, who place explanatory knowledge in a privileged position across the range of disciplines in both theology and the sciences.⁹ The problem with such a critique as this is its failure to take into account the precise theological and epistemological issues that are laid out in the pages preceding the above quote from McMullin's 1981 article “How Does Cosmology Relate to Theology?”. The underlying problem is that these critics of McMullin select what they suppose to be a weak

theological position by simply adverting to the appeal of the universe's created order and God's active involvement in it. But, on a more careful reading of McMullin's article, with its own theological emphasis, this concern for the created order is precisely what McMullin prioritizes. The difference, however, is that God's activity cannot be founded upon a mere linear extension of scientific explanation through a leap mediated by the concept of design, or any other concept.¹⁰

There are two reasons for this. The first is the clear scientific possibility of a differently dimensioned reality that exists beyond the space-time parameters of the Big Bang singularity. There might exist "a preceding stage of matter, to which we simply have no access."¹¹ This is a real question that does not emanate from a desire to speculate philosophically. Rather, as McMullin says,

"[c]osmologists who postulate a contraction preceding the Big Bang [...] are assuming that certain parameters remain invariant (total mass, for example) or are continuously traceable..."¹²

This is a perfectly reasonable stance to take, one that allows for future cosmological inquiry to probe beyond the currently defined limits of space-time. This puts into question any theological strategy that draws on scientific data as a simultaneously and theologically meaningful form of data. The perceived need to locate a beginning of time in scientific thinking is a tradition with deep roots in Christian theology, because of its manifold links to the history of scriptural interpretation, and the development of the Christian doctrine of '*creatio ex nihilo*.'¹³

This raises the complex issue of what is specifically theological in any account of the universe. In light of successive events since the Enlightenment to recognize the natural sciences and autonomous scientific method and the absence of an empirical scientific foundation for understanding scripture, the central question surrounding the idea of creation has turned on how

to understand its essential meaning in faith. Even the suggestion that an immutable core of meaning lies behind the variety of developments in historical theology, religious meaning requires hermeneutical analysis. Nevertheless, McMullin stakes his theological wager on the fact that some kind of religious knowledge is viable and communicable. The wager presupposes that a valid distinction can be made between the reality contained within the space-time continuum and a domain that lies beyond any created reality. Although he does not emphasize his dependence on a reading of Thomas Aquinas in his writings, McMullin borrows from Aquinas on several occasions to make this distinction clear. For example, McMullin states:

“Although Christians have always believed, on theological grounds, that the world began at a finite time in the past, this is not (Aquinas insisted) part of the content of the notion of creation itself, which merely signifies dependence on being, not necessarily an abrupt origin in time.”¹⁴

So, before the Big Bang can be scrutinized for its theological potential, McMullin’s quote supports the thomist presupposition that a distinct source of understanding grounds the notion of creation, an understanding that is summarised with the word ‘dependence.’¹⁵

Another distinction is immediately implied by such a claim. It appears in McMullin’s more intentional borrowing from Augustine. This is the distinction between nature and history. History, in particular salvation history, is the basic context for grounding, in Christian theology, revelation. As Polkinghorne emphasizes, the basis for religious knowledge is the christological historical event that precedes and informs the enterprise of natural theology. This distinction permeates McMullin’s corpus as it does for Polkinghorne’s work. However, on closer examination, there are additional, positive resources in McMullin’s work on the structure of human rationality as a critical realist position on knowledge. Indeed, McMullin’s arguments

almost comprise an explanation for what the difference means and why it is defensible. With Polkinghorne, the validity of the distinction is mitigated by the fact that he offers only a descriptive account.

McMullin explores with more exactitude the nature/history distinction in terms of what it implies for creation at the end of his article "Cosmology and Religion":

"Implicit in the notion of creation has always been the idea of a universe coming whole and entire from God's hands, without gaps or supplements that would give a handhold to those who seek 'scientific' ways to assure themselves of God's existence. Does this make God an idle wheel? No, because God's role in salvation history has been direct and dramatic, even if not of the gap-filling sort that philosophers and scientists have debated."¹⁶

Underlying this argument about "divine action" is McMullin's appreciation of a historical transition. This transition concerns the terms of reference for a theology of creation. McMullin describes it thus:

"Cosmology and religion are not as intertwined as they once were. The naturalization of cosmology that began with Descartes [...] has led religious believers to recognize that the motives for belief animating the three great religions of the Book (Christianity, Judaism and Islam) were not in the first instance cosmological."¹⁷

McMullin's reference to 'motive', or what is referred to in this study as the quest for self-transcendence, is thought to consist of a different kind of knowledge.

The transition McMullin refers to here implies a greater latitude for the use of psychological and philosophical perspectives in religious self-understanding. This came about after the seventeenth century, as a radical departure in the way the universe is understood as a single object. The roots of this deepened quest for self-understanding can be traced to the rise of Christian mysticism, the spiritual traditions of the high Middle Ages, and Renaissance humanism. This historical background is significant because these traditions emerged at a time of

cultural renewal in Europe. Ironically, they can be said to emerge due to an increased confidence in the ordered structure of the cosmos, a confidence born of the medieval scholastic worldview.¹⁸ In light of later developments that are now widely judged less fruitful, such as the estrangement of the human subject from the larger world reflected in many parallel cultural dynamics, it is easier to appreciate the fideistic impulses that gathered strength from the nineteenth century onwards.¹⁹ These impulses can be seen to be parallel to the philosophical 'turn to the subject,' even though many fideist thinkers consciously dedicated themselves to overturning the residual effects of this philosophical revolution.

Theologically, this historical rise in the dedication given over to self-knowledge has reinforced a variety of interpretations of how a theology of revelation might proceed, since its primary reference is to text and/or personal experience. In this context, I would say that there is a distinct theological parallel to the distinction drawn by Milton Munitz and William Stoeger earlier.²⁰ These two thinkers distinguished between metaphysical and existential questions in cosmology and philosophy. In theology, this distinction can be carried over into what Peacocke regards as the distinction between questions of truth and meaning.

In creation, it is clear that questions of existential meaning begin to overtake questions of ontological truth. However, they do so without rejecting the ontological inquiries, but rather, build upon them. The turn to textual interpretation and personal experience as the poles of orientation for theological inquiry following the Enlightenment reduced the theological significance associated with cosmological questions like "Why should the universe have existed in the first place?". But, following McMullin's suggestion, with a realist scientific rationality secured in terms of values, the cosmological and the personal are not opposed. This confirms this

study's aim to build a framework that does not oppose historical contingencies and objective scientific rationality. An interpretation of McMullin's contribution on this question is not difficult to render: The retroductive quest to identify the values animating an understanding of the real in nature, are imaginatively and ontologically linked to the values that answer the questions of the meaning of our own existence in the universe's existence.

Creation is the obvious candidate for wedding the two inquiries of truth and meaning together. The first hurdle that usually must be negotiated is that creation designates merely a beginning of time. On the contrary, there is historical evidence from the development of the doctrine that it has functioned as reflection on the basis of a profound theological anthropology. Understanding the universe as a creation results from a process of conversion. This is both the result and the backdrop to much of the scriptural evidence for creativity and the religious, transcendent nature of human rationality. It is expressed in the historic doctrine of humanity as *imago dei*. With McMullin's operative distinction between nature and history co-existing with his identification of the creative imagination in scientific inquiry, a fresh approach to thinking about the human as "where science and theology meet," is possible.²¹

5.3.3 McMullin on the Anthropic Principle, Evolution and Theology

In addition to McMullin's approach to creation, his theologically oriented reflections on the anthropic principle support a clear nature/history distinction in his thought. As already described in chapter four, the anthropic principle is used by some to justify the re-introduction of a design argument for the existence of God, a strategy intended to safeguard the distinctiveness and specificity of theological investigations.²² In a thorough treatment of many of these issues in the context of the idea of creation, Mark Worthing states:

“A possible demiurge, as suggested by (Paul) Davies, the universe itself (Dawkins), or one of several versions of the strong anthropic principle, as outlined by Barrow and Tipler, all take into account and accept, in principle, the evidence of design. That the “designer” of the universe must not necessarily be the Creator God of theism, however, neither constitutes a proof against the existence of such a Creator nor does it make design arguments irrelevant. It merely witnesses to the limitations of pure reason as an epistemological approach to God.”²³

Worthing supports this distinction between notions of design associated with the anthropic principle on the one hand, and the understanding of a God who relates to the world as a Creator by discussing the ambiguities and controversy surrounding the publication of *A Brief History of Time* by Stephen Hawking.²⁴ Worthing’s distinction seems to cohere with the one McMullin employs between nature and human history. Worthing re-orientes the origin of the notion of creation away from the natural sciences and towards the wellspring of faith as another form of knowledge. I believe that McMullin does the same.

In contrast to the theological basis for the idea of creation, McMullin identifies overtones in the anthropic principle of ‘physico-theology.’ This is a cosmological argument for the existence of God and natural theology that link divine action with some dynamism in natural process that is non-physically caused.²⁵ On the other hand, there would be an alternative argument afforded the anthropic principle

“If fortified by the traditional doctrine of creation [...] though it is no longer, of course, a scientific explanation.”²⁶

The possibility that “[r]easons can be given in the traditional Judaeo-Christian perspective, why God *would* want man in the world,”²⁷ as McMullin says, is a major premise in an explanation for human being, but derives its meaning wholly from within the historical sense of belonging and the meaning of understanding ourselves as loved and valued by God. This sense of belonging or

being desired as creatures is clearly beyond the scope of anthropic-based arguments in science.

Of course, the potential weakness of an argument based on the nature/history distinction is the implication of a dualism in human inquiry between theological explanations, based in understanding love, value and human meaning on the one hand, and scientific explanations based in understanding empirical reality on the other hand. One runs the risk of returning to a position close to that of Plantinga. Certainly, the challenge for a philosophical mediation of these two kinds of inquiry is acute. It is easy to fall into the “two-truth” theory of reality. This involves the claim that there exist two parallel yet different structures of inquiry, each with their own peculiar sets of terms and relations, connected by some vague notion of human creativity and critical realism is somewhat dissatisfying.

However, the strength of this strategy is its faithfulness to an attentive reading of the history of philosophy and theology with regards to antecedent versions of design arguments that resemble the anthropic principle. The eighteenth century drift away from theological principles and arguments is the clearest evidence yet that an exclusive reliance upon design arguments for the existence of God is a misreading of the task of natural theology. There is further evidence to suggest that an analysis of human creativity and imagination, highlighted in the context of a wider portrait of rationality is not a vague strategy. It consists in merely claiming a pivotal role for the operation of our imagination attending to varieties of objects according to a differentiated understanding of the two basic questions of truth and meaning.

As the previous chapter showed, the anthropic principle should not be evaluated as an inherently theological idea. But neither should it be regarded as an isolated incident of scientifically theorized teleology. Rather, it should be understood as a philosophically pregnant

theory that re-invites discussion of the positions of necessity and contingency in philosophical cosmology. It is not a directly theological issue however. Nevertheless, this debate has a venerable theological heritage, and is marked, among other events, by Aquinas's memorable attempt to balance the two schools of thought.²⁸

McMullin refers to the state of the scientist who is caught at this point of dealing with such a philosophically significant scientific theory with implications for theological reflection:

"The case for necessity [for the universe to be necessarily anthropically structured] makes him uneasy; yet settling for contingency leaves him dissatisfied [...] it seems fair to expect an answer to the question: well, then why *is* it this way?"²⁹

McMullin here establishes the heuristic utility of the anthropic principle by posing the question that lies at the heart of the debates surrounding critical realism:

"[...] is there a [...] point beyond which genetic explanation cannot be carried, when we just get back to a first state that just *was* that way?"³⁰

In this case, the heuristic extends outside the strict boundaries of retrodution, though aided by the insight into rationality afforded by retrodution.

McMullin's question should be interpreted in light of other considerations. There is no logical reason to stop asking questions concerning the sheer meaning of existence. Questions that transcend the scientific scope of inquiry at the level of the anthropic principle signifies, at the very least, that at this level a leap in universal intelligibility occurs. It occurs as the transfer from mere intelligibility to intelligibility and meaning taken as a whole. We already understand this leap at the level of our appreciation of rationality and subjectivity. But our experience of human rationality is further verified from the vantage point of the object, in this case is the universe itself as a whole. It is this act of further questioning that signifies the lack of a mere philosophical

answer to the issue of meaning and worldview.

The debate between necessity and contingency is turned around in light of the anthropic principle. It is transformed away from an exclusive consideration of the universe as a single object, to one in which we consider the universe as a reflection, in a fundamental sense, of human meaning and destiny. Do truth-laden explanations of natural process cohere with our own constructed sense of purpose? Even if only the weak anthropic principle is legitimately defensible, the theological implication is strong. However, the implication is still indirect. It needs to be filtered through a philosophical or intellectual conversion to seeing the issue in terms of inquiry. The mode of implication is not direct, by virtue of some logical extension.

The anthropic principle, if verified as having some minimal applicability, would oblige a choice between two philosophical worldviews. This choice, at first is only metaphysical. But, it is also a choice about how knowledge is achieved. With a necessary universe, in which the anthropic principle is but one theory in a linear logic of scientific, philosophical and theological explanation, no other possibilities can exist. The theological end of the spectrum, on this view, is subject to the results of philosophy, and would severely limit the scope of how we understand divine action or the God-universe relationship. The main problem with this result of what McMullin calls the “theological version of the anthropic principle” or new design argument, is that this

“argument [...] still relies on a “gap” namely, the inability of contemporary physical theory to explain the original tight specification of the ‘initial cosmic state.’”³¹

Thus, the limits of science to ‘explain’ the universe are underdetermined by the very explanatory success of science in probing the mystery of the initial universal or cosmic constants.

The second option of philosophical contingency, in contrast, does not permit the anthropic principle to serve as the pivotal theory in the general structure of universal explanation. Rather, as McMullin's reference to creation shows, the act of explanation is transposed entirely out of the natural sciences, once the limits of scientific explanation are properly delimited by philosophical factors. The independence of theological sources for parallel explanation are preserved.

This is not carried out negatively, in the hopes of preserving the historic contents of theology. It is carried out positively in light of theology's ability to follow up philosophical questions with new resources to transpose the anthropic puzzle along trajectories of meaning. This follows quite naturally from the clues available from the retroductive theory of scientific rationality. In retroduction, the quest for intelligibility utilizes a basic value of fertility in ordering possible verifications of theory. This quest is buttressed by the an originating power of human intentionality that empowers human imagination and creativity. Because retroduction is a theory about the probability of knowing as well as a knowledge of the world, it shows how meaning and imagination are already at work. Basic values, especially the employment of fertility, validate this twofold affirmation.

It should be emphasized that this philosophical position of natural contingency emerges from inquiry into natural process. It does not presume a theological outcome. It is a response to a specific limit in the discipline of cosmology that takes seriously the speculative reach of science. However, contingency better respects the empirical boundaries to which speculation can be directed. Thus, it is the ontological, cosmological category that is more plausible than some argument from necessity. Needless to say, it is consonant with the theological notion of creation,

even though creation does not necessitate the outcome of a philosophical debate. Theology is therefore not implicated by any one cosmological theory *per se*. Rather, it contributes enormously to meet cosmology and philosophy at their respective limits, in light of theology's own explanatory structure in reflections on meaning and purpose arising out of the religious imagination. McMullin's preferred term for this kind of interaction is 'consonance,' which will lay out his sense of science-theology integration more adequately. On this issue of integration, more shall be said in the next chapter.

5.3.4 McMullin, Contingency, Human Evolution and God

Assuming that some weaker form of the anthropic principle becomes accepted in the future, it is interesting how well contingency serves a philosophical and theological appreciation of the discipline of cosmology. On the other hand, there are not so many lessons to be gained from a study of contingency at the limits of other scientific disciplines. In a recent article on contingency in light of evolutionary biology and specifically human evolution, McMullin rules out any theological implications arising out of contingency in the origins of the evolutionary sequence in organic life forms:

“[...] the contingency or otherwise of the evolutionary sequence does not bear on whether the created universe embodies purpose or not. Asserting the reality of cosmic purpose in this context takes for granted that we already believe that the universe depends for its existence on an omniscient Creator whose action is sufficiently like ours to allow us to call it purposive, in an admittedly analogical sense.”³²

This is an enormously important quote. It reflects strong theological assumptions. In marshalling his argument, McMullin cites the writings of thinkers like Stephen Jay Gould, who emphasize the contingency of the evolutionary sequence. Here, contingency means something subtly different than what it means in philosophical cosmology. It means the utter non-predictive

character of the emergence of life. Gould, Jacques Monod and George G. Simpson, among others, would like to interpret the existence of chance and randomness as evidence that any “attempt to abstract ‘trends’ or ‘tendencies’ [in evolutionary biology] is bound to fail.”³³ This is the predominant view in the philosophy of biology, and it goes against a “progressivist” strand of thought that is evident in other thinkers such as Teilhard de Chardin and Christian de Duve. As McMullin repeats Gould’s view, the evidence of chance mutations and the non-law like conditions for the emergence of life forms is particularly strong with regard to the many episodes of extinctions in natural history. How does he evaluate this tension in the philosophy of biology for theology?

McMullin’s response is fascinating for his appeal to what he terms a more “traditional” view of divine action, where he assumes, in contrast to scientific inquiry that “western theology is of its nature anthropocentric [...] Within the religious traditions of the West, the assumption has always been that human beings play a special role”³⁴ The problem with the variety of contemporary theological responses to the presence of contingency in natural process is that they each begin from the presupposition that God is time bound. McMullin’s proposal takes for granted the special place of human beings, and does not try to justify that place in terms of a philosophy of biology. Otherwise, as he says, we are left “groping for a means by which the real contingency of the evolutionary process might be overcome by the Creator.”³⁵ McMullin nevertheless acknowledges a strength to this type of theological argument. He notes in a cosmic context that

“the enormous space of evolutionary possibilities would ... make it possible to maintain that there is a cosmic purpose at work here on the part of a Creator, a purpose that the contingency of a *particular* evolutionary line like ours would not defeat. If God be

conceived as a time-bound Creator whose knowledge of the future depends on a knowledge of the present, this way of swamping contingency in order to achieve a distant end might seem plausible.”³⁶

McMullin follows this observation with an analysis of the deficiencies in the way in which Peacocke and Polkinghorne, in particular, understand God’s relationship to the world. Each of these two Gifford lecturers relies upon contingency in evolutionary process as a way to reveal God’s purpose in creating. What emerges from this theological contrast of Peacocke and Polkinghorne with McMullin’s view that God can in no way be conceived as a temporal being.

On the contrary, with Augustine, McMullin advises that we come to understand the radical notion of time: “Temporality is the first and most obvious constraint of the created world, a mark of its dependent status.” He goes on to state “The Creator on whom the universe depends for its existence cannot be limited in this way.” And this co-creation of time and creature McMullin borrows from Augustine.³⁷ From the conclusion to this article quoted earlier,³⁸ McMullin conjectures that our limited understanding of purposiveness is analogically the basis for calling God’s own action purposive. So, while our rationality is called on to make a realist theological claim, McMullin’s departure from the Gifford lecturers and other theologians’ belief in the temporality of God marks a strong contrast in the kind of knowledge theology claims of God. The belief in what we “already” know about God’s creation of the universe comes from another source. Again, McMullin employs a well known strand of thought from Augustine:

“When in the *Confessions* Augustine looks back over his life and finally recognizes a Providence at work through all the contingency, it is to teleology of this sort that he is appealing.”³⁹

In short, this study takes teleology to be re-defined, from a cosmic teleology to a teleology that complements the anthropocentric with the cosmic, the external with a teleology of interiority.

This understanding of purpose in creation, of God's relationship with the world, holds faith as a distinct form of knowledge that pertains to the goals of a person's self-transcendence. This response, moreover, begins to respond effectively to Polkinghorne's priority of faith noted in the first chapter. McMullin does so however, in the spirit of caution regarding Polkinghorne's use of indeterminism in chaotic systems as an indication of divine action in nature. Faith, on McMullin's account seems to be heavily weighted in an Augustinian account. What is the nature of McMullin's reliance on Augustine? To this question I now turn.

5.3.5 McMullin and Augustine

McMullin opens his introduction to the *Evolution and Creation* reader with an account of the conflict between the belief in a "Creator" God of the emerging Christian church and the Manicheans with whom Augustine affiliated himself before his conversion. McMullin lays out the problem that Augustine faced:

"The challenge was not only to develop a theological account of the creation relationship but to provide a set of principles for the reading of texts like Genesis [...]"⁴⁰

McMullin sums up Augustine's formulated response as follows:

"When conflict arises between a literal reading of some Bible text and a truth about the nature of things which has been demonstrated by reliable argument, the Christian must strive to reinterpret the biblical text in a metaphorical way. Since real conflict is impossible between the two sources of truth, revelation and our tested knowledge of the world, the presumption will be that when we are *sure* of our natural knowledge, the apparent conflicting text of the Bible must be read in a way which will eliminate the conflict."⁴¹

On the question of whether the creation of the world transpired according to the literal account that is found of the Genesis text, McMullin identifies Augustine's principle in terms of an application that had its roots in the extant patristic literature, notably the writings of Gregory of

Nyssa.⁴² Augustine's application of patristic thought to the Genesis text results in his proposal of the "Seed Principles" or *rationes seminales* of creation.⁴³ In effect, the Seed Principles

"function [...] to explain how one can say *both* that God made all things at the beginning *and* that the various kinds of things made their appearance only gradually over the course of historic time. And the warrant for it is almost entirely theological."⁴⁴

Augustine's theological task is therefore set as one that mediates and draws together natural and revealed knowledge, and in this case, as capable of fitting evolutionary thought with divine creation whereby "the Creator might make use of his creature, time, to accomplish his ends."⁴⁵

When McMullin further extols the virtues of Augustine's hermeneutic at the end of this article by way of recommending a contemporary effort to reconcile creation with evolution, it becomes clear that McMullin places Augustine's contribution as a theological accomplishment with relevance and importance for contemporary debates. Augustine's contribution apparently withstands the test of time.

His appreciation of the Augustinian legacy is a fascinating theological dimension to his work in science-religion issues. First, it is striking how McMullin selects Augustine over Aquinas to guide his theological inclinations. Roman Catholic thinkers in natural theology and the philosophy of religion have tended to emphasize the foundational aspects of Aquinas's contribution not Augustine's. Like Rahner, most natural theology has grappled with the decline in neo-Thomist studies after the Second Vatican Council by using Aquinas, though rather more selectively. Augustine, it is assumed, offered much less in this regard. Selective use of Aquinas is even evident among contemporary thinkers whose own inclinations are markedly different from the traditional emphases of Thomism.⁴⁶ In answering a direct question on the subject, McMullin has offered as his reasons for this choice the fact that Thomas, for all his wealth of insight,

approaches scripture with too literal a cast of mind.⁴⁷ For McMullin, Aquinas extends the Augustinian hermeneutic to a breaking-point, and in a concise summary narrative of the prelude to the Reformation and the Enlightenment rupture of knowledge, he identifies the risks Aquinas took in making such an extension in order that the Aristotelian system of natural philosophy be sustained.⁴⁸ Elsewhere, he goes further by distinguishing between Augustine's theology of scripture and the post-Reformation principle of *sola scriptura*.⁴⁹

What Aquinas did that left the doctrine of creation open to future criticism was to hold out for both Augustine's "seed principles" as an indirect mode of divine action, as well as special direct action necessary for the creation of the "higher animals," a type of divine action that could potentially include provision for the creation of the seeds themselves if necessary, not to mention the basis for the human intellect and the incorruptible human soul. This is an important insight into the way the Aristotelian legacy committed Aquinas to demur from embracing Augustine's "seed principles" outright.⁵⁰ The difference between these two positions can be understood, according to McMullin, as the difference between a philosophy of nature that places a priority on "potencies" (Aquinas) versus "development" (Augustine). The latter term is associated with Augustine's wider view of natural process. Aquinas's cosmological allegiances to the neo-Aristotelian notion of potencies also committed him to an interpretation of the heavenly bodies in light of both the texts from day four of the Genesis creation narrative and the Aristotelian position that the heavenly bodies remain incorruptible. McMullin concludes that his position, as articulated in the *Summa Theologiae* I (q. 70, a.1, ad.1), "seems a bit strained, but then Aquinas had undertaken a near-impossible task to begin with."⁵¹

What are we to make of this relative favouring of the Augustinian view over the Thomist

one? What strikes McMullin are the difficulties raised by Aquinas's commitment to a literal reading of scripture in which scripture and only scripture, understood as revelation, provides for the knowledge that the universe had a beginning in time. One of the most evident difficulties is the fact that Aquinas is obliged to construct elaborate reinterpretations of the scriptural texts. These reinterpretations are required to be imaginative on some occasions, such that the literal meaning of scripture is diminished in a case of conflict with authoritative natural philosophy. A demonstrative view of the sciences of nature was also defended by Aquinas simultaneously such that this synthesis of science and faith came under severe challenge, beginning in Aquinas's lifetime. McMullin laments that

"In this climate the Augustinian view that God had made use of the powers originally implanted in nature to bring about the wondrous diversity of the world lost ground. The new stress on the radical openness of history to God's free action, untrammelled by considerations of "essence" or "nature", made it easy to read the Genesis text in a more or less literal way as a sequence of "miracles", of divine actions lying outside the bounds set by such human notions as nature or potency or even seed-principle."⁵²

Thus, the stage was set for the eventual Newtonian settlement as grounds for a retreat to physico-theology. This placed in opposition a theological accent on divine will to act simultaneously with the necessity of generalized, inductively reasoned natural laws.

Alvin Plantinga, an inheritor of the Reformed tradition of theology and prominent exponent of theism in the analytic tradition, has argued for a contemporary version of exactly the kind of voluntarist theology that McMullin implies grew out of the misinterpretation of Aquinas concerning the God-world relation.⁵³ Plantinga's hesitation concerning the elements of a natural theology that I mentioned at the beginning of this chapter carries over into an epistemologically controlled and voluntarist view of God's divine power, evolution and creation. On this question

of the process of creation, Plantinga and McMullin have engaged in a serious debate.

In a response to Plantinga's proposal, McMullin tackles the issues of monogenism and the scientific theory of evolution. According to Plantinga, the theory of evolution cannot account for the gaps "among the major forms."⁵⁴ These gaps are the evidence Plantinga needs in order to posit a case for "special creation," openings in the account of natural process that lead to his affirmation of faith in God. At issue between McMullin and Plantinga is the question of the uniqueness of humanity, human nature, and the degree to which an acceptance of an evolutionary theory of human origins supports or detracts from a theologically coherent view.

McMullin begins by questioning Plantinga's theologically motivated strategy, one that is centered upon the establishment of an opposition between naturalist science and theistic science.⁵⁵ Theistic science "should not be described *as* science. It lacks the universality of science [...]"⁵⁶ Plantinga goes further by posing the question as a choice between competing probabilities: "It is a bit more probable, before we look at the scientific evidence, that the Lord created life and some of its forms - in particular human life - specially [emphasis McMullin's]."⁵⁷ What is striking is the way in which McMullin defends the scientific enterprise from the skepticism that Plantinga showers on it. He questions Plantinga's claim that certain cultural patterns give *univocal* support to the connection between atheism and scientific methodology.⁵⁸ In clarifying the status of the term 'theory' in the theory of evolution, he refers back to the same broad retroductive account of scientific rationality by re-stating that the truth of a theory is normally intended to mean the "overwhelming likelihood" that scientists normally mean when they defend theories such as evolution without the qualifications that would normally characterize findings in less familiar fields or subjects of investigation. To equate, *a priori* as Plantinga does, evolution

as fact with a stated denial of God's existence, goes too far in pre-judging the entire scientific enterprise.

In this passing reference to theory in an area of dispute such as evolution, McMullin is relying on his vaster expertise in the function of a theory in the epistemological and ontological levels of explanation in order to promote the integrity of the scientific enterprise in the face of severe restrictive critiques. He manages to do this, moreover, in spite of certain shared understandings with Plantinga on the profound dependence of atheism on the intellectual integrity of the theory of evolution. As well, he notes a shared concern in terms of which evolution functions to spotlight the divide between secular and Christian "myths" of society and historical purpose.⁵⁹ Without dwelling on the details of McMullin's response to Plantinga's characterization of the explanatory capacity of evolution and the options available for evaluating its significance, I believe that McMullin succeeds in unravelling Plantinga's argument.

In short, Plantinga claims that only two options are available on the issue of how human beings were created. Instead of either evolution *or* special divine (interventionist) creation in time, McMullin counters that the number of options are really four: 1) atheists who hold to evolution, 2) theists who hold that God *could not* intervene necessarily (Plantinga's "semi-deists"), 3) theists who hold out for special creation, though not by divine necessity (Plantinga), and 4) theists who, like McMullin, hold that although God certainly could have intervened to specially create in nature. But, in fact, the fourth argument concludes, God has not done so. McMullin's counter-argument is buttressed by a call to focus on the arena where God's action is at work according to the Judaeo-Christian theological tradition:

"The possibility [...] of a mode of action that lies *beyond* nature must not be excluded in

advance. indeed [it] must be affirmed. [...] [There is no] reason why someone who defends the evolutionary account of origins should go on to deny that God might intervene in the later human story in the way that Christians believe God to have done.”⁶⁰

The distinction between nature and history, continuities notwithstanding, thus appears to be foundational for McMullin. It correlates neatly with the retrieval of the Augustinian heritage. In a shorter version of this response to Plantinga, McMullin draws the same conclusion but recalls instead “a set of old and valuable distinctions between nature and supernature, between the order of nature and the order of grace, between cosmic history and salvation history.”⁶¹ Traditionally, this focus on salvation history and indeed the Augustinian heritage of biblical hermeneutics and personal engagement with one’s own spiritual desire is heavily distinguished from natural theology over the course of history. Again, it is for this reason that I suspect that Polkinghorne, in recognizing the lack of such meaning inherent in undertaking natural theology, makes his break from that format and opts to reflect from the standpoint of the Creed.

McMullin’s approach is more nuanced than Polkinghorne adverts, because he frames it within the parameters of the questions he is engaging. He is nonetheless blunt:

“The story of salvation is a story about men and women, about the burden and promise of being human. It is not about plants and animals [...] If Plantinga were merely to say that God somehow “leant” into cosmic history at the advent of the human, Scripture would clearly be on his side. How this “leaning” is to be interpreted is, of course, another matter.”⁶²

He then goes on to put Plantinga’s claim to the test in terms of the basic question of what a reading of the biblical texts might yield: “what would the eloquent texts of *Genesis*, *Job*, *Isaiah*, and the *Psalms* lead one to expect? What have theologians made of these texts?” to which his response begins with a characteristic reference to Augustine: “[he] is the most significant guide, perhaps, to the broader theological response to this question.”⁶³ The Augustinian hermeneutic is

worth retrieving, according to McMullin, to counter the negative implications of Plantinga's proposal. According to Plantinga's reasoning, the logic of argument proceeds by "checking to see what evolutionary theory has, in *his* view been able to explain successfully. And then, whatever is left over, God is more likely to have brought about miraculously. God of the gaps? It certainly *sounds* like that [...] One is reminded of eighteenth century theology."⁶⁴

For McMullin then, in twice choosing to respond to Plantinga, the leading issue is plainly theological as well as anthropological at the same time. There are problems that can be resolved at the level of the theological. Once again, rather than viewing the problem as a question strictly at the nexus of the scientific and the philosophical, there is room in McMullin's thought for the role of theological reflection to respond originally and creatively to a range of questions. I would tentatively conclude that the thread linking McMullin's insight of retrodution with the simultaneous defence of divine transcendence with the integrity of natural process is based on a finer, albeit unstated, appreciation of the differentiated status of human consciousness itself. His asides on the hermeneutic sophistication thrust upon theologians by contemporary historical consciousness and the historical flows in theological systematics governing the degree to which theologians can respond to such a transformations, are grounds for seeing significant potential in his thought. This confidence, however, ought not to be taken as presuming a complete array of theological resources that can be marshalled, if only due to the fact that he is not a theologian.

In a completely different genre, McMullin expands his analysis of the Augustinian hermeneutic, in reference to the Galileo controversy.⁶⁵ Most of McMullin's historical work on Galileo concerns the legacy left by the discoveries and operating philosophy of science that Galileo introduced. McMullin discusses the infamously well known dispute between Galileo and

the Church, with a specific focus on the issue of scriptural interpretation that lies at the heart of the matter. The Galileo affair has supported centuries of ideological conflict between science and religion, but at the heart of the affair is a distinction often overlooked, and which sets the stage for retrieving Augustine's scriptural hermeneutic:

"The theologian-consultors who were asked in 1616 to evaluate the Copernican assertion that the sun was at the center of the world saw [...] [t]he Copernican claim [as] 'foolish and absurd in philosophy' (or as we would say, in science), but far more seriously in their eyes, it was formally heretical, since it explicitly contradicts in many places the sense of Holy Scripture according to the literal meaning of the words and according to the common interpretation and understanding of the Holy Fathers and the doctors of theology."⁶⁶

The stereotyped image where the Church endeavours, through its pursuit of Galileo, to protect an outdated cosmology is diminished, therefore, as a complete analysis of the situation. "The Galileo affair ought not [...] be construed [...] as primarily a clash between rival cosmologies."

The cosmological aspect to the dispute is secondary to the much more decisive theological issue:

"Galileo had the misfortune to bring the Copernican claims to public notice at just the wrong time, a time when sensitivities in regard to questions involving scriptural interpretation and Church authority were at their most intense."⁶⁷

Ironically, McMullin concludes that Galileo saw that the appeal to scripture by the Aristotelian philosophers was a desperate attempt to save their untenable position. At a particular point in his effort to persuade other theologians of this fact, Galileo has to rely on the Augustinian position regarding the interpretation of scripture, the Genesis creation narratives in particular:

"It was not surprising that Galileo would look back to Augustine for support [...] for Augustine had to contend with a very similar challenge when trying to meet the criticisms launched by the Manicheans [...] against the *Genesis* account of cosmic origins."⁶⁸

Augustine's handling of difficult scripture passages in the context of evolving natural knowledge is labelled by McMullin as the "Principle of Prudence."⁶⁹ In short, this principle rejects overly

hasty judgments on correct readings of difficult scripture passages and emphasizes the existence of different interpretive possibilities. The rush to make such judgments jeopardize the process of reinterpretation that would be required by later accumulations of natural knowledge. In several extensive citations from Augustine's *Literal Meaning of Genesis (De Genesi Ad Litteram)* that are quoted by Galileo, McMullin draws out two secondary principles that form the backdrop for his Augustinian view of the faith-reason relationship.

The first one is the *Principle of Priority of Demonstration*, a way of expressing the priority given to knowledge born of reason. This knowledge cannot conflict with Scripture, because of its source:

“In Augustine’s theory of knowledge, Divine illumination is the source of the intelligibility that enables the human reason to render true judgment. In this perspective, the illumination that comes directly from God through the words of Scripture far outshines the mere products of human ingenuity.”⁷⁰

And what characterizes the knowledge derived from scripture? McMullin cites another passage from Augustine’s *De Genesi Ad Litteram*⁷¹ that Galileo quotes to show his own concern with the theological knowledge, as distinct from natural knowledge, that needs to be upheld: “[...] the resurrection of the dead, the hope of eternal life, and the kingdom of heaven”⁷²

This direct form of Divine illumination, as Augustine calls it, forms the basis for McMullin’s characterization of Augustine’s second principle that makes up the Principle of prudence: the *Principle of Priority of Scripture*. This principle is self-evident in terms of what it means, but the ambiguity arises in determining how a reading of scripture reveals God’s will. Two exegetical tertiary principles operate, therefore, to safeguard the integrity of scripture: the *Principle of Accommodation* (belief that the “choice of language in the scriptural writings is

accommodated to the capacities of the intended audience”) and the *Principle of Limitation* (belief that the primary concern of scripture is with human salvation, not “technical issues of natural science.”).⁷³ While aspects of the latter judgment concerning the importance of salvation history are not necessarily defended self-consciously by Augustine (McMullin recognizes this fact), what is important is to recognize that Galileo’s adoption of this operative scriptural hermeneutic not only incorporates Augustine’s legacy, but in doing so, puts the theological resources of a major theologian in support of Galileo’s defence. What emerges from McMullin’s close reading of Galileo’s appropriation of Augustine and from an interpretation of Augustine in light of these operative principles, is a tension. McMullin describes it thus:

“PPD [the Principle of the Priority of Demonstration] conveys the impression that there is a need to achieve a level of demonstration in regard to “physical” propositions, whereas according to PL [the Principle of Limitation] this is not the case. [...] if priority is given to Scripture in the event of the claim to natural knowledge falling short epistemically, this would contravene the assertion made by PL that Scripture is simply not relevant to natural knowledge in the first place.”⁷⁴

This contradiction is the basis for the entire dilemma Galileo faced in defending the Copernican theses while accepting from the start, the Aristotelian (and Augustinian) principle of PPD - the Principle of the Priority of Demonstration. Pure demonstration, as it was accepted by the neo-Aristotelians of Galileo’s time, was simply unavailable for astronomical discoveries and theories. Yet, this was precisely what Bellarmine requested in the dispute. Drawing on a reading of Galileo’s inconsistencies in philosophical method, particularly in his *Letter to the Grand Duchess* that immediately preceded the Galileo’s well known *Dialogue of the Two World Systems*, McMullin draws the following theological lesson that I would highlight for the purpose of engaging the differentiated account of human rationality that I am laying out:

“[Galileo] was disposed to concede [...] the priority of Scripture, following Augustine’s precedent, where full-scale demonstration was not available. The premium set on the criterion of certainty in assertions about the natural world was unmistakable. Had Galileo been less an Aristotelian in his manner of treating the requirements of natural knowledge, the exegetical advice offered by the *Letter* might perhaps have taken a simpler, and ultimately a more coherent, form.”⁷⁵

Even allowing for the possibility of a more coherent set of exegetical principles and a more coherent philosophy of science itself, this would still not have been enough to shift the terms by which Galileo was judged at his trial, given the strict senses in which demonstration and scriptural interpretation were defended. Nevertheless, there is room to see directions in which, hypothetically speaking at least, Galileo could have moved in order to clarify the tension in the Augustinian position that he leapt to defend.

Therefore, this is to suggest that with McMullin’s analysis of the Augustinian heritage in the context of disputes surrounding the way in which God and the world are related, we are dealing with a theological tradition that places a high priority upon the integrity of the understanding of salvation history. Yet, when it comes to relating those understandings to the more speculative traditions of what is now called natural theology, contradictions emerge. This sense of contradiction is summarized by McMullin in his 1981 article on cosmology and theology more simply. In terms of the later analysis of Galileo’s Augustinian appropriation, it is a tension between PPS (the *Principle of the Priority of Scripture*) and PL (the *Principle of Limitation*) or as McMullin puts it earlier, a contradiction between the relevancy principle (theology as relevant to cosmology) and the neutrality principle (theology as neutral in regard to cosmology).⁷⁶

The question that must be posed at this point is whether the advent of self-conscious

retroductive reasoning since the Scientific Revolution has any bearing on the Augustinian priority of faith that has been have outlined so far in this chapter. Is critical realism able to somehow combine the retroductive accent on the realist status of probable reasoning with a more general theory of rationality that allows for this Augustinian move regarding faith in the face of the growing speculative reach of contemporary natural theology?

In fact, there is a profound tension between faith and a view of nature that McMullin identifies with realism. However, it is a positive tension, not one of opposition. Faith can be readily cohered with a naturalist view of science and scientific rationality. While someone such as McMullin may see the positive, distinct role of faith and religious forms of knowledge, many do not. Scientific heuristic notions, such as theory, hypothesis and probability, form the basis for natural knowledge that can justify a retreat from an understanding of divine revelation altogether.⁷⁷

Indeed, in this cultural context, theologians have interpreted a philosophy or theory of science, preferring to adopt a professed ignorance, rather than countenance a return to scholastic metaphysics. The assumption is that theology has progressed to a point where these kinds of questions no longer need to be revisited. The problem with this assumed separation is that it encloses natural science within restrictive parameters, even while purporting to focus on the central *motifs* and subject matter of theology. In the context of the philosophical rupture between subject and object that I claim blocks a successful definition of critical realism, the Augustinian (or similarly structured theological heritage) lays out a potential pre-emptive theological distancing from nature as a basis for a refined theological understanding of nature and the God-nature relationship. What might be the consequences for the science-theology dialogue?

5.4 Repercussions: Contingency, Imagination and Self-Transcendence

Assuming that, to some extent, a tension within the Augustinian legacy exists as McMullin relates it to Galileo, and assuming that the emergence of probable reasoning has contributed to a deepening of the significance of this tension in terms of what it means, it is possible to turn to an exploration of the comparatively small amount of evidence McMullin has drawn together to expand on a positive Augustinian view of science and natural knowledge.

One catches a glimpse of McMullin's own frustration with the move to censure natural theology in an exchange with the revered Reformation historian Heiko Oberman in the early 1970's. Oberman argues for a nominalist foundation for the natural sciences in the Scientific Revolution, an interpretive hermeneutic of history that permits him to speak of science as the pursuit of *accuracy* in contrast to a (Barthian) style of theology that is free to pursue *truth*, with even the metaphysical aspects of the term truth available for reflection, free of natural theology. Oberman sees the search for accuracy on the part of the scientist as directed toward Augustine's *creata*, not the Creator. McMullin contrasts Oberman's theological reading of scientific history with a combination of Augustinian and realist insights:

"In the nominalist tradition as Dr. Oberman interprets it, the goal of natural science is not truth: it is something diminished, something to be contrasted with the deeper truth of revelation, the deeper truth of metaphysics. [...] man cannot arrive at an insight into reality, but only at a kind of peripheral account. The Divine "illumination" that Augustine in his theory of knowledge saw as aiding man in his attempt to grasp the structures of God's world no longer plays any part. This world is now a collection of opaque particulars admitting no more than instrumentalist generalizations [...] I would want to stress how remote from this the realism of the 17th-century science was [...] I would also want to recall the arguments brought by contemporary philosophers of science in favour of a broadly realistic understanding of science."⁷⁸

In a revealing climax to this exchange, McMullin asks Oberman whether "[t]here can be any

truth about *creata* at all [...] other than revealed truth?” to which Oberman responds “Yes, ‘this truth I hold!’ I assume with my whole existence and vocation that it can be!”⁷⁹ While Oberman goes on in his response to contrast the *Renaissance* “fallacy” of universal knowledge with the self-limiting humility of Thomas Aquinas, this exchange nonetheless shows McMullin involved in a dual affirmation of reason as both realist and full of truth, owing to Divine Illumination.

I have already examined his extensive analysis and original development of the realist argument in the philosophy of science in the contemporary context with historical case studies to support his position of scientific and critical realism. What is less obvious at this point is how a realist position on natural knowledge could be something that is simultaneously understood as divinely or spiritually illumined. McMullin offers much less in the way of suggestions on this point. But, in the key area of human imagination that serves his purposes so well in the self-conscious form of contemporary scientific realism, he has provided some clues.

In a recent article dedicated exclusively to developing a deeper understanding of the human imagination, McMullin points up a cultural and historical problem with imagination as a cognitive faculty:

“When we speak today of ‘the works of the imagination’, we generally have in mind poetic and artistic creations. The assumption is that the faculty of imagination is a distinctively poetic talent [...] Science, in contrast, tends to be regarded as the domain of method, of rule, of painstaking determination of experimental fact followed by tightly governed theoretical inference.”⁸⁰

In undertaking an archaeological survey of the roots of the contemporary term imagination, he summarizes the Platonic and Aristotelian traditions as well as the later Roman writers who used and applied the Greek terms *phantasia* and *phantasma*. Then, he turns once again to Augustine, who works out a foundational understanding of imagination in his work *De Genesi ad litteram*:

“It may be to Augustine that we owe the Latin term *imaginatio* and hence the term ‘imagination’. He has much to say about imagination, in part because of its close association with one of his favourite topics, memory, in part because of its tie with the imaging relationship between the Creation and its Creator. *Imaginatio for him is not itself a faculty but a product of a faculty he calls spiritus [...]* *Imaginatio* thus plays a part in all knowing. But in addition it may derive from the constructive activity of *spirit* [...]”⁸¹ (emphasis mine)

Aquinas transposes this understanding of imagination, according to McMullin, by building on Augustine’s understanding and linking it more closely with the meaning of the Greek *phantasma*, specifically as that faculty which stores and constructs new images. As comprising both of these natural and “supernatural” sources, imagination “creates” the forms received by sensible experience. This, of course, is where the *rapprochement* between the Augustinian and the Aristotelian heritages is evident. Imagination, on this twofold view, is understandable from either vantage point. On their own, neither of these perspectives, whether natural or supernatural, serve to explain the entire meaning of what imagination means.

In his historical examination of the philosophical treatment of imagination, McMullin recounts its gradual impoverishment of meaning, beginning with the way in which Descartes associated imagination with corporeal existence and pitted it over against intuition, the famous Cartesian *a priori* basis for scientific and natural knowledge.⁸² The recovery of imagination was made by the romanticist movement, and especially Coleridge, on whom McMullin relies for a rehabilitation of a language about imagination that captures the Romanticist accent on creativity in imagination in such a way as to take it beyond strictly aesthetic bounds.

In summarizing the linkage covered earlier with regards to retroduction and scientific imagination, McMullin repeats his argument in this essay, that the rise of the sciences of the distant, with their inherently theoretical questions, involved imagination in a radical and far-

reaching way. The irony is, as McMullin notes again, that the scientists in question, Newton for example, thought that it was a combination of strict (deduction or) induction that was the epistemological and cognitive basis for their scientific work. What was really going forward, however, was a more self-reflective method in science that now required a reliance on the cumulative richness and operating creativity of the human imagination.

The lack of self-conscious reflection notwithstanding, McMullin sees the import of the rise in the use of the faculty of imagination as having a significance beyond issues of epistemology or philosophy of science:

"In the nascent sciences of chemistry, optics, astrophysics, geology, paleontology, it was not at all clear that laws, that is, observed regularities, *were* the ultimate goal of inquiry [...] what was sought was, rather, the distant *causes* of these regularities, the corpuscles, comets, and long-past processes that shaped earth and the life that once inhabited it. It was an *existential* inquiry, an effort to extend knowledge of the natural world to realms far distant from the immediate range of the human senses. For this the constructive imagination was the key."⁸³

As constructive, the imaginative schemes in successful theories of more and more scientific work had now to rely on what McMullin calls a 'second imagination', a qualitatively different sort of imagination where "ordinary combinatorial powers of imagination, constructing causes and categories from elements of the familiar, would not be enough."⁸⁴

McMullin describes this new, second imagination as involving a whole "categorical distance." "an ability to understand nature, to construct physical models, even where they cannot express this understanding in perceptual terms,"⁸⁵ a contrast with what was previously assumed. It was a "shift, so discomfoting to the scientists involved, [demanding] a new level of creativity on their part, [a] new quality of imagination."⁸⁶ It is no stretch to say that the importance of this distinction and recovery of imagination for a theory of science is critical, in light of the twentieth

century accomplishments in areas such as quantum mechanics and astrophysics. Without the depth of mathematically laden imagination contributing to image formation, such complex areas of science could not explain microcosmic or macrocosmic natural processes. What is not so obvious, but even more profound, is the portrait of human rationality that emerges from an attention to the act of imaging. The possibility of a radically creative and scientifically successful 'second imagination' in human rationality gives confidence in understanding the inherently probabilistic character of the universe as both deterministically and indeterministically functional. It also helps see the way in which we understand God in relation to the universe as not contrary to what one expects from the *telos* of the human imagination. The unobservable is nevertheless still real. The tie to the God question is clearest in light of the medieval (and contemporary) theory of analogy, which McMullin notices in this article as an

"obvious ability on our part to think of objects and properties that we could in principle never perceive [...] God cannot be imagined by us in the ordinary imaging sense of that term. One could simply invent a new term for this ability, but it seems preferable to view it as the manifestation of a more creative level of the constructive ability we already call imagination, especially because of the role that analogy plays in its functioning."⁸⁷

While McMullin's mention of analogy is not an endorsement of such a metaphysical theory in natural theology, it does seem to serve as an expectation that natural theology could potentially provide clues to knowledge of God within a wider Augustinian framework with its own specific focus on salvation history. This seems to be the best way to describe the motives that guide McMullin's contribution to the science-theology dialogue. There appears to be an openness, in principle, to natural theology in McMullin's thinking. Perhaps one further stage of inquiry can illuminate the way in which McMullin thinks through this question of theological method. On certain contemporary theological issues, McMullin clarifies just how the area of human

imagination and the theory of analogy can clarify the problems with other theological positions in the dialogue.

Another thread of McMullin's thought has addressed the traditions of "physico-theology" which have historically been associated with design arguments purporting to demonstrate God's existence. Analogical knowledge, by its very nature, makes different claims about what can be said of God from a basis in a knowledge of the world. In "Natural Science and Belief in a Creator", one of his most cited essays, McMullin notes that in the aftermath of 17th. century physics, natural scientists who were also believing Christians leapt into the chasm created by the demise of Aristotelian metaphysics in the face of the universality of empirical laws. Boyle and Newton, in particular, advocated different forms of 'physico-theology.' Newton's argument, in particular, consisted in a pure "God-of-the-gaps" argument.⁸⁸ It is the subsequent collapse of physico-theology, in ways tantalizingly similar to the demise of the Medieval synthesis amid the rise of voluntarist and nominalist theologies, that strikes McMullin as the core issue in relating the disciplines:

"The collapse of physico-theology in the latter part of the nineteenth century undoubtedly contributed to the growing crisis of religious faith at that time. In retrospect, it is easy to see where the trouble lay. The believer was too readily tempted, in the new scientific age, to seek for quasi-scientific validation of religious beliefs. God appears as the terminus of what purports to be a standard causal argument beginning from some feature of the natural world. [Moreover] this mode of argument [...] has affinities [...] with earlier Aristotelian and Thomist traditions."⁸⁹

He draws the conclusion, therefore, that physico-theology is not to be trusted in its basic conclusion. For one thing, the "'Filler of the Gaps' is hard to identify with the Creator God of the Christian tradition."⁹⁰ For McMullin, this critique of physico-theology extends to the contemporary movement known as process theology, which extends and builds on the work of

A.N. Whitehead, C. Hartshorne and others. McMullin's cursory yet poignant evaluation of process thought as a mediation between science and theological reflection is a judgment that it errs in two ways. First, it errs in assuming that "its own explanation of cosmic process is superior to the conventional one given by the astrophysicist and the neo-Darwinian biologist." Equally as serious is the shared belief among process thinkers that

"notions like striving are *required* for the understanding of material process generally, and evolutionary change testifies directly to the shaping action of mind. [...] their approach presupposes a quite specific physico-theology, one that depends for its persuasiveness on the proposition that the categories of conventional natural science are inadequate for the explanation of evolutionary process."⁹¹

As we saw with McMullin's response to Peacocke and Polkinghorne's employment of purpose within a temporal view of God, such a presumption by process theology of a certain scientific conclusion is problematic. With McMullin's reflections on imagination in mind, I suggest that the striving present in the universe is of a different sort. It is a striving in view of the advent, reflective activity and accomplishments of mind and the human spirit. While McMullin does not make this kind of extension to his argument, he crafts a similar argument. His alternative to this contemporary process option is, as he says, "the one that harks back to Augustine." On this theological account, there is "[f]or the Creator [...] neither chance nor necessity: only a single Act in which *all* comes to be."⁹²

The advantage of the Augustinian route is the preservation of the integrity of the natural sciences. Certainly, this empirical position coheres with a traditional trinitarian doctrine of God. Yet, McMullin notes a specific problem inherent in choosing this option: the problem of communicating its efficacy in a scientifically informed culture: "since there are no real 'gaps' to fill, *we may be left without an argument for God's existence of the kind that would convince a*

science-minded generation.” Even after he has shown how arguments such as those of Plantinga are so deeply problematic, and while Augustine’s hermeneutic is potentially helpful, McMullin confronts a major problem. The dilemma at this point is to articulate a systematic theology that deals with the problem that “God does not *seem* to make a difference [...]” while realizing the problems inherent in following any strategy that hinges on the necessity or plausibility of an interventionist God.⁹³

In a dramatic end to this article on science and God, McMullin lays out an option that strongly echoes the endpoint of cosmological speculation that I discussed in chapter four: an inquiry “that explores the conditions of possibility for there being any kind of scientific explanation.”⁹⁴ This option does not take a process-like interpretation that seeks to merge scientific explanation with a form of teleology. With the nature of scientific explanation ruled out as an exclusively law-like, deductive or inductive approach employing traditional forms of non-imaginative syllogisms, the question is: what kind of God is McMullin advocating? What does the combined force of the contingency and realism of explanation provide theology?

The solution to the problem does not lie with how the Augustinian or a trinitarian account fits with an account of nature on their own. Rather, the solution involves a theology that begins by acknowledging contingency and a portrait of human rationality as self-transcendent, since our scientific inquiries meet the limit of inquiring into inquiry itself through cosmology. The presence of values and meaning in science extends into those theological reflections that are based in an active, personal God of salvation history. The effort to construct this coherence is the task of systematic theology. This function or specialty of theology is one step removed from the demands of faith, even though it mediates faith with culture according to the classic definition

fides quaerens intellectum. What should be emphasized is that this theological function is closely connected to the task of communication that McMullin refers to at the end of “Natural Science and a Belief in a Creator.” It involves the formulation of worldviews, which form the backdrop for how theological or religious insights are communicated, but whose formulation is nevertheless distinct.⁹⁵ I will return to the role of systematic theology in the final stage in drawing together the various elements of the critical realist framework. This is the question that will direct the final chapter.

5.5 Conclusion

In this chapter, this study has begun an interpretive move concerning the corpus of Ernan McMullin based on his writing in the science-theology exchange. The goal has sharpened to elicit elements of a critical realist account of scientific rationality that coheres with faith and theology. With the specific historical focus of faith in mind, the goal has been to show how even the contrast with rationality can be developed in terms of an approach that does not pit them against one another. The limits shown by considerations of cosmology block an implication from rationality to faith that is not mediated through the levels of self-transcendence. It is true that McMullin’s belief in the Christian atemporal Creator God is not grounded on science or scientific rationality. Critical realism and scientific understanding of the universe would thus appear to contribute little to the knowledge claims of religious faith. However, this is not the case. Science does confirm through the prism of retrodution McMullin’s distinction between orders of knowledge is contextualized in the integration that his view of knowledge works as a unity of personal self-transcendence along different lines of inquiry. This is apparent in McMullin’s strictures against the adoption of a temporal God in the work of Peacocke,

Polkinghorne and in process thought, as versions of contemporary physico-theology. McMullin's work appears to be safeguarding the distinct, eternal source of religious faith that Polkinghorne chooses to defend in his Gifford lectures. McMullin's defence of faith is nevertheless distinct from such fideist strategies as the one by Alvin Plantinga.

Yet, there is abundant reason to suppose that there exists other elements in McMullin's reflection on the workings of human rationality to postulate a critical realist stance for theological knowledge claims. Chief among these is McMullin's realization that the realist aim of the scientific imagination is laden with what Augustine called "Divine illumination," which can be especially correlated with the second imagination. The human imagination is a seamless directed "spirit" in quest of self-transcendence. It operates on the presence of values, whether working on truth in scientific explanations or questions of meaning in human history. While McMullin operates with a distinction between nature and history in order to distinguish the differentiated realms of science from faith, he upholds a continuity at the heart of human intentionality in the form of spirit and imagination working on empirically present values and meaning. This is the way to account for what Peacocke explicitly terms "self-transcendence."

As McMullin recognizes, this does not provide an argument for God's existence for a scientifically informed contemporary culture. The implication of an Augustinian stance would appear to block an opening towards a natural knowledge of God based on the human experience of purpose and meaning. Is there a way to get around these counterbalancing arguments in McMullin's thought? Is there a way to articulate what Clayton, whose text was referred to at the beginning of the chapter, refers to as an adequate God-universe relationship? The best way to treat this question would be to end with a reflection on McMullin's chosen notion of

“consonance” as the sense in which a science-theology integration occurs. McMullin’s sense of integration neatly complements the accent on faith and rationality, and ensures that no opposition between the two is viable. This reflection will take up, as a result, the very integrating impulses that spawned each of the Gifford lectures that were examined in chapter one by the scientist theologians Barbour, Peacocke and Polkinghorne.

Endnotes

1. See chapter one, p. 64.
2. Philip Clayton, *God and Contemporary Science* (Grand Rapids: Eerdmans, 1997), p. 233.
3. See chapter one, p. 53.
4. See *Reason and Reality*, chapter 6 "Cross Traffic" where this instinct is reflected in how science and theology mutually interact.
5. Alvin Plantinga, "The Reformed objection to Natural Theology" in *Proceedings, American Catholic Philosophical Association* 54 (1980), p. 49.
6. *ibid.*, p. 51.
7. Cf. *Fides et Ratio*, # 55, and the reference therein to *Dei Filius* III. See also Gerald McCool's helpful discussion of the ways in which fideism arose in the nineteenth century in response, albeit based partly in a misdiagnosis, of neoscholasticism in Catholic theology in his *Catholic Theology in the Nineteenth Century: The Quest for a Unitary Method* (N.Y.: Seabury Press, 1977). Plantinga's critique of natural theology seems to imply a form of fideism, for example in his statements that "The reformers mean to say, fundamentally, that belief in God can properly be taken as *basic*. That is a person is entirely within his epistemic rights, entirely rational in believing in God, even if he has no argument for this belief..." (p. 53) and "I believe [this is] best understood as rejecting classic foundationalism." (p. 57). Plantinga elaborates further in this article that religious beliefs should be understood in the context of 'noetic structures' or sets of propositions and their epistemic interrelations. But, this depiction of belief does not deal squarely with the issue of faith and the epistemological status of beliefs. By characterizing beliefs over and above the reasons for believing, including the existential data, desires and intentions that lead to but which are not necessarily explained by beliefs, Plantinga is setting up religious knowledge for a fall, assuming that historical critical methods are readily available to subject beliefs to ongoing revision. It may be perfectly legitimate to criticize philosophical or theological foundationalism for allowing religious knowledge to be subsumed by generic forms of knowledge, but it is just as disingenuous to suppose an *a priori* preeminence of religious knowledge simply because it is God under consideration.
8. See McMullin, "How Does Cosmology Relate to Theology?", p. 39. Cf. the favourable reception to this approach in Mark Worthing, *God, Creation and Contemporary Physics* (Minneapolis, MN.: Fortress, 1996).
9. Dembski has argued elsewhere for scientific evidence pointing directly towards a position of 'intelligent' or 'universal' design by a creator. In this criticism of McMullin, this belief in the universality of the conception of design extends to provide a perspective of mutual 'epistemic support' among and between the Big Bang and creation. See Dembski and Meyer's article "Fruitful Interchange or Polite Chitchat? The Dialogue Between Science and Theology" in *Zygon* 33, 3 (1998), pp.415-30, esp. 417-18.
10. Dembski's writing in particular is representative of a wave of new work that attempts to portray science as confirming the notion of God through the concept of design. See his book *Intelligent Design: The Bridge Between Science and Theology* (Intervarsity Press, 1999).
11. "How Does Cosmology Relate to Theology?", p. 35.
12. *ibid.*

13. See Gerhard May, *Creatio Ex Nihilo: the doctrine of "Creation Out of Nothing" in early Christian thought*. (Edinburgh: T.&T. Clark, 1994) for an authoritative account of how the idea of creation grew in relation to a religious understanding of time.
14. See McMullin, "Cosmology and Religion," p. 604.
15. Cf. the systematic theology developed by A.-D. Sertillanges based on this reading of Aquinas on creation in his *L'idée de la création et ses retentissements en philosophie* (Paris: Aubier, 1945).
16. McMullin, "Cosmology and Religion", p. 604.
17. *ibid.*, p. 605.
18. See Louis Dupré, *Passage to Modernity* (Yale University Press, 1993) for an articulate defence of the connection between the medieval mystical traditions and the positive developments that characterised the Italian renaissance.
19. Gerald McCool provides an excellent outline of the variety of Catholic *fideisms* in the nineteenth century in his work *Catholic Theology in the Nineteenth Century: The Quest for a Unitary Method* (N.Y.: Seabury Press, 1977).
20. See chapter four, pp. 191-93.
21. This distinction is present in several of his articles, but is particularly evident in "Evolution and Special Creation". "Galileo on science and Scripture" and "Cosmic Purpose and the Contingency of Human Evolution."
22. Nancey Murphy and George Ellis's *On the Moral Nature of the Universe* (Minneapolis, MN: Fortress Press, 1997) is probably the best recent example of a theologically programmatic work that takes some sort of design principle seriously as a presupposition for the claims made in the book. This presupposition is presented, in terms of a theological interpretation of the anthropic principle. See pp. 16, 51-59.
23. Mark Worthing, *God, Creation and Contemporary Physics* (Minneapolis, MN.: Fortress Press, 1996), p. 47.
24. *ibid.*, pp. 52-60.
25. See McMullin, "Evolution and Creation", p. 44 ff.
26. See McMullin, "Is Philosophy Relevant to Cosmology?", p. 186.
27. *ibid.*
28. The conflict between the Augustinians and the Averroists in the Middle Ages on this philosophical question is best described by M-D Chenu in his work *Introduction à l'étude de saint Thomas* (Montréal: Institut des études médiévales; Paris: Vrin, 1954). It is revived along a different course after Aquinas' death in the ongoing controversies between the voluntarists, the nominalists and the Thomists. Central to these debates was the epistemological question in light of the theological status of the learning coming from the new sciences. The relevance of these debates is therefore useful for reviewing for theologians who seek historical indicators on which course to follow in attempting similar synthetic reconstructions as the one Thomas Aquinas laid out.
29. "Is Philosophy Relevant to Cosmology?", p. 185.

30. *ibid.*, p. 186.

31. McMullin, "Natural Science and Belief in a Creator", in David Byers, ed. *Religion, Science and the Search for Wisdom* (Washington, DC: NCCB, 1984), p. 39. McMullin goes on to note Alan Guth's inflationary theory of the universe as the first indication that this version of the anthropic principle could be a philosophical *cul-de-sac*.

32. McMullin, "Cosmic Purpose and the Contingency of Human Evolution" in *Theology Today* 55, n.3 (1998), p.413.

33. *ibid.*, p. 394.

34. *ibid.*, pp. 397-8.

35. *ibid.*, p. 399.

36. *ibid.*, p. 400.

37. *ibid.*, p. 408.

38. See p. 238, note 33.

39. *ibid.*, p. 413.

40. McMullin, "Introduction: Evolution and Creation", p. 1.

41. *ibid.*, p. 2.

42. See McMullin, "Natural Science and Belief in a Creator" in Robert Russell, William Stoeger, SJ and George Coyne, eds., *Physics, Philosophy and Theology* (Vatican Observatory, 1988), p. 58.

43. *ibid.*, p. 11ff.

44. *ibid.*, p. 15. The reference made is to Augustine's claim that reading the scriptures is what led him to distinguish between the initial simultaneous moment of creation and the later appearance of "kinds of things" according to different species and so forth.

45. *ibid.*, p. 16.

46. See Elizabeth Johnson, "Does God Play Dice? Divine Providence and Chance" in *Theological Studies* 57 (Mar. 1996), pp.2-18 and the work of Joseph Bracken, SJ who attempts to blend of process and thomist thought.

47. from a personal conversation, Feb. 24, 1998, South Bend, Indiana.

48. "Introduction: Evolution and Creation", p. 18.

49. Augustine "did not require a *conclusive* demonstration on the side of natural reason before abandoning the literal reading of the narrative of the six days of creation and espousing a highly metaphorical alternative. And he constantly stressed the antecedent importance of literary norms in determining how biblical texts should be

interpreted. The strong presumption in favour of literalism [...] is much more characteristic of post-Reformation theology." (See McMullin, "Evolution and Special Creation", p. 309.)

50. "Introduction: Evolution and Creation", p. 18.

51. *ibid.* p. 19.

52. *ibid.* p. 20. See McMullin's references to Augustine's central work on creation: *De Genesi ad Litteram* in "Natural Science and A Belief in a Creator" (especially pp. 55-59).

53. My association of Plantinga with divine voluntarism is based in Dupré's understanding of voluntarism, as a form of scholastic philosophy that shifted the terms of natural law away from reason to the divine will, a trend that peaked with the thought of Calvin. Plantinga's theological roots in Calvinism is further evidence for the correlation I am making here. See Dupré, *Passage to Modernity*, p. 136.

54. See Alvin Plantinga, "When Faith and Reason Clash: Evolution and the Bible" in *Christian Scholar's Review* 21 (1991), pp. 8-32. It is cited extensively by McMullin in "Evolution and Special Creation" in *Zygon* 28, n.3 (1993), esp. p. 323

55. McMullin in "Evolution and Special Creation", p. 301. Plantinga's thesis, according to McMullin, is that "God created humankind, as well as many kinds of plants and animals, separately and specially [and] is more probable than the thesis of common ancestry (TCA) that is central to the theory of evolution." Cf. Plantinga (1991), pp. 22, 28)

56. *ibid.* p. 303.

57. *ibid.* p. 313. McMullin is quoting from Plantinga, "When Faith and Reason Clash: Evolution and the Bible" in *Christian Scholar's Review* 21, p. 22.

58. This connection has been exploited by Phillip Johnson, the American cultural critic, who cites the alleged role of scientific naturalism in building support for cultural relativism and agnosticism.

59. *ibid.* p. 305.

60. *ibid.* p. 327.

61. McMullin, "Plantinga's Defense of Special Creation", *Christian Scholar's Review*, p. 74.

62. *ibid.* pp. 74-75.

63. *ibid.* p. 75.

64. *ibid.* p. 73.

65. See *The Cambridge Companion to Galileo* ed. Peter Machamer (London: Cambridge University Press, 1998), chapter 8: "Galileo on science and Scripture."

66. "Galileo on science and Scripture," p. 272.

67. *ibid.*, p. 273.
68. *ibid.*, p. 291.
69. "Galileo on science and Scripture," p. 292.
70. *ibid.*, p. 295.
71. McMullin refers to a recent English translation of Augustine's text. See John H. Taylor, *The Literal Meaning of Genesis (LMG)* (New York: Newman, 1982).
72. *ibid.*, I, 19, vol. 1, pp. 42-43.
73. These principles are defined in "Galileo on science and Scripture", pp. 295-299.
74. *ibid.*, p. 317.
75. *ibid.*, p. 319.
76. "How Does Cosmology Relate to Theology?", pp. 22-25.
77. McMullin describes this tension thus: "something of the old ambivalence between a 'relevance' and 'neutrality' principle still manifests itself in recent debates." *ibid.*, p. 25.
78. cited in the "Collegium III" section in Owen Gingerich, ed. *The Nature of Scientific Discovery* (Washington: Smithsonian Institute, 1975), p. 534.
79. *ibid.*, p. 535.
80. "Enlarging Imagination" in *Tijdschrift voor filosofie* 58, n.2 (June, 1996), p.227.
81. *ibid.*, p. 231.
82. *ibid.*, p. 235.
83. *ibid.*, p. 248.
84. *ibid.*, p. 258.
85. *ibid.*
86. *ibid.*
87. *ibid.*, p. 253.
88. McMullin, "Natural Science and Belief in a Creator" in Robert Russell, William Stoeger and George Coyne, eds., *Physics, Philosophy and Theology* (Vatican Observatory, 1988), p. 66.

89. *ibid.* p. 67.

90. *ibid.* p. 71. The Augustinian ring to this judgment is unmistakable.

91. *ibid.* p. 73.

92. *ibid.*

93. *ibid.* p. 74.

94. *ibid.*

95. I'm thinking of systematic theology as a distinct theological function in terms of the methodological language and meaning of the task of promoting understanding that is framed by Bernard Lonergan. See Lonergan's *Method in Theology* (Minneapolis, MN.: Seabury ed., 1975), chapters 13 and 14, esp. p. 340: "If the aim of systematics is, as I hold, understanding, then it must present a single unified whole and not two separate parts that tend to overlook the primacy of conversion and tend to overemphasize the significance of proof."

Chapter Six: McMullin, Theology and Self-Transcendence

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6.1 Introduction

In chapter six, a second movement of integrative elements will be presented as unique contributions from McMullin's work. While McMullin emphasizes the elements that distinguish theology from the critically realist natural sciences, he nevertheless articulates an interdisciplinary view of consonance in broadly integrative terms. Having said this, it is also necessary within the parameters of this study, to establish some lines of thought about how McMullin's mix of integrative and distinguishing elements can be elaborated beyond what he has envisioned thus far.

Since McMullin does more to articulate the difference between faith and rationality, the further elaboration that is required will lie largely in terms of the second movement of integration. A clarification of McMullin's integration can be articulated in terms of the style that Peacocke, in particular, contributes. Peacocke, it will be recalled, brings an explicitly christological resolution to the questions of natural theology, introducing it through a minimal metaphysical notion of communication. McMullin is reluctant to pursue even this restrained metaphysical strategy. Instead, he prefers to contrast theology from other disciplines that are critically realist.

In a similar vein, Bernard Lonergan distinguishes theology from disciplines that involve verification. Indeed, as an extension of McMullin's contribution, Lonergan's theological project would ally with Peacocke's accent on self-transcendence. This stands as a mild corrective to McMullin's lack of metaphysical strategy in theology. In conclusion therefore, having secured an explanatory basis for the notion of self-transcendence as the central reference to a critical realism in the science-theology dialogue, this study raises the possibility of theological analogy that

corrects an overemphasis on models and metaphors. Keeping in mind the non-verificationist structure of theology that McMullin and Lonergan highlight, this study points out the similar role that imagination plays in theological inquiry as in scientific inquiry. Theologically, the imagination operates in terms of the discovery of self-transcendence and its verification in christology.

As a result, the discussion of chapter six will address the following elements. First, it will set the stage for why McMullin's thought on integrative elements is a crucial complement to Peacocke's sophisticated integration of biology and theological anthropology. McMullin's careful articulation of the autonomy of theological inquiry, with a basis in self-transcendence, will be described in contrast to Peacocke's panentheistic position in theology. Second, Peacocke's contribution is reviewed in light of what it can gain from McMullin's contribution yet also in terms of what it can add to McMullin's contribution by way of a christological framework. Third, McMullin's position of consonance is then introduced as a term of meaning that takes up critical realism's integrative approach, even though McMullin does not carry out the integration metaphysically. Fourth, it is suggested that Lonergan's contribution to the discussion of a natural knowledge of God contains a distinction between theology and other disciplines that concerns theology's lack of verification. Fifth, this is taken up in a reflection on the possibilities of analogy, discussed in contrast with popular contemporary proposals for a God "without Being." Analogy is discussed as a special type of language that can order conflicting tensions between natural theology and a theology of revelation, fully aware of the unity that self-transcendence brings, understood as a result of an explanatory form of critical realism.

McMullin expands the basic elements of a critical realist epistemology in science and

religion beyond Barbour's concise introduction. By providing an explanatory theory of scientific explanations in retroduction, McMullin recognizes, like Peacocke, the impact of these discussions on conceptions of existence and systematic theology. Along with Polkinghorne, he is attuned to the fact that religious faith obliges a specific kind of theological form of knowledge. Polkinghorne still calls theology critically realist. McMullin resists such a designation. Is consonance a form of unity that can still account for these varying strands of inquiry and positions?

McMullin promotes a retroductive, ontologically real theory of scientific rationality that originates from a source that is expressed in acts of imagination and which he aligns with the term 'spirit.' This insight is borrowed partly from Augustine. Simultaneously, McMullin argues for a God-World relationship that is one of complete distinction due to the time/eternity division. Thus, there are two implications for natural theology as a result of McMullin's analysis. The first concerns scientific rationality in light of the crucial stage of cosmology. The second concerns the affirmation of God the creator in theology. Overall, McMullin's reflections are a positive reading of the potential for a natural knowledge of God, because of the explicit and explanatory standpoint adopted through an interpretive notion of self-transcendence.

However, McMullin's cautious interpretation of natural theology from a neo-Augustinian viewpoint is also an explicit critical appraisal of natural theology. As the last chapter showed, McMullin has reservations about how his own differentiated account can communicate the meaning of God in a contemporary scientifically informed culture. This reservation of McMullin's is where this study can contribute clarifying remarks in order to bring the advantages of systematic theology to bear on the subject.

McMullin's proposals show three features of the question clearly. First, it needs to be an account of scientific knowledge made in judgments of verified theories regarding entities. Second, this account critiques the ones offered by the Gifford lectures where the accent is on a gap between subject and object, between theoretical constructs and the intelligibility of the entity in question. McMullin's account better appreciates the distinctive character of theology. Third however, there still exists a tension between the emphasis on distinction versus one on unity in McMullin's thought, as the most appropriate way to resolve the issue theologically.

This tension suggests that McMullin's insights expressing theological autonomy need to be further clarified with respect to the overarching concern for unity and consonance that lies at the heart of the projects of the Gifford lecturers. The hope is that a natural theology cognizant of the role of values and the spirit of imagination in scientific rationality might be a catalyst for a portrait of rationality that positively allows for religious faith.

Three additional stages of the argument of this study need to be presented in the hopes of clearing up this ambiguity that exists in light of Polkinghorne's wager on faith and McMullin's differentiated critical realism that offers a similar wager. The first concerns the notion of creation that was discussed already in the last chapter. The second and most important is an account of the meaning of interdisciplinary consonance and unity as a result. Third, there is a related question of what theological language best meets the challenges of a differentiated account of unity or worldview. Analogy may still have a role to play in promoting this strategy of interdisciplinary integration, although it would be different from Clayton's model as discussed in chapter five.¹ It cannot be understated what relevance this final reflection means, given the underlying search for unity through critical realism by the three Gifford lecturers. Their desire to identify the universe

as friendly or ‘on our side’ is the existential issue arising from the theological implications of critical realism in the first place.²

The key question underlying reflections on creation, consonance and theological analogy is critical realism as a theory of knowledge. What is the scope of natural theology as a human enterprise?³ As McMullin frames it, human rationality is already uniquely directed to account for reality. The success of ongoing scientific explanations, the heuristic role of the imagination in those explanations and the surplus that extends beyond cosmology are evidence for this. The spirit of human rationality frames scientific rationality by virtue of its creativity, its formation of images of empirical data, explanatory accounts of these images, and the progress that marks successive schemes of this process. The thrust of enquiry spills over empirical boundaries to face the fully human realms of existential and religious categories. Peacocke terms this “self-transcendence.” and he relates it to the anthropic level of a differentiated hierarchy of entities and disciplines in nature. As an integrating suggestion, self-transcendence is the underlying manifold for the possibility of religious faith. While the last chapter addressed this possibility, it remains to decipher elements of the underlying integrating manifold that Peacocke describes.

In engaging this teleology of the scientist in self-transcendence, we are not neglecting the natural world. Rather, since scientific knowing involves the subject in self-transcendence in first imagining and then affirming existence, we begin to see the value of a natural knowledge of God. Transcendence is the act of creative human imagination operating in the pursuit of understanding. Since our understanding is always moving forward imaginatively in affirmations of new theoretical entities in the world, we see how the theological questions that emerge at the limits of philosophical cosmology imply a Creator God who is not merely dissimilar. We also

comprehend a God who possesses the fullness of knowledge that our notion of intelligibility grasps partly.

It is possible to go further by suggesting that the Christian tradition's claim regarding the Holy Spirit is actually pre-figured in potency through this developed understanding of rationality. This would be consistent with McMullin's retrieval of Augustine on this question. This is fully realized on God's side of creation, as McMullin says, where "there is only *knowledge*, the knowledge proper to a maker who is not bound by these distinctions" of rationality and the search for understanding.⁴ To extrapolate from the experience of self-transcendence to an omniscient God would require critical correlations with a theology of revelation. That is not the goal of this study. Here, the emphasis remains with the categories and objects of religious meaning in a general inquiry that works in view of a theology of revelation. Yet, it is one which seeks a portrait of human rationality that is open to the life of faith.⁵ As such, faith is not undermined by scientific reason. It is affirmed by the understanding of oneself in the act of reason. Can this trust in reason be the cornerstone for a critical realism that mediates theological claims? The theological notion of creation is an obvious test case for such a mediation.

6.2 Giffords Revisited: God and World in Relation

Polkinghorne's creedal focus in *The Faith of a Physicist* would seem, at first glance, to provide the opening to theological anthropology and christology that Peacocke incorporates in terms of creation.⁶ Polkinghorne's emphasis on doctrinal statements pertaining to the resurrection and incarnation would seem to suggest that his understanding of the God-World relationship is the most developed of the Gifford lecturers when it comes to accounting for faith.⁷ Yet, he judges his efforts as equal to those of Barbour and Peacocke: "though we have traveled different paths,

we have arrived at similar destinations.”⁸ He is explicit that a metaphysic or an ontology can result, but he never actually develops one in any of his writings beyond some brief descriptive statements on what he terms a “dual-aspect monism.” He also notes that Peacocke is reluctant to adopt a metaphysic.

In spite of Polkinghorne’s bolder attempt to salvage a distinct theological terrain in this dialogue, it is actually Peacocke’s Gifford Lectures that provide us with a more suggestive theological grammar for discussing the human basis for better understanding the God-World relationship. His understanding of creation is thus richer and more suggestive. This is mostly due to his intended reflections in the mode of systematic theology. In *Theology for a Scientific Age*, he adds an entire final section on the christological and the theological anthropological dimensions to his discussion of God and Nature. As I suggested earlier through McMullin’s invitation to consider the human and epistemological arenas where science and theology interact, Peacocke’s biological background gives him an advantage in pursuing this insight.

Peacocke introduces the christological component to his work by reference to the way in which God chooses to “communicate with humanity.” The theme of personal communication, as covered in chapter one⁹, is Peacocke’s metaphysical contribution to conceiving the God-World relationship, although this might not be how he would frame it. His suggestions are an essential backdrop to Philip Clayton’s more explicit connection between the conception of human rationality and a panentheistic God-World relation. In the chapter that precedes the section on humanity, Peacocke discusses the roadblocks that stand in the way of conceiving the God-World relation positively:

“It is indeed difficult to imagine *how* God might be an agent in a world conceived of as

ruled by deterministic laws at all levels when the only analogy for such agency has itself been formulated in dualistic terms [...] theologians expounding apparently very different understandings of how God acts in the world, or of whether he does so or does not do so, tend to resort to just assertion that there *is* such a link in the case of human action itself, which illumines *how* God might be conceived of exercising his influence on events in the world.”¹⁰

Yet, Peacocke is willing to describe the human analogate for God-talk without apparent hesitation:

“We may say that human beings are ‘self-transcendent’. So self-awareness and self-consciousness, coupled with our intelligence and imagination, generate a capacity for self-transcendence which is the root from which stems the possibility of a sense of the numinous - and so of the divine [...]”¹¹

Peacocke’s theological anthropology is the result of his extensive reflections on the human place in the world, with particular attention to the biological and environmental conditions that gave rise to the hominids in the course of our own evolution. This position is now termed ‘emergentism’ in the science-religion and philosophy of mind literature. It enshrines a set of interpretations of the sciences that differ with and correct earlier mind/body or mind/spirit dualisms. But Peacocke carries his emergentism to a moral and christological conclusion when he claims that human ‘becoming’ is a paradoxical reality:

“The religious and moral experience of humanity is that this self-consciousness, by its very character as *self*-consciousness, has made human beings aware of what they might become - and of their failure to fulfill their potentialities and to satisfy their highest aspirations.”¹²

Citing John Macquarrie’s book *In Search of Humanity*, Peacocke signals the importance of human freedom as the dimension through which humans actually emerge, and into which his christological reflections are rooted. Christology shows ultimate promise for Peacocke in terms of the science-theology dialogue by expressing God’s ‘personality’ to humanity.¹³ In his

“ascending” or “below-upwards” account, Peacocke provides a rich description of transcendence as we experience it. He supports the human experience of transcendence through self-consciousness with his claim for the “non-reducibility” of levels of physical and disciplinary reality.

However, Peacocke leaves out the unique role for the human imagination as the heuristic operation McMullin identifies as the creative transcendence of our extant knowledge. One could expand Peacocke’s portrait significantly by citing the imagination as operative in different disciplines as the underlying potential in the desire to understand, whether what is understood is an aspect of existence or God. The imagination is the heuristic principle that is both an originating and an integrating power in human rationality. Suffice it to say that for Peacocke, biology’s inability to account for the complete experience of being human leaves reality open to the probability of divine incarnation as the means for God’s communication with humanity. This fulfills the promise of creation, and carries forward the transcendence already experienced in humanity’s interaction with nature towards the human experience of grace, hope and self-identity as ‘created co-creator.’¹⁴

Without an account of the imaginative heuristic of human knowledge and desire, Peacocke’s metaphysical integration of creation stumbles slightly. By opting for panentheism as a model for combining a philosophy of God and a theology of creation, Peacocke restricts the theological imagination to an image of spatial or proportionate bodies in interaction. As described in chapter one, panentheism is introduced by Peacocke as a way of “holding together” God’s transcendence and immanence. It is for this reason perhaps that McMullin criticizes Peacocke’s immanentist God. McMullin’s reliance on an atemporal notion of God is intended to

counter the impression that panentheism alone adequately defends a Creator God.

However, the problem with Peacocke's model of panentheism does not lie in the way he expresses God's continuing creation in the universe. Rather, it is the idea that a model is theology's best chance of communicating the meaning of creation. Why is self-transcendence not sufficient to ground a theological understanding of a natural knowledge of God? Why would panentheism or another model of God-World interaction be better suited to convince readers of God's involvement with the world?

There is something in Peacocke's presentation that portrays the scientific disciplinary structure, exemplified through the act of modeling, as the framework of theological reflection. This would undercut the central focus of theological concern on our destiny before God. This is not to suggest that an emphasis on self-transcendence excludes the theological insights that arise in proposing models. It is to affirm that theological models do not, on their own, provide the insights that pertain to God's gratuitous action, made real through events of revelatory significance. The same problem was identified in connection with Clayton's reliance on a model for God-world interaction in chapter five. Going on McMullin's position in scientific realism, we need to remember that models on their own are insufficient to communicate meaning. This would be all the more valid when speaking of creation.

By couching his understanding of creation in christology, Peacocke overcomes many of the difficulties that his reliance on models raises. Christology offers an arena of discourse where the accent is on the resolution of human intentionality in a divine gift of redemption, a "top-down" movement of grace. His shift to christology away from a strict focus on creation goes some distance to meeting previous objections leveled in a 1993 dissertation study by Steven

Crain.¹⁵ Crain concludes that both Peacocke and Polkinghorne in their pre-Gifford lecture works, conceive of divine action as simply a question of choosing between “‘influence’ or a combination of ‘pre-planning’ and ‘intervention’ that entail ‘control.’”¹⁶ Crain chooses to conclude that a contrast exists between Peacocke and Polkinghorne’s preference for divine influence on the one hand and the notion of creation *ex nihilo* on the other hand. This judgement may overstate the emphasis that each thinker places on the continuing activity of God’s creation, over against the initial creative moment of the act. Nevertheless, Crain draws on a belief in divine creation from nothing in the light of its explication by Thomas Aquinas and two contemporary interpreters: David Burrell and Robert Sokolowski.

Crain’s study is more concerned with the theological implications of Peacocke and Polkinghorne’s metaphysical interpretation of recent physics in contrast to this study’s starting point in a critical realist epistemological problem. Nevertheless, he draws some fascinating conclusions which parallel this analysis. First, he claims that there is a limited sense in which the

“unique relationship between causal power and micro-structure serves in certain respects as a functional *analogy* for the unique relationship between God’s ability to act ‘in’ the world and the world itself. (italics mine)”¹⁷

Peacocke expresses this metaphorical analogy through his relationship between Christ and humanity. Yet, Crain faults Peacocke for using a model, for this attempt to image a spatial or proportionate relationship contradicts the notion of creation as pure dependency:

“ this third alternative [*contra* either divine influence or divine intervention] cannot be ‘pictured’ or ‘modeled’ [...] Rather, following Burrell’s interpretation of Aquinas, one can give ‘grammatical’ rules for speaking about this alternative [...]”¹⁸

Crain’s conclusion is that the idea of creation differs fundamentally from the theological models offered by both Peacocke and Polkinghorne. What is so intriguing is that his defense of the

“traditional” notion of creation is made in contrast to Peacocke and Polkinghorne’s metaphysical perspectives:

“The framework for this theological vision [...] is: God and World parallel to one another - indeed God and the world pitted against each other [...] God and creation relate to one another in a ‘zero-sum game,’ wherein creation’s freedom is purchased at the expense of divine knowledge and power, and God’s ability to influence events at the price of creation’s freedom.”¹⁹

This ‘zero-sum game’ is precisely the logic that is implied by the *via media* style of thinking that governs their understanding of critical realism, and therefore their conception of knowledge. A Cartesian framework may be at work in shaping their reflections, both at the level of epistemology, as this study has argued, and metaphysically, as Crain argues. I would qualify this evaluation by stating that the degree to which Peacocke and Polkinghorne recover a language of theological anthropology and christology in their Gifford lectures goes some distance to constraining the impression of naïve realism present in their work. This is especially true, as I have shown, in their continued equating of critical realism in the sciences with a critical realism in theology.

The link between this analysis and Crain’s analysis concerns how creation is to be understood. There is a fundamental lack of appreciation for the probable character of knowledge undergirding all empirical understanding since the 17th. century which has combined with a lack of resolve to follow through on the radical character of divine transcendence that is intimated by self-transcendence. What is striking in Crain’s thesis is the degree to which his analysis turns on a key insight from an interpretation of physics:

“According to [Peacocke and Polkinghorne’s] notion of creation, the primary and most important sense in which God is continuous creator is that the processes which God holds in being are themselves creative. Moreover, creativity in this latter sense is then *made to*

*depend on indeterminism, because deterministic processes are said to be incapable of producing 'novelty' both in the broad sense of something truly new and in a narrower sense that involves emergence. [...] [They] each claim that only an 'emergent' entity qualifies as a 'novel' entity in the deepest sense, and furthermore that only an indeterministic process is capable of producing such entities. God is therefore continuous creator in that God continuously brings into being novel forms via indeterministic processes."*²⁰

In selecting indeterministic processes out for special theological treatment, Peacocke and Polkinghorne lean toward a form of theological determinism by speaking of creation and the character of the God-world relation as dependent with indeterministic processes of causation. Only a recourse to a wider distinction between divine universal and special action can repair this impression. While being careful to spell out that his critique does not lead to belief in a deterministic universe. Crain notes that creation cannot be made to fit any particular physical characteristic, even as a limited definition of emergence or novelty.

The insight highlighted from this study of critical realism and scientific rationality simply carries this critique one step further. In understanding natural process at either the micro or the macro level, one apprehends the real with the same resources of imagination and confidence in the structure of the sciences which we already know provide us with explanatory knowledge. This is the context for any interpretation concerning the indeterministic character of an aspect of reality, including the famous Heisenberg Uncertainty Principle. In reaching conclusions about the indeterministic features of reality, one does not add to or take away from an entity or set of entities' reality. This merely alerts the scientific imagination to the need to operate on other epistemic values in order to explain in what way it marks out that reality.²¹

Furthermore, if reason has been demonstrated through the originating power of imagination to confirm the realist position on existence, and provided that we can assume the

process of self-transcendence transforming ourselves, then our efforts to re-direct meaning at the level of human freedom is not especially clarified by an overarching model of God's relationship to the world. The notion of creation already captures it by being the possibility for redemptive action in the first place. On the contrary, in the spirit of the medieval *via negativa*, perhaps the attributes accorded to God by virtue of this kind of combined natural and revelational theology need to be complemented by analogical talk of God's utter dissimilarity. This dissimilarity, couched in terms of analogy, might avoid the traps of the inherently metaphorical model. Creation cannot be captured by this epistemological tool.

The other difficulty with Peacocke's spatial model of panentheism as a way of communicating creation is over God's alleged influence on world-process. Barbour's process model coheres roughly with the same intent. Again, I doubt whether this pursuit of God's influencing activity can bear the kind of fruit that Peacocke thinks. Nevertheless, it bears repeating that Peacocke's references to panentheism are limited in his Gifford lectures. They appear mostly in footnotes. One of these includes a corrective to process thought on the character of God's receptivity.²² He seems to adopt a more explicit panentheistic stance in his earlier work *Creation and the World of Science*.²³ Yet, even there, his instincts seem to place more credence in a christological character to this model, thus limiting the impact of the model. It should be noted that his language contained in both of these works on the subject of christology makes it seem as if revelation could be fully anticipated by a natural theology that attends to meaning. Echoing Karl Rahner's theological anthropology, Peacocke states on several occasions that owing to the fact that God is "at least personal," it should be expected that God "would be expected to be *self*-communicating."²⁴ Yet, one of the strengths of Peacocke's work is that he

connects biology to personhood, meaning and value, thus indicating that natural and revealed theology are empirically linked.

With Crain, however, it is important to signal a concern over Peacocke's metaphysical warrant for claiming divine influence as the theological knowledge we acquire when we understand the basic character of the universe. This is the impression that reading *Theology for a Scientific Age* gives. It hinges on the assumption that science can claim credit as the genuine source for the doctrine of creation. Therefore, a certain contradiction exists between Peacocke's christological conclusion to his theological anthropology on the one hand, and his metaphysically guided model of the God-World relationship on the other hand. A contradiction emerges from Peacocke's unwillingness to invoke an analogical qualification as the distinctive step between his conception of natural theology and revelational theology. In a fascinating hint of the conclusion to this study, McMullin's 1985 critique of Peacocke's critical realism, which comes from his 1984 work *Intimations of Reality*, contains the following evaluation:

"Why [...] does [Peacocke] stress the commonality between science and theology when the methodological differences are so profound? I think it is because of *one* affinity between them which has only recently been recognized, and which would even still be debated. That is, the generally metaphorical character of the main explanatory concepts in both."²⁵

McMullin falls down on the side of some sort of "grammatical rule" or analogy in order to arrive at a better solution to interdisciplinary consonance:

"In short, the reason why the language of theology is held to be analogical ("metaphorical" in the extended contemporary usage) lies not in its procedures but in the character of its object which is said to transcend all human modes of expression. In science, the emphasis on metaphor comes from a different quarter [...] The relation between metaphor and analogy is quite complex, more complex (I think) than Peacocke seems to allow. Much metaphor in science does *not* rely on analogy; it is not as though the extension of our imaginations into the unknown is always accomplished by means of

analogies with what we already know.”²⁶

This is a key text for the additional integration being advocated in this chapter. McMullin implies something paradoxical. Contrary to the metaphorical reach of the scientific imagination into the unknown, the reach of theological analogy is also beyond our grasp. Yet, it is a part of what “we already know” in our experience of ourselves as historical agents coming to terms with sin and evil, which fall outside the range of meaning in scientific rationality. What we already know might also be extended to include the christological dimension to human hope that Peacocke in particular raises to prominence in his Gifford lectures. We can conclude from McMullin’s various stances that analogical speech concerning God is possible in theology as different from the standard critical realist methods in the sciences, yet as similar since it partly results from the process of self-transcendence envisioned in the practice of science. This marks off theology as substantially different from the sciences. Theology refers to the reality of God that cannot be modeled, or fully appreciated through metaphor. Nonetheless, there is still a problem with how to construe an integrating claim as a claim of knowledge. How does theology situate itself in relation to the sciences?

6.3 McMullin and Interdisciplinary Consonance

McMullin’s preferred notion to describe the science-theology relationship is “consonance.” It is coined by McMullin to claim interdisciplinary non-contradiction.²⁷ The reason for this notion is not an implicit agreement not to disagree. Rather, it represents a more sophisticated neo-Augustinian position in which his positions on scientific and critical realism are implicated. McMullin’s position of ‘consonance’ should be seen in light of the perspective that he has adopted on philosophical issues like the anthropic principle and his Augustinian

approach to theological method. Consonance is not an *a priori* view of non-contradiction among and between disciplines. It should be noted that this is precisely the opposite view to how Barbour describes McMullin's position.²⁸ Furthermore, McMullin's usage of this term should be understood through his extensive engagement with epistemological questions leading to a self-transcendence based on the implications of realism for debates in the philosophy of science.

It is a position that differentiates within the integration that is experienced in human rationality. As such, the choice of "consonance" is not surprising, given McMullin's misgivings over natural theology. It is logical, given his reticence in seeing God incorporated in a temporal metaphysic or general evolutionary account. Consonance is a widely referenced position in the science-theology literature. Indeed it is attributed to McMullin as an original term by several thinkers identifying a position that is accorded varying degrees of approval or disapproval.²⁹

Through this term, McMullin introduces a coherent, deep philosophical mediation to the science-theology dialogue. He uses the term explicitly in his 1981 article "How Does Cosmology Relate to Theology." In light of what he has since written elsewhere in science-religion dialogue and the philosophy of science, I see his usage of consonance as explanatory, not descriptive. McMullin's use of consonance is a carefully weighed judgment that different disciplines are involved in constructing explanations about overlapping (but not equivalent) realities. These overlapping realities imply the similarity/dissimilarity conjunction of analogy at a metaphysical level. Certain questions are raised but will remain unanswered by individual disciplines. Further, this implication is defined *a posteriori*. By this is meant that no single epistemological doctrine is available to handle knowledge across the interdisciplinary divide. McMullin's careful critique of Polkinghorne is an excellent vantage point from which to probe further the meaning of

consonance:

“[...] the critical realism of natural science does not, to my mind, carry over into theology. The affinities that Polkinghorne finds between the development of Christian doctrine and the recent development of quantum mechanics do not extend to the manner in which the two sorts of development were *validated*. But it is on the mode of validation that the thesis of scientific realism depends. And the arguments that are advanced on its behalf simply do not carry over into theology [...] arguments [...] for an appropriate doctrine of critical realism in theology [...] would have to be of a kind very different from those relied on in regard to natural science.”³⁰

How would a theological critical realism be different? One way of interpreting McMullin would be to suggest that consonance is present when explanations such as the doctrine of creation, for example, relate to science by virtue of a dual verification process. The first part of this verification process involves the uncovering of other insights, beliefs, experiences and discoveries in theological sources, primarily scripture. It is here where the term creation possesses its primary reference to personal meaning. The task of understanding how creation coheres with other disciplines and their findings is a distinct second tier in the search for its meaning. As such, it comprises a distinct set of tasks that shape the meaning of consonance. Both pursuits of consonance conform to the task of doing systematic theology, where systematic theology is understood as endeavouring to unite natural theology with revealed theology under the rubric of self-transcendence.

Consonance is therefore a question of making a theological idea or doctrine actual by virtue of allowing an interaction at the level of systematic theology and in the communication of these systematic understandings. It is not a description of parallel investigations searching for non-contradiction, but the result of a specific function in theology that is available to all theological affirmations, regardless of whether their formulation implies an interaction with the

natural sciences for further understanding or some other discipline in the human sciences such as sociology and psychology. This strongly resembles the method of critical correlation that has been developed in contemporary theology. However, the self-transcendence present in scientific rationality renders the correlationist task theologically oriented. The underlying goal is the explicit reference to a Creator God.³¹

McMullin's Augustinian framework is well situated in placing a priority on faith and religious experience in theology. Nevertheless, I am aware that by merely repeating Augustine's own position of consonance, McMullin does not really explore the underlying reasons behind why Augustine attempted a broader theological worldview that could engage the natural (and human) sciences on theological grounds in the first place. I argue that consonance should therefore be understood as a form of critical realism in which knowledge is equally verified and empirically verified in both disciplines. But, knowledge is verified on radically different grounds with respect to different objects. In science, the verification is made with respect to objects in the world. The self-transcendence emerging from a consideration of the human in cosmology is the empirical grounding for a theological act of understanding. The verification involved in theological understanding, however, is primarily with respect to the questions of meaning and purpose of human destiny as a microcosm of universal destiny.

In summary, McMullin articulates consonance better than the Gifford lecturers, but not to the point where his appropriation of Augustine does not beg further questions. Why would Augustine have pursued such a position of a worldview of differentiated unity, such as the consonance expressed in exegetical works as *De Genesi ad Litteram*? My provisional answer, which would require further support from secondary sources, is that Augustine's pursuit of self-

knowledge through religious conversion obliged a quest for greater coherence in and through the realization of his own unity as a human person. This unity in differentiation was consequently the source of his achievement in his development of a non-literal sense of scriptural interpretation, and his valuation of the seven liberal arts, the *trivium* and the *quadrivium*.³²

This seems to be the best way to understand and clarify McMullin's use of the word consonance in light of his explicit appropriation of the Augustinian heritage. As such, this interpretation goes some distance beyond a position of semi-independence regarding the different disciplines. This position of semi-independence was the position ascribed to McMullin by Barbour. However, this does not account for the more complex picture of theology's position as a discipline with specific requirements on what it may communicate from a basis in its own sources of reflection and on what it may not. The key word, from Peters' summary of McMullin's position is the term 'correspondence' (a term historically associated with naïve realism). Yet, this is a term which McMullin distances himself from, because he has not pursued a metaphysical reflection that ties together nature with history.³³ Owing to God's atemporality, there is not a simple transfer of meaning of "correspondence" from the sciences to theology.

Would McMullin criticize the attribution of correspondence to his consonance position? This is doubtful, assuming the term 'correspondence' is given to mean a consonance of the disciplines deepened through an understanding of the imaginative heuristic of human rationality toward constructive self-transcendence. This is also to state where the notion of consonance is limited as a worldview. Its primary orientation is to the knowledge of different disciplines, not the self-transcendent inquiring subject *per se*.

On a reading of McMullin's understanding of natural theology, there should not be a

correspondence of the differently located disciplines *vis à vis* nature only. Theology's distance from nature, according to the Augustinian hermeneutic, is partly due to its lack of an explanatory account of nature, and this is what lies behind McMullin's reticence toward a natural theology. McMullin's judgment on natural theology is clarified in response to Peacocke's defence of a capacious meaning for critical realism:

"It would today be very risky, to my mind, to propose *any* aspect of Nature (whether it be the transition of "level" in the evolutionary record or the choice of the "right" parameters to get the Big Bang off to a proper start) which can only (or best) be explained by something by something like Divine intervention. Such arguments rely on gaps in current scientific explanation."³⁴

McMullin's response to Peacocke on the subject of critical realism echoes Polkinghorne's sentiments precisely on the centrality of human rationality in understanding where science and theology do meet:

"Theology and science deal for the most part with different domains of the same reality. Science has no access to God in its explanations; theology has nothing to say about the natural world. Where the two, however, may overlap and thus interact is in the *human* domain; *each has things to say about the nature of human reality.* (emphasis mine)"³⁵

What McMullin says with regard to the ways in which science and theology overlap is that the means of "adjudicating between rival theoretical understandings" in each discipline are markedly different in terms of the "criteria of assessment."³⁶ In describing the contemporary theological terrain, McMullin simply notes that different types of theology (he lists four: natural, experiential, revelation/biblical and ecclesial) confound the image of steady progress that typifies the (critical) realist understanding of science. The result lies in differentiating the real in terms of what exists as existence and the existence that is purely transcendent. None of these forms of theology exhibits "the 'best explanation' form of argument for realism [...]"³⁷ It is difficult to

accord a theological dimension to critical realism, according to McMullin. There is a fundamentally semantic difference contained in the term itself once it is transposed into theology. He considers the possible structure of critical realism for experiential theology, or reflection on God from religious experience, but quickly adds that “the structure of this argument is not primarily explanatory.”³⁸ McMullin then turns to natural theology, which “*does* have a structure of explanation.” But he does not pursue what this structure is.

For McMullin, the problem with the tradition of natural theology, in spite of its explanatory appeal, is its excessive ties to the physico-theology of English 17th. century scientists. The need to avoid historical mistakes blocks a bold contemporary foray in natural theology as far as he is concerned. But, this association is also noticed by Peacocke. And, as I have noted from the first chapter, Peacocke prefers to select aspects of nature in order to propose a hierarchy in nature and the corresponding human disciplines. He does not pursue a narrow “causal joint” between God and nature. Instead, his proposal is based in the model of “top-down” interaction with the world as a whole. This comprises his strategy for natural theology with persons and personhood being an axis or central defining point of departure. This is a significant amelioration of a traditional mode of argumentation in natural theology. Moreover, it is one which I think McMullin could readily accommodate, in spite of his reticence toward contemporary theology’s temporally located understanding of divine action.

The question that all of this poses however is whether or not a natural theology could be constructed with a notion of consonance and critical realism arising from McMullin’s development of the term. What possibilities exist in order to avoid arbitrary, conceptual selections from the sciences? Can Peacocke’s formulation of a systematic natural theology be

revised in order to move beyond understanding God merely in terms of top-down causation?

Recalling McMullin's brief question noted in chapter five³⁹, what about pursuing a natural theology that explores the conditions of possibility in humanity for any explanation whatsoever? This is where McMullin willingly acknowledges that the two disciplines converge. McMullin's own work in uncovering an irreducible role for values and imaginative creativity at the heart of scientific reasoning brings a certain teleological response to this question in terms of spirit. But, in terms of transferring the mode of verification over from science to theology, there must also be a transfer from nature to history. This is where I suggest that the well developed christology contained in Peacocke's Gifford lectures is a significant dimension. In those lectures, Peacocke adverts to Jesus Christ in a significant and extended reflection on the results of theological anthropology.

Strangely, McMullin does not mention christology in his work that touches on theology. This absence, while understandable given McMullin's reflections on divine action, nevertheless leaves his preference for theology's basis in salvation history unfulfilled. Peacocke, on the other hand, does pursue an anthropologically referenced christology. His christological reflections, however, do not contain as clear an understanding of the distinction between nature and history, nor an awareness that meaning and values fundamentally transform the meaning of critical realism in theological discourse away from the universe to the human subject located in the universe. Therefore, a combined strategy is required where Barbour's original insight into the metaphysical possibility of critical realism, Peacocke's christologically guided notion of self-transcendence, Polkinghorne's dual emphasis on intelligibility and revelation and McMullin's portrait of rationality incorporates each of these elements selectively in an Augustinian

framework.

It is christology as intertwined with a notion of creation that might integrate further the spiritual character of human rationality that McMullin works out. Not coincidentally, creation and christological redemption are the two foundational dimensions of a theology of revelation. By reflecting christologically, while being faithful to McMullin's distinctions, we might better address the personal and communicative nature of God with humanity that Peacocke emphasizes. What this establishes is that verification, the hallmark of McMullin's retroductive rationality does carry over into theology, but with respect to the person as a seeker of meaning and hope in a God who is immanent in history. Verification, it will be remembered, was the second movement of return from theory to data in a theory of scientific rationality. In theology, a reflection on the gift of Christ provides a verification of the search for meaning and value that sparks the scientific, cosmological, philosophical and theological imagination in the first movement of intention toward the universe and then God. As such, an understanding of Christian hope manifest in the life, death and resurrection of Jesus, is a mark of the fertility of a theological inquiry. However, as with the meaning of critical realism and verification, the meaning of the word fertility is vastly different in a theological milieu. The strand of continuity between scientific fertility and theological fertility is that the pursuit of the inquiry, an inquiry into God's answer to human hope, bears fruit in a meditation on the person of Christ.

Does this mean that theology is critically realist? In the sense that theology contains a roughly similar reference to a real entity, namely God, then yes, it is critically realist. However, because of the highly significant differences in the meaning of words, the positive answer must be heavily qualified by what constitutes a verification in theology. A clue as to what verification

or empirical affirmation of God means is available from Bernard Lonergan's philosophy of God.

6.4 From World to God: Lonergan's "Natural Knowledge of God"

Beginning with the liberal and neo-orthodox reactions to positivist currents in theology late in the nineteenth century, the variety of arguments for the existence of God from nature have come under serious disrepute. In the wake of these reactions and the simultaneous rise in the autonomy of the natural sciences, theologians have neglected to attend to nature or the study of nature as a potential ground for complementing a theology of revelation. Against the stale objectification of God (parallel to what Harnack referred to as the "hellenization" of Christian doctrine), theology has since come to focus more and more on the intersubjective character of theological reflection. According to this pattern of theological reflection, God is not to be conceived as one more object of thought among others, but rather as a subject with whom we exist in primary, personal relation.

In an essay on the traditional teaching of Vatican I's *Dei Filius*, Bernard Lonergan sketches a precise summary of the problems of adhering to a *strictly* intersubjective view of theology. Lonergan's conclusion meets the issue of critical realism as a theological problem. This study has argued that a view of reality accorded in scientific rationality is theologically significant. This, in turn, correlates with what was claimed at Vatican I. There, as Lonergan recounts it, a natural knowledge of God was defended as a possibility. This human potency to know God naturally is "not moral but physical. The natural light of human reason is part of man's physical make-up."⁴⁰ Lonergan goes on to qualify this claimed potency: "It is not asserted that this light is sufficient for fallen man to come to certain knowledge of God [...] [Furthermore] the knowledge in question is not immediate but mediated, and it is mediated not by revelation but

by creation.”⁴¹

The reason for raising Lonergan’s discussion of a natural knowledge of God is to clarify more exactly the road of self-transcendence that is the non-reflexive process of verification that differentiates theological critical realism from other critical realist disciplines. In this article, which builds on his earlier massive work *Insight*, Lonergan contrasts a natural knowledge of God with scientific knowledge. The difference is over the question of verification. A natural knowledge of God based on a knowledge of the world is itself based on what Lonergan calls an “unverifiable principle.” It is non-reflexive. Science, in contrast, is based on the need for verifications. For a natural knowledge of God to occur, Lonergan points to the mere act of attending to who we are as knowers. This attention is non-reflexive, not a set of scientific operations involving the need to understand, conceive, affirm and verify. As Lonergan puts it, “the self-transcendence of knowledge is merely intentional.”⁴² Intentionality is understood as the pure desire to answer questions. In meeting the objections raised to considering God as an object, Lonergan re-defines objects as “what are intended in questioning.”⁴³

However, employing Lonergan’s terms, the assurance of a natural knowledge of God cannot be sustained if there is raised the philosophical possibility that answers do not follow questions. Thus, without the assurance of verified judgments in a knowledge of the real, then what Lonergan calls the unverifiable principle operative in a natural knowledge of God is unhinged from its support in a human subject who understands and verifies objects (or, to use McMullin’s preferred term “entities”). In the portrait of scientific rationality gained with the assistance of Eman McMullin, we have a better portrait of how scientific rationality is realist. Once this is historically verified through the efforts of attentive collaboration, it is critically

realist as well. It thus overcomes historicist, instrumentalist or empiricist impulses in the philosophy of science. Indirectly then, the effort to secure a realism about the world is theologically significant. This is no small step in the affirmation of the reality of a theological knowledge claim, as Lonergan's exemplary argument for a natural knowledge of God shows. If we are to meaningfully point to the self-transcendence operative in knowledge, morality and religious experience, as Lonergan differentiates the three basic stages of self-transcendence, then it is vital to possess a systematic understanding of how answers follow questions at the level of knowledge. With intentionality secured in the act of knowing, a valid "verified" theological reflection on intentionality may suitably follow.

This does not assume that a theology of revelation is strictly dependent on the kind of natural knowledge that is secured in this differentiated manner. However, without such a basis in a verified realism, theology is left without a way to communicate itself systematically in contemporary cultures. Without such a philosophical reference point, we would be unable to overturn a theological lack of confidence in the world as creation. We would be unable to forge a precise account of the human potency for a natural knowledge of God.

6.5: Natural Theology and Analogy: God with Being?

The corrective that I have shown in this study of McMullin's account of critical realism beyond the critical realism of the three Gifford lecturers shows that a re-vitalization of analogy is possible as a metaphysical complement to an epistemological resolution of the problem of faith and rationality. The role of McMullin's theory of scientific rationality is that it highlights the historical subject in the act of explanation. This leads to a better account of critical realism and, therefore, a new conception of self-transcendence. This understanding of self-transcendence

builds on the elements provided by the Gifford lectures by explaining why the existence of entities are investigated and affirmed over time. With the key factor of cosmology in particular, McMullin proposes the key to the human experience of self-transcendence. This notion of self-transcendence is empirical. It is a manifestation of cosmic intelligibility affirmed as intentional on the part of the subject and real with respect to the achievement of verified knowledge in relation to the object. It is not a simple question, therefore, of supposing a *via media* as proposed by the Gifford lecturers.

The quest to defend a critical realism can legitimately be seen as a theologically motivated quest in all four thinkers. Critical realism is a way of affirming the participation of the inquiring person in a greater whole, in reality. McMullin's defence of scientific realism can be seen as a defence of a position on the reality of the whole in which we participate. Reality is thus theologically pregnant, especially when we are obliged to defend it as scientists, philosophers or theologians.

Philosophers classically labelled this "whole" as "Being." While such language is much less helpful given its connotations of classicism, the limits of inference in this notion of critical realism coupled with the positive sense of transcendence into atemporality affirms that analogy is a worthwhile extrapolation from existence to God. As such, it forms a natural knowledge of God that leaves room open through the search for personal meaning, but does not anticipate revelation and God's saving action in history. This reminds us of why Polkinghorne's and McMullin's corrective on Peacocke's over-reliance on metaphors and models is crucial. What is really important theologically is the act of understanding itself, understood as continually operative in history as McMullin has outlined it. The theological affirmation of a natural knowledge of God

through analogy is affirmed through critical realism because of the way that this critical realist portrait of scientific rationality consistently shows how the issue for inquiry is the issue of progressive knowledge. This progress meets a limit that exists by virtue of the time/eternity divide in cosmology, so analogy becomes the best recourse to account for the perfect understanding that grounds the ongoing attempts at systematic, progressive understanding in human rationality.

Without an analogy from a potentially verified form of self-transcendence in and through knowledge, theological analogy to God would be akin to other metaphors and models. Rather, theology is radically dissimilar from these other models and metaphors because of its verification from a completely transcendent source. The dissimilarity is grasped by appreciating that the reality of a complete act of understanding cannot be attained in a continual movement upwards to answer questions. With this asymmetry ensured in theological language, the Creator God of the traditional Christian doctrine can be more adequately communicated in consonance with the analogy of natural theology.

Thus, theology is critically realist if the meaning of critical realism is primarily self-transcendence. In the natural sciences, critical realism still has another primary meaning bound up with the affirmation of existence, though directed toward self-transcendence. Insofar as a theological critical realism points from rationality towards christology, it functions in terms of the meaning of self-transcendence. In a sense, this is a foundationalist position regarding the true nature of human knowledge and intentionality, but it is very different in orientation from classical foundationalism.⁴⁴

As this study has shown with respect to the role of imagination in scientific rationality's

twofold process of discovery and verification, this cannot be a view of knowledge that is *a priori*. Rather, it is a view that arises as the outcome of appreciating the subject in understanding scientific, explanatory knowledge. As such, this understanding of explanation is a view of knowledge that is foundational precisely because it is critically realist. And insofar as it is critically realist, it is open to historical revision. Insofar as it engages cosmology, it is open to emergent probability.

By understanding critical realism in the way shown here, a constructive link between natural and revealed theology is opened up. The key lies in how theology treats the reality of the *humanum*. Over the past century, theologians and philosophers either tended to treat the universe as a whole in terms of its religious relevance or, in a focus on self-understanding, it focussed on the meaning of texts in light of religious and moral conversion. The rifts between these two theological types, a theology of revelation and natural theology, are the backdrop to a long series of disagreements in theological method. And this conflict is precisely what lies behind the divergence between Polkinghorne's approach from the other Gifford lecturers.⁴⁵

6.6 Conclusion: Points of Convergence in Theology

An opposition between a theology of revelation and natural theology is also reflected in the significant themes addressed and expounded by Jean-Luc Marion in his widely read work *God Without Being: hors texte* where he invokes the Heideggerian legacy in specific ways to separate theology from philosophical reflection:

"To liberate theology from the word *Being* now assumes a precise meaning: it is not in any way a question of unbinding theology from *Dasein* but, on the contrary, of according theology a proper domain - faith - only on condition of submitting it to an ontological 'correction.'"⁴⁶

This unbinding of faith from Enlightenment reason is the stance of Alvin Plantinga, and represents a fideistic stance that a misreading of Polkinghorne's Gifford lectures might mistakenly conclude.⁴⁷

There is a legitimate point being made by Marion, and it is reflected in a growing theological consensus. There are now a diverse number of thinkers who have diagnosed theology's chief weakness in terms of its historical ties to particular metaphysical constructs. So Marion's identification of the problem is not unique. Nevertheless, if we bear in mind the problem that the Gifford lecturers address, Marion's philosophical dis-establishing of theology implies the sort of rupture in knowledge that the science-theology dialogue is precisely trying to avoid. Therefore, some postmodern critiques of the drive to understand the unity of reality ironically expands the extant separations in modernity. Wentzel van Huyssteen claims, in response, that rationality is literally re-discovered in light of the postmodern "crisis":

"if we let rationality slip away, we will be losing that which gives our identity as human beings. The special focus of the postmodern challenge to human rationality will therefore be found in the challenge to revision the notion of rationality in such a way that all our reasoning strategies will ultimately again benefit from the rich resources of rationality [...] neither theological reflection nor the many forms of contemporary scientific reflection require universal epistemological guarantees anymore."⁴⁸

For van Huyssteen, the crux of the issue has to do with the re-establishing of religious questions as legitimate. But he is anxious to communicate, against the well known work of John Milbank, that theology's isolation from the other disciplines does not permit a splendid isolation where theology is simply postulated as "queen of the sciences."⁴⁹ van Huyssteen's critical comments of modernity's foundationalism, nonfoundationalist fideism and Nancey Murphy's postmodern strategy follow from his choice to articulate a *via media*. His proposal thus contains valuable

parallels to the kind of argument I have undertaken in this study with regard to rehabilitating critical realism as an indirect theological concern.

In light of the heuristic capacity of human intentionality argued for here, it would be better had van Huyssteen couched his discussion of dimensions of rationality in terms of the nature of rationality rather than the narrower model of rationality. As stated earlier, the vital question centers on understanding our own self-transcendence. In contrast, advocating a mere model of self-transcendence will block self-transcendence, thereby maintaining subject/object oppositions.⁵⁰ Rather, self-transcendence, in the way I have framed and amended its relation to ourselves and reality, needs to become the new focus of a natural theology.

Indeed, Walter Kasper, in *The God of Jesus Christ* retrieves the original context in which natural theology was conceived systematically and shows how it contrasts with Barthian characterizations.⁵¹ Kasper goes on to state the issue in stark terms:

“The conflict between faith and unbelief is thus not a conflict about some sort of higher or ulterior world but a conflict regarding our present reality.”⁵²

Rather than declare that faith is separately warranted belief, impervious to other forms of knowledge in the way that Plantinga describes it, I argue that natural theology can investigate faith from the vantage point of our common reality. This account of the question of faith in God and the conception of the God-world relationship puts the problem precisely where the Gifford lecturers begin: their anxiety to communicate their critical realism. The issue of reality, echoing Ladrière’s contention from chapter 2, is precisely why McMullin’s differentiated account handles the otherwise poignant critiques of anti-realist or even postfoundationalist views on knowledge. It is important to locate faith as a position of conversion or human intention that has some

distinct role and function in relation to reality in general. Even Karl Barth himself recognizes the importance of attaching to faith a certain account of how we know and intend things.⁵³

But, if empirical reality is understood with the explicit aid of the imagination operating on one's sense experience, then religious meaning, by transcending that sense experience does not operate with another imagination impressing a different class of forms on different data. The imagination simply follows a differentiated set of intentional operations that can be described in terms of McMullin's reference to second imagination.⁵⁴ These operations are imaginative, but operate with regard to categories of history, meaning and human freedom. Yet, once understood through a worldview constructed in light of the science-theology dialogue, these operations do not stand apart from reality as a whole. They pertain to the subject as subject. The imagination is the heuristic of human intentionality as Lonergan defines it. The world of the subject should not be viewed as of no concern to the wider reality. Faith and reason are linked by imaginative reasoning. The imagination disembodied from its empirical reference in verified forms of knowledge implies that in theology, it refers strictly to the *narratio* to the exclusion of the *ratio*.

On the contrary, McMullin shows that, on the theory of retroduction, imagination is bound through reason to reality. By extension, following the limits tested through examining cosmology and the revelation focus of Augustinian theology, we can extend this link between reason and reality to the dimension of human history, narrative and the elements that comprise human freedom. This is why the dimensions of creation and christology are important to bring forward from Peacocke's work especially. This meaningfully adds to and complements McMullin's proposals.

It is a core element of human subjectivity that grounds scientific realism and potentially

unveils the wellspring of religious knowledge through its appeals to values in the process of scientific verification. If imagination plays no significant role whatsoever in scientific knowledge, as the positivists thought, then the theologian might err by focusing on the genius of religious narrative and systems of meaning in order to draw a contrast. Theologians, on seeing this realist shortfall in accounting for human rationality, could be persuaded to permit or construct a contrasting theological epistemology over against a rule-oriented empirical epistemology in the natural sciences.⁵⁵

One could even obtain the same impression by noting the shortfalls contained in a deficient meaning of critical realism. On seeing the description of critical realism in the work of the Gifford lecturers, one might be led into thinking that their position of opposition between subject and object obliges them to take a position of basic trust with respect to the objects of both the natural sciences and theology. This is a misinterpretation of their ultimate stance. By seeing how they each aim to provide a positive articulation of the God-World relationship as a theological knowledge claim, this study nevertheless claims that this potential misinterpretation can be corrected. This is especially the case in light of McMullin's analysis of scientific rationality and its philosophical scope.

Through an analysis of the work of Ernan McMullin, this thesis has traced a trajectory of philosophical mediation, and through his theory of scientific rationality, a renewal of theological critical realism, re-conceived as a radically different form of critical realism. Theological critical realism pertains to personal meaning and the historicity of the subject, faced with the unique event of the Incarnation. The analogy goes beyond being a model or metaphor to one of partial versus complete understanding in light of creation's message of divine initiative and complete

understanding. This additional step is necessitated by Barbour, Peacocke and Polkinghorne's suggestive contributions and their limitations. In utilizing their respective contributions, this study has incorporated McMullin's stress on rationality, its realist intent, historically verified ontological achievements and the imaginatively secured human self-transcendence exercised in view of the limits of cosmology to answer questions of existence.

All of these elements, however, do not attach themselves to their ultimate theological meaning without a clear understanding of the notion of creation. Augustine's articulation of creation *ex nihilo* is the best example in this tradition. McMullin, as this study indicates, shows how a retention of this traditional understanding contradicts an exclusive modelling or metaphorical expression of a scientifically informed approach. Yet, the intent of what Peacocke and Polkinghorne express is coherent in terms of the Christian spiritual tradition. Louis Dupré echoes Walter Kasper's recovery of natural theology by noting that

“[...] never before the modern age did Christians consider a notion of extrinsic causality adequate to express the intimate, permanent presence of God to his creation.”⁵⁶

Creation is much more than a theory of extrinsic causality.

This chapter has offered further implications for what comprises a roughly critical realist theological claim in light of the notion of rationality developed in earlier chapters in its epistemological, historical-critical and cosmological dimensions. The overarching goal has been to line up the self-transcendence of critical realism as a framework to mediate the dialogue between the sciences and theology. Thus, the result of a differentiated notion of critical realism in theology is the possibility for a natural knowledge of God, secured in understanding the desire for understanding on the part of the subject. The security attends an explanatory theory that

provides historical verification of knowledge concerning existence. The result is that, as a discipline, theology is “consonant” with the natural sciences. The consonance has to do with the similar drive for understanding, and is chiefly differentiated by the presence of verification in science contrasted with the much more general notion of verification of our acts of self-transcendence in historical acts of meaning for theology.

The goal has been to deepen the claim that theology has real, empirical claims to knowledge. Not the least of these pertains to creation, in the way that Dupré and others have outlined it so well. The trajectory of postmodern and historicist critiques in both science and theology is now leading to a renewed commitment on the part of other thinkers to carefully articulate the precise role and meaning that metaphysics plays in the working out of interdisciplinary discourse.⁵⁷ While I have not been able to pursue an explicit metaphysics here, the implicit goal has been to put in place key elements for an implicit anticipation of metaphysical discourse. The epistemological and philosophical correctives to the use of critical realism on the part of the Gifford lecturers by McMullin, combined with a pursuit of the explicit metaphysical and theological goals of those lectures would improve the chances that a systematic natural theology of the future can confidently provide a worldview that is communicable, given the success of contemporary natural sciences.

Endnotes

1. See chapter five, p. 217.

2. This language describing the desire for personal coherence was first coined by Bernard Lonergan. See *Method in Theology* (New York: Seabury Press, 1972), pp. 101-102.

3. This question has become crucial since E.O. Wilson's proposed socio-biological synthesis 25 years ago. For a strategy that undercuts the socio-biological agenda in terms of the reality of human freedom, see Robert Wright, *Non-Zero: The Logic of Human Destiny* (New York: Random House, 2000) where human history and the reality of meaning defy easy explanation from within the parameters of empirical psychology, neuroscience or evolutionary biology. E.O. Wilson's early works that contributed to widespread unease within many scientific disciplines concerning the scope of naturalist interpretations in anthropology and the human sciences are: *Sociobiology: The New Synthesis* (Cambridge: Harvard Univ. Press, 1975) and *On Human Nature* (Cambridge: Harvard Univ. Press, 1978). See the essays critical of such methodological reductionism by Camilo J. Celo-Conde, William Stoeger, Paul Davies, Philip Hefner and Arthur Peacocke in Robert J. Russell, William R. Stoeger and Francisco J. Ayala, eds., *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action* (CTNS, Vatican Observatory, 1998). Cf. Peacocke, *Theology for a Scientific Age*, pp. 226-232. I have not dealt with the implications that involve the assumptions of naturalism. Grappling with this literature would form an important complementary study to the one undertaken here. However, this study would cohere in key respects with a theological or philosophical argument against naturalism. Against naturalist positions, this study suggests that the practice of science is marked by imaginative investigations that both determine the universe as real yet contingent, while at the same time seeing those very imaginative structures suitable for structuring other questions of meaning that are taken up so vitally by religious traditions.

4. McMullin, "Cosmic Purpose and the Contingency of Human Evolution," p. 409.

5. By 'extrapolation,' I am evoking the detailed and expansive metaphysical prolegomena to the question of God that is worked out by Bernard Lonergan. There is not the space here to expand on Lonergan's own argument for a philosophy of God or how this philosophy coheres with contemporary theology. However, I want to indicate that I do see significant coherence between the transcendental character of retroduction and Lonergan's understanding of transcendence 'from below.' In *Insight*, chapter 19, he states that "transcendence means 'going beyond.' So insight, inquiry and formulation do not merely reproduce the content of sensible experience but go beyond it." (*Insight* Collected Works of Bernard Lonergan Toronto: University of Toronto Press, 1993, p. 658).

The content of sensible experience that Lonergan speaks of here is the image or *phantasma* that captures the data being sensed. The production of images in scientific rationality is what McMullin stresses as the heuristic for the inquiry that tends, when corrected by supplementary and coherent insights, to affirm the existence of entities as real. The brilliance of retroduction as a theory, is that it anticipates self-knowledge. Even though self-knowledge, with all of its religious potential does not guide scientific inquiry per se, it is the reflective result of the transcendence that characterizes scientific rationality. This assumes first, that judgment is affirmed as part of a realist position of knowledge and second, that there is a unique way in which cosmology thrusts the scientific and philosophical questions into theological ones. This is how I see the basic connection between McMullin's theory of retroduction and Lonergan's cognitively founded philosophy of transcendence and God. Much more would need to be said on the connections in relation to 'the known' itself, metaphysically speaking, and not just in the process of knowing.

This is where Lonergan's full account of reality in his theory of emergent probability would need to be taken up. I see the theory of retroduction, and the critical realism that I have developed as a result of that theory, to be a preparation for accepting the philosophical and theological viability of emergent probability as a metaphysical position. A metaphysical position such as emergent probability requires, it seems to me, studies that carefully attend to the historical record in science. It also requires an ability to affirm the possibility of ontological statements without casting aside sociological conditions of knowledge, or the realist intent of the human imagination.

6. Polkinghorne himself draws this conclusion in his evaluation of the three Gifford lectures: "Barbour does not go on to give an account of what he believes we actually know historically about Jesus [...] The idea of Christ as being outstandingly human [...] can for Barbour find historical expression in evolutionary terms [...] Barbour is attributing a prime significance to Jesus, but in a way that will cause no shock or disturbance to a scientific mind [...] The question is whether this somewhat bland christology is adequate to the strangeness and hopefulness of Christian experience. I suggest that it is not." See *Scientists as Theologians* (London: SPCK, 1996), pp. 67-69.

7. *ibid.*, pp. 72-78, especially p. 72 where he states that Peacocke verges on a 'Pelagian christology.'

8. *ibid.*, p. 78.

9. See chapter one, pp. 44-48.

10. Peacocke, *Theology for a Scientific Age*, p. 148.

11. *ibid.*, p. 74.

12. *ibid.*, pp. 249-250.

13. See *ibid.*, p. 317-318: "[...] Jesus the Christ occupies in 'spiritual' history (that is, the history of the relationship of humanity with God) the place that a mutation does in biological evolution - an irreversible transformation into a new kind of existence allowing the actualization of new possibilities."

14. *ibid.*, pp. 320, 339, 343, 345.

15. *Divine Action and Indeterminism: On Models of Divine Agency that Exploit the New Physics*, (Univ. of Notre Dame: UMI Microfilms).

16. Crain, *Divine Action and Indeterminism*, p. 366.

17. *ibid.*, p. 369.

18. *ibid.*, p. 368.

19. *ibid.*, p. 351.

20. *ibid.*, p. 355.

21. Lonergan concludes on this basis to the probabilistic character of contemporary science at the micro and macro level. Scientific knowledge itself is divisible between classical and statistical investigations. The probabilistic character of statistical investigations reveals that the questions for intelligibility that guide classical investigations are simply not the questions suited for probabilistic contexts. There is "nothing to be known" in asking these types of questions when it comes to realms or fields of indeterminacy, whether in the event of a coin toss or the wave/particle duality of light. To carry this classical/statistical distinction any further than say Lonergan does, is to exaggerate the metaphysical implications of the scientific revolution. Recalling McMullin's careful definition, scientific realism does not forecast that existing entities can be charted along a neat continuum of inductively accounted for laws and universal regularities. It merely makes the claim, following McMullin's account, that intelligibility is to be fully expected based on past experience, even though it will likely be heavily weighted towards hypothetical and probabilistic intelligibility.

22. Peacocke, *Theology for a Scientific Age*, pp. 371-72.
23. Peacocke, *Creation and the World of Science* (Oxford: Clarendon Press, 1979), pp. 141-142.
24. See *Theology for a Scientific Age*, passim. Cf. Peacocke's *God and Science: A Quest for Christian Credibility* (London: SCM, 1996), p. 23.
25. McMullin, "Realism in Theology and Science: Response to Arthur Peacocke" in *Religion and Intellectual Life* vol. 2, n.4, p. 45.
26. *ibid.* p. 47.
27. See Polkinghorne in *Scientists as Theologians* p. 6 (footnote 14) and p. 87.
28. See Barbour, *Religion in an Age of Science* (HarperCollins, 1997), pp. 91-2.
29. See Barbour's citation in *Religion and Science* (1997), p. 92 and Polkinghorne's debt to McMullin in *Reason and Reality* (Philadelphia: Trinity Press International, 1991). Ted Peters gives the clearest indicator of McMullin's introduction of the term in the introduction to *Science and Theology: The New Consonance* (Boulder, CO.: Westview Press, 1998), p. 18: "The term 'consonance,' coming from the work of Ernan McMullin, indicates that we are looking for those areas where there is a correspondence between what can be said scientifically about the natural world and what the theologian understands to be God's creation." Peters himself describes consonance in terms of cognitive harmony and cites McMullin from an earlier essay in articulating consonance as a complicated balancing act that may not easily be understood: "McMullin may be saying two things. On the one hand, he advocates a two-language position, arguing against any God-of-the-gaps reasoning from scientific gaps. [...] On the other hand, he is concerned about compatibility, consonance and coherence between scientific and theological statements. Theologians should aim for some sort of 'coherence of world-view' [...]." See Ted Peters, "On Creating the Cosmos" in Robert Russell, William Stoeger and George Coyne, eds., *Physics, Philosophy and Theology: A Common Quest for Understanding* (Vatican Observatory, University of Notre Dame Press, 1988), p. 293. Peters himself takes up the need to construct an integrated worldview along with other methodological and interdisciplinary commitments.
30. See McMullin's review of Polkinghorne's *Belief in God in an Age of Science* (Yale Univ. Press, 1998) in *Commonweal* 125, n. 17 (Oct. 9, 1998), p. 23.
31. See the insightful clarifications of critical correlationism made by Neil Ormerod, "Quarrels with the Method of Correlation" in *Theological Studies* 57 (1996), pp. 707-719.
32. Cf. Augustine's *De Doctrina Cristiana*.
33. McMullin nuances his use of correspondence theories considerably in his article "A Case for Scientific Realism", pp. 25, 35. He is prepared to accept correspondence as the result of a retroductive theory of science in a not-yet-complete portrait of the ontological claims implied by the progressive course of natural sciences. This neatly skirts the attacks of anti-realist philosophers Rorty and Putnam.
34. *ibid.*
35. McMullin, "Realism in Theology and in Science: A Response to Peacocke" in *Religion and Intellectual Life* 2, n. 4 (1985), p. 39.

36. *ibid.*, p. 43.

37. *ibid.*

38. *ibid.*, p. 44.

39. See chapter five, p. 258.

40. Bernard Lonergan, "Natural Knowledge of God" in William F.J. Ryan and Bernard J. Tyrrell, eds. *A Second Collection* (Westminster Press: Philadelphia, 1975), p. 118.

41. *ibid.*

42. *ibid.*, p. 128.

43. *ibid.*, p. 123.

44. Generally speaking, foundationalism is a term that identifies a view of knowledge where "properly justified knowledge claims must be grounded upon some kind of ultimate, firm, invariant, and immediately justified foundation [and] [...] by its affinities to the ideals of universal commensuration, omnitemporal and transcultural criteria for epistemic justification [...]" This is taken from Ulf Jonsson, *Foundations for Knowing God: Bernard Lonergan's Foundations for Knowledge of God and the Challenge of Antifoundationalism* (Frankfurt am Main: Peter Lang, 1999), p. 335. For an expanded definition of foundationalism including key references, see Jonsson, chapter 3, esp. pp. 248-260. One reason for raising the topic of foundationalism is the prevalence of a view that it has essentially been abandoned in favour of some form of postmodernism or antifoundationalism. Jonsson usefully distinguishes between a "broad" and a "proper" foundationalism, and it is into the latter category that he argues for epistemic considerations that support a "natural knowledge of God" extending the work of Lonergan into this area. A broad foundationalism recognizes only the goal of ultimacy and foundation that stems from a consideration of the role of judgment in human knowing. Jonsson associates proper foundationalism with propositions that purport to be epistemically basic and justificatory. Given the rise in fideistic and non-foundationalist perspectives in both theology and its dialogue with the sciences, it is important to qualify my proposal in this thesis as similar in outlook, following Lonergan (and Jonsson) to the broad foundationalist but not the proper foundationalist view. With this distinction in mind, as Robert Audi notes in his *The Structure of Justification* (Cambridge: Cambridge Univ. Press, 1993), there is a "myth of the demise of foundationalism" (p. 13). This is quoted by Jonsson in *Foundations for Knowing God*, pp. 248-249.

45. Moreover, this divergence is reflected in particular historic theological discourses. It is the key to understanding, for example, the deep divisions that opened up in early twentieth century German Protestant theology on nature and grace. See Garrett Green, *Imagining God: Theology and the Religious Imagination* (Eerdmans, 1989), chapter 2 "A Theological Dilemma: 'Natural Theology' or 'Positivism of Revelation'" where he describes the tension that grew out of Karl Barth's commentary *Epistle to the Romans* into a debate between 'mediating' liberal theology and dialectical theology.

46. Jean-Luc Marion, *God Without Being: hors texte* trans. Thomas Carlson (University of Chicago Press, 1991), p. 68.

47. It reflects a widespread trend in theology and philosophy of religion, following post-liberal, non-foundationalist, neo-pragmatic and postmodern intuitions that led theology and philosophy away from one another. As Marion convincingly argues, in light of the phenomenological prioritizing of meaning and language, the difference is between *theology* and theology. The liberation of God-talk from "Being" and onto-theology is "contrary to the

conditions of thought,” p. 61. Theology is, as a consequence, transformed in order to cohere “with the fact [...] of faith in the Crucified, a fact that only receives and conceives: it secures its scientificity by [...] the relation of the believer to the Crucified.” p. 65.

48. Wentzel van Huyssteen, *The Shaping of Rationality: Toward Interdisciplinarity in Theology and Science* (Grand Rapids: Eerdmans, 1999), pp. 3-4.

49. *ibid.*, pp. 80, 85.

50. In continuity with the prominent defenders of critical realism, van Huyssteen neglects to take up a theory that accounts for similar and dissimilar elements in cognition or intention. Contrary to these critical realists, he articulates the subject-object dichotomy in terms of human rationality and context rather than knowing and known. So, postfoundationalism is a successful move beyond nonfoundationalism in philosophy that opens up new space for theologians who want to avoid a fideist position. But it falls short of elaborating a theory of knowledge that can go beyond a mere model.

51. What is interesting is how Kasper shows a way forward to contrast Plantinga's, (and by extension, Marion's) understanding of natural theology: “ [...] the original meaning of natural theology in High Scholasticism and the new approaches of the Reformation to it are not so far apart as they might seem to be [...] In both approaches there is no question of a neutral pre-structure and sub-structure for revelational theology or for a general framework in which the special revelation in salvation history could be subsequently inserted. In the theology of the High Scholastic period the point is rather that there is a relatively independent reality which revelational faith presupposes and which achieves its own fulfillment only through faith. *Natural theology does not substantiate the faith; rather the faith grounds natural theology* [...] Natural theology is therefore concerned with the reasonableness and universality of faith.” See Walter Kasper, *The God of Jesus Christ* trans. Mathew O'Connell (New York: Crossroad, 1984), p. 78. Cf. the excellent summary of Kasper's line of argument against Plantinga's reading of natural theology by Hunter Brown, “Alvin Plantinga and natural theology” in *International Journal for the Philosophy of Religion* vol.30, n.1 (1991), pp. 1-20, esp. pp. 7-10.

52. Kasper, *The God of Jesus Christ*, p. 78.

53. Barth notes with respect to the practice of biblical interpretation and narrative theology that “the human possibility of knowing is not exhausted by the ability to perceive and comprehend. Imagination, too, belongs no less legitimately in its way to the human possibility of knowing. A man without imagination is more of an invalid than one who lacks a leg.” See Karl Barth, *Church Dogmatics*, vol. III/1, p. 81. Cf. Fergus Kerr's citation and surrounding analysis in his “The Modern Philosophy of Self in Recent Philosophy” in Robert J. Russell, Nancey Murphy, Theo Meyering and Michael Arbib, eds., *Neurosciences and the Person: Scientific Perspectives on Divine Action* (CTNS/Vatican Observatory, 1999), p. 27. With reference to McMullin's citation of Coleridge (chapter 5), we could rightly extend and interpret Barth's invitation to consider the imagination as a recovery of the genuinely religious character of value and human desire most welcome. However, Barth's strictures against natural theology run counter to McMullin's realist context for the human imagination. By ruling out metaphysically positioned theological reflections, Barth constricts the imagination to a purely narrative subjective desire within a limited conception of the religious horizon. According to the neo-orthodox tradition that Barth helped launch, the imagination and scientific knowledge are of two different orders.

54. McMullin, “Enlarging Imagination,” *passim*.

55. This is how Fergus Kerr describes the epistemological outlook of Hans Küng, the most widely read theologian in the English-speaking world. See Kerr, *ibid.*, p. 31: “consider the following remark by Hans Küng [...] ‘The history of modern epistemology from Descartes, Hume and Kant to Popper and Lorenz has - it seems to me - made clear that the fact of any reality at all independent of our consciousness can be accepted only in an act of trust.’ The

theological position, according to Küng, is to articulate God's existence simply as one of trust, an extension of a basic attitude of trust and a defense of beliefs in science that are no longer secured by the safe parameters of positivist epistemology. According to Kerr, the positing of trust hinges on the decision to gamble: "The alternative to radical scepticism in its most nihilistic Nietzschean form [is that] [...] 'Every human being decides for himself his *fundamental attitude* to reality: that basic approach which embraces, colours, characterizes his whole experience, behavior, action.'" p. 31.

56. Louis Dupré, *Passage to Modernity: An Essay in the hermeneutics of nature and Culture* (New have: Yale Univ. Press, 1993), p. 173. The antecedent cause of this reduction of divine creation to causality is due to a misinterpretation of Thomas Aquinas by the nominalists, according to Dupré (p.3). This is one of the chief insights of Dupré's historical work, and in the context of a theological recovery of the universe as a point of departure, his identification is crucial. When God is removed from creation where God's presence was previously established by virtue of the natural desire for God on the part of the subject, the theological imagination must revert to the power or will of God expressed in particularities. As a complement to this from the perspective of a pure nature, natural theology evolved to become an exercise in what Dupré calls a "science of God based exclusively on rational arguments [...]" (p. 178) This analysis is repeated and sharpened in Dupré's article "Philosophy and the Natural Desire for God: An Historical Reflection" in *International Philosophical Quarterly* vol. 40, 2 (2000), pp. 141-148.

57. James Marsh has concluded that such careful articulation means "that the most important service performed by post-modernism by metaphysics [...] is that metaphysics becomes more chastened, nuanced, deeper, more methodologically self-conscious and confident. Post-modernism performs a service for metaphysics similar to the service performed by the masters of suspicion, Freud, Nietzsche, and Marx, for religious belief; such belief purifies itself, and shakes off outmoded notions of God as a neurotic father figure or ground of resentment or buttress of the economic ruling class. In confronting post-modernism sympathetically, metaphysics rooted in self-knowledge becomes deeper and stronger and more sure of itself. Is this the ironic result of the post-modern critique of metaphysics?" See Marsh, "Comments on Schmitz" in *American Catholic Philosophical Quarterly* vol. 73, n.2 (1999), p. 275.

Conclusion

Overview

This thesis has laid out in several major steps a broaden the notion of critical realism, which can help mediate a dialogue between the natural sciences and theology. Again, it needs to be emphasized that without such a mediation, the different concerns and contents of the disciplines is likely to become confused. Without a critical realist framework, the theological tendency towards idealism in interdisciplinary dialogue and the scientific tendency toward empiricism in the face of challenges to its authority might re-ignite a conflicted view of the universe and a conflict within the human subject as well.

This study has tried to establish a more explicit philosophical mediation between the natural sciences and theology. However, the aim has been consistently theological. This was particularly manifest in probing what a theological claim to knowledge means, notably the key theological claim of whether and how the world and God are held in relation. The specific thrust of this study has been to show that theology cannot credibly make such claims without understanding how it is first constituted and able to make such claims. For several centuries, by contrast, the natural sciences have shown how self-confidence in methodology and purpose can lead to an assured understanding of what knowledge is in particular inquiries.

Several avenues of thought might be prompted by this exploration in order to probe the question of faith, rationality and interdisciplinary consonance further. It remains to be seen how a study which affirms both an integrated worldview and the distinctiveness of religious faith from other forms of knowledge can be sustained without additional reflections on related questions and analyses. What emerged from this study is a fascinating contrast between two thinkers,

Peacocke and Polkinghorne, who each depend on Barbour in some way for the confidence to make wider metaphysical claims of knowledge from the insight into the critical realist structure of knowledge. However, while Peacocke has tended to emphasize the elements of integration, Polkinghorne made a break from the traditions of natural theology to emphasize the contrast between faith and scientific rationality. The point is that each emphasis retains a validity that should not be overturned. The integrity of each style became the point of departure for each of the last two theologically oriented chapters. The tension that McMullin holds within his own thought, therefore, captures the tension that marks the contrast between Peacocke and Polkinghorne on how theology claims knowledge in light of critical realism. McMullin's contribution to the issue of theological knowledge and critical realism is to account in more explanatory terms why both a distinction and an integration are valid interpretive keys for a science-theology consonance. Where this study introduces an original note is to suggest a continuity in McMullin's work in disparate fields oriented around the notion of self-transcendence that operates in and through a theory of scientific rationality.

Future Implications

This study has been very clear regarding the high dependence for these inquiries on the contribution of Ernan McMullin. From chapter two and three especially, this study has drawn on the thought of an important figure within contemporary Catholic philosophy and the philosophy of science in general. One suggested direction of this theological interpretation by a Catholic philosopher of science is the hope for a renewal in broadly Thomist philosophical and theological scholarship.

McMullin presents three crucial impulses in order to envision such a revival. The first is

an informed and prescient interpretation of Saint Augustine. This retrieval insightfully earmarks a theological hermeneutic that has as its goal a clarity of communication with a diverse and educated audience in mind. As such, McMullin in effect draws together two of the central figures in the Christian theological tradition in order to make the case for a fundamental theology in the dialogue with the natural sciences.

The second of these is the pragmatist impulse that he brings from a reading and appropriation of Charles Peirce. What is the possibility of constructing a pragmatic Thomism with the aid of some of McMullin's writings? It is possible to imagine, for example, a new language of philosophy and theology where the participation of human creatures in God's creation is expressed through mediated channels that attend to what transpires in any given field. Retroduction is a good example of this. Following the pragmatist lead, McMullin transposes a theory about actual complex forms of inference into a theory of scientific rationality, one that is supported by the historical studies he so correctly emphasizes. Going on the strong distinction between scientific and existential cosmology presented with the help of other thinkers, it is possible to foresee new directions in existentialist philosophy that support both McMullin's philosophy of science and the confidence he shows in religious sources to enrich the world of meaning. This can be shown to be both a pragmatic strategy and a Thomist strategy, given their respective concerns. Bridging two different philosophical streams with a clear theological purpose in mind is no small accomplishment. Indeed, McMullin's reticence to connect his work in the philosophy of science with his reflections in science-theology dialogue reflects the difficulty of articulating the multi-staged mediations that need to be made. This study presents a start in this general direction.

The third major impulse McMullin discusses is the scientific dimension. This might appear to be obvious at first. It is well known that Aquinas incorporated the structure and empirical intent of the entire Aristotelian scientific tradition, as it was then known, into philosophy. The focus then, as is the case now, was on the act of understanding. For Aquinas, there was no real understanding of understanding unless nature was the permanent object of empirical inquiry.¹ For Aquinas, knowledge in the sciences was distinct, but still fundamentally inseparable from considerations of the universe as good and beautiful. Likewise, McMullin's keen sense of the realist intent of science also embraces the role of values that assist scientific inquiry. As was indicated throughout the study, McMullin's attention to the actual practice of science evokes the ways in which Thomas Aquinas retrieved an empirical programme of study in order to explicitly harmonize the medieval worldview for theological reasons. In this historical context, McMullin's attention to the realist thrust of science and the historical contingencies that mark different investigations is an important synthesis to identify and communicate. It has the potential to hold together worlds of meaning that might otherwise exist in opposition and conflict. Indeed the growing popularity of the field of "science studies"² that mitigate against any sign of scientific objectivity is a signal of the kind of cultural currents that McMullin's methodical scholarly studies can calmly stanch.

Besides the legacy of the thought of Ernan McMullin, there are other thematic implications that are immediately relevant to theology. The most contemporary one of these is regarding the problem of theological method. Is it possible to envision theological reflection that is openly different from the popular post-liberal and radical orthodoxy strains of thought that currently predominate in many Anglo-Saxon theological contexts?³ The popularity of the Gifford

lecturers points to such a need for a more open theological style of reflection that sees a wide role for communicating religious meaning.

In terms of how this study can impact the field of theology directly, the hope is that future reflections in “natural theology” can grapple more seriously with the act of mediation that the critical realist framework of knowledge claims invites. The danger is that natural theology will continue to proceed as a somewhat more theological reflection on the God of the philosophers in degree, without a critical view to what changes in inquiries are obliged by the concrete difference made by self-transcendence. More specifically, future efforts in natural theology need to attend more openly to a retrieval of such notions as analogy and creation as the direct result of a theory of knowledge claims. In light of what was said with respect to McMullin’s Thomist background, there are certainly more resources in traditions such as the Thomist tradition on what makes up a knowledge of God. The relationship between analogy, understanding and grace in this context is complex but well worth the effort of retrieval in the context of science-theology dialogue.

Clearly, a main avenue of thought that is implicated is one that has been mentioned several times already. It is the need for an explicit metaphysical worldview that can signify what elements of existence pertain to a critical realist theory of knowledge, a retroductive theory of scientific rationality and the demands of religious faith. What has been purposefully absent in this study is such a pursuit of an explicit metaphysical scheme that could build on what the Gifford lecturers have attempted in their rather descriptive accounts. The chief unexplored implication of this study is a renewal in a theologically oriented metaphysical scheme that can go beyond the largely epistemologically oriented reflections on critical realism contained here.

Lonergan’s metaphysics is obviously a vital option in this regard, although his broadly

thomist metaphysics is neither alone in the field, nor without the need for further amendments and reconsideration. Indeed, Lonergan himself envisaged such a reconsideration on the place of metaphysical reflection. In his writings after the 1960's, his metaphysical "proof" for the existence of God became subject to a more limited role in communicating religious meaning as he turned to explore the importance of moral and religious levels and dimensions of consciousness, as well as aspects of a philosophy of action that resulted from this shift. Within the reception of Lonergan's work, there has long been an intriguing division among those whose primary reference is his later work *Method in Theology* from those whose primary reference is *Insight*. The possibility of integrating the perspectives both of these works represent lies in systematically following through the insights within one domain as they lead into the other. This is what has been attempted here by exploring how a pursuit of scientific rationality leads to a consideration of cosmology and theology as different disciplines that contain plausible answers to questions that emerge at the limit of other disciplines.⁴

On occasion, this study referred to Lonergan's proposals as set forth in *Insight*. Insofar as this study has been able to offer a contemporary molding of the critical and the realist elements in a broader outlook, there is now more adequate grounds for retrieving Lonergan's complex project, which was rooted in an exploration of the act of understanding in the context of successful scientific rationality. This is certainly the overwhelming impression that one gets from a reading of the numerous examples offered by Lonergan in *Insight* that are scientific in nature. The contribution of this study, in the context of Lonergan studies, is to reflect theologically in a scientific *milieu* needs to engage the promise of a critical metaphysics without operating within a metaphysical horizon. To do otherwise would undermine the hope of communicating the

importance of cohering scientific and theological inquiries.

A resolution of some of these issues is probably some distance off, and fortunately, there is a growing interest in the field of science-theology dialogue that can infuse such resolutions with vibrant intellectual creativity and energy. The risk, as always, will lie in trying to create an easy integration or separation. On the other hand, a steady engagement with the richness of rationality and the “human condition” in all its complexities, will ensure longer term successes.

Endnotes

1. In "Insight: Preface to discussion," Lonergan writes that "...any genuine development in Aristotelian and Thomist thought, if conducted on Aristotelian and Thomist principles, will originate in a development in man's understanding of the material universe; from a developed understanding of material things it will proceed to a developed understanding of human understanding; and from a developed understanding of human understanding it will reach a clearer or fuller or more methodical account of both cognitional reasons and ontological causes." See *Collection* vol. 4 *Collected Works of Bernard Lonergan* (Toronto: University of Toronto Press, 1988, pp. 144-145)
2. See, for example, Steven Shapin's *The Scientific Revolution* (Chicago: The University of Chicago Press, 1996) and Lisa Jardine's book *Ingenious Pursuits: Building the Scientific Revolution* (New York: Doubleday, 1999), both of which take issue with the objective leap to a new orientation in scientific method following the seventeenth century.
3. The work of John Milbank in particular has made a tremendous impact, partly by virtue of the fact that many opponents to Milbank's claimed "orthodoxy" nevertheless share his general post-metaphysical, post-liberal outlook which either does not engage philosophy or sees philosophy as strictly submerged to a theological *a priori*.
4. See Lonergan's article "Natural Knowledge of God" in *A Second Collection* (Westminster Press, 1974) where the metaphysical elements of his earlier thought come to complement and support other foci of theological and philosophical reflection.

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