THOMAS BRADWARDINE'S VIEW OF TIME: A STUDY OF THE INTERRELATIONSHIP OF NATURAL PHILOSOPHY AND THEOLOGY IN THE FOURTEENTH CENTURY

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ABSTRACT

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Thomas Bradwardine is widely regarded as one of the most influential thinkers of the early fourteenth century, both in natural philosophy and theology. Most studies of Bradwardine's work focus on his contributions either to mathematics and physics or to theology, with little attempt at integration. This dissertation seeks to take a broader approach by assessing the extent to which Bradwardine's expertise in natural philosophy influenced his theological outlook, as he expressed in the *De causa Dei*, by examining his view of time as a mathematical, philosophical and theological concept.

The investigation begins with two introductory chapters tracing discussions about time from the classical period through the late thirteenth century. The next three chapters concentrate on Bradwardine's references to time in four philosophical works, *De proportionibus*, *De continuo*, *De incipit et destinit*, and *De futuris contingentibus*, in which he defines time as a successive, infinitely divisible continuum which encompasses all other continua. These chapters confirm not only Bradwardine's indebtedness to traditional Euclidian mathematics and Aristotelian natural philosophy in his treatment of time, but also his imaginative responses to the challenges to these traditions which arose in the late thirteenth and early fourteenth centuries. An additional chapter explores Bradwardine's method for reconciling in the *De causa Dei* his essentially Aristotelian definition of time with his Augustinian notions of eternity and divine causality. The concluding chapter examines the

influence of Bradwardine's ideas about time and related issues by comparing his views with two younger contemporaries, Thomas Buckingham and Robert Holcot.

This study reveals that Bradwardine employed the conventional Augustinian-Boethian distinction between the temporal existence of created being and the eternal timelessness of God to justify those controversial positions on predestination, grace and free will which have led to a major historiographical debate about the true direction of his theology. By examining Bradwardine's theological positions from the perspective of late medieval approaches to time and by comparing these views with those of his contemporaries, however, one arrives at a more complete understanding of Bradwardine's thought as a whole than studies of either his natural philosophy or his theology alone permit.

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LIST OF ABBREVIATIONS

AHDL	*Archives d'histoire doctrinaire et littéraire du moyen âge.*
Barnes	*The Complete Works of Aristotle: The Revised Oxford Translation*, Volume I. Ed. Jonathan Barnes. Princeton: Princeton University Press, 1984.
CHLMP	*Cambridge History of Later Medieval Philosophy*. Eds. Norman Kretzmann, Anthony Kenny and Jan Pinborg. Cambridge: Cambridge University Press, 1982.
De causa Dei	Thomas Bradwardine. *De causa Dei contra Pelagium, et de virtute causarum ad suos Mertonenses, libri tres.* Ed. Henry Saville. London: Ex Officina Nortoniana apud Ioannem Billium, 1618.
De continuo	Thomas Bradwardine. *Tractatus de continuo*. Ed. John Emery Murdoch. In "Geometry and the Continuum in the Fourteenth Century: A Philosophical Analysis of Thomas Bradwardine's 'Tractatus de Continuo.'" Diss. University of Toronto, 1957.
De futuris	Thomas Bradwardine. *Tractatus de futuris contingentibus*. Ed. M. Jean-François Genest. *Recherches augustiniennes*, 14 (1979), pp. 249-336.
De incipit	Thomas Bradwardine. *Tractatus de incipit et destinit.* Ed. Lauge Olaf Nielsen. In "Thomas Bradwardine's Treatise on 'incipit' and 'destinit': Edition and Introduction." *Cahiers de l'Institute du moyen âge grec et latin*, 42 (1982), pp. 1-83.
De proportionibus	Thomas Bradwardine. *Tractatus de proportionibus*. Ed. H. Lamar Crosby. In *Thomas of Bradwardine, His Tractatus de Proportionibus: Its Significance for the Development of Mathematical Physics*. Madison, Wisconsin: University of Wisconsin Press, 1955.
MTSM	*Motion and Time, Space and Matter: Interrelations in the History of Philosophy and Science*. Eds. Peter K. Machamer and Robert G. Turnbull. Columbus, Ohio: Ohio State University Press, 1976.

SMPSL	Moody, Ernest A. *Studies in Medieval Philosophy, Science and Logic: Collected Papers, 1933-1969*. London: University of California Press, 1975.
RTAM	*Recherches de théologie ancienne et médiévale*.

INTRODUCTION

Thomas Bradwardine is generally regarded as one of the most influential English philosophers and theologians in the early fourteenth century. His accomplishments in the fields of logic, mathematics, physics and theology, outstanding in their own right, account for only part of his fame. His abilities attracted the attention of a powerful patron, Bishop Richard of Bury, who helped him to attain high public office. As chancellor of St. Paul's and confessor to Edward III, Bradwardine demonstrated great skill in mastering the demands of ecclesiastical and civil service and was rewarded with the see of Canterbury in 1349. Yet in spite of his importance in fourteenth-century England and the survival of a relatively large portion of his writings, many important aspects of Bradwardine's thought remain unstudied.

Historical research on Bradwardine in its present state does not successfully integrate his philosophical and scientific ideas with his theological convictions. Because of their highly technical nature and wide range of topics, Bradwardine's treatises present serious challenges to even the most skillful researchers. It is not surprising, therefore, that most studies of his work consist of critical editions and of commentaries on single texts rather than investigations of concepts which emerge in various contexts throughout his writings. Taken together, however, existing studies constitute a fairly complete record of Bradwardine's academic work and provide essential resources for a more synthetic approach to his thought. The recent growth of interest in some of Bradwardine's less well-known contemporaries, the men to and for whom he wrote, has created a large body of supplemental material which

can be applied with good effect to an analysis of Bradwardine's theological and philosophical views.

This dissertation investigates the mathematical and philosophical foundations of Bradwardine's theology by considering his view of time, an issue which interested almost all natural philosophers and theologians in the late Middle Ages and which emerged in various contexts in all of Bradwardine's major treatises. Although some aspects of the problem of time, such as infinity, continuity and contingency, seem to be primarily philosophical, fourteenth-century thinkers regularly considered these subjects in conjunction with more recognizably theological topics such as eternity, divine foreknowledge and free will.[1] In many cases, in fact, it is impossible to separate philosophical concerns from purely theological ones in late medieval discussions of time. Like many of his colleagues and his thirteenth-century predecessors, Bradwardine tried to accommodate both Aristotelian physics and Augustinian theology in his view of time. The distinctiveness of Bradwardine's approach to time resulted from his habit of treating almost all intellectual inquiries, both physical and theological, from the perspective of Euclidean mathematics. Bradwardine's view of time therefore provides an exceptionally clear example of the tendency among fourteenth-century thinkers to explore theological truth through mathematical and philosophical means.

The specific aims of this dissertation are to describe the classical and medieval corpus of speculation on time which Bradwardine inherited, to examine his response to the problems of time in his early academic writing and to assess the relative influences of Euclid, Aristotle and Augustine in his final statements about time in his monumental theological work, the *De causa Dei*, first published in 1344.[2] The purpose of this study is not just to show how one prominent fourteenth-century thinker coped with a long-standing philosophical problem; it also seeks to examine Bradwardine's interaction with predecessors and contemporaries by focusing on a

topic which incorporates the methods and principles of several disciplines including natural philosophy, logic and theology. This assessment of Bradwardine's view of time will help not only to establish the main issues in fourteenth-century academic debates about time but also to assess Bradwardine's particular role in those debates.

In spite of his many accomplishments, Bradwardine, like most fourteenth-century personalities, remains a mysterious figure. What little is known about his life comes primarily from his own writings and scattered references to his activities at Oxford or in the service of Edward III. Unfortunately, a purely textual approach to the biography of such an obscure figure as Bradwardine can give a distorted image of his character. One observer, Gordon Leff, has even suggested that an uncritical reading of Bradwardine's treatises might make him appear to be "an inhumane genius" who "can hardly be called lovable."[3] Although he enjoyed prominence as a mathematician and theologian at Oxford in the 1320s and 1330s and eventually rose to the highest ecclesiastical office in England, no historian has yet been able to construct a biography for him which is as full, for example, as the one which Katherine Walsh has been able to produce for his slightly younger contemporary, Richard FitzRalph.[4] Historians have estimated that Bradwardine was born some time during the last two decades of the thirteenth century, probably in the early 1290s. There is no evidence of his birthplace but an oblique reference in the *De causa Dei* to his father as living in Chicester suggests that he might have come from Hertfield or Heathfield in Sussex.[5] According to Oxford University records Bradwardine resided at Balliol College, where he was a fellow from 1321 to 1323. In 1323 he accepted another fellowship at Merton and spent the next three years completing his regency in the arts. Sometime during this period he became the proctor of Merton; afterwards he served as Chancellor of the University.[6]

While at Merton Bradwardine was introduced to the brilliant circle of nathematicians, logicians, physicists and astronomers whose work contributed to

the outstanding reputation for natural philosophy which Oxford University enjoyed in the first half of the fourteenth century. Bradwardine's early academic work clearly indicates that he flourished in this stimulating academic setting. Within a decade of his arrival at Merton he had composed several important treatises on a wide range of scientific and logical topics, including velocity, proportionality, continuity, contingency, memory and signification. His achievements in these fields alone have led historians to call him a "mathematical genius"[7] and to compare his works in physics favorably to those of Galileo.[8] As a consequence of this remarkable productivity, Bradwardine attracted the patronage of Richard of Bury, Bishop of Durham, who was instrumental in encouraging scientific inquiry of all kinds during the second quarter of the fourteenth century and was a particular patron of the fellows of Merton College.[9] When he was invited to join Bishop Bury's household in 1335, Bradwardine entered a group of some of the most talented natural philosophers of the mid-fourteenth century. The dedication of the *De causa Dei* to his colleagues at Merton confirms his recognition of the prestige associated with his former college as well as his sincere affection for it.

Bradwardine's ecclesiastical career was equally distinguished, thanks again, in part, to Bury's influence. Within two years of entering into Bury's service, Bradwardine became Chancellor of St. Paul's in London. In 1339 he took on the additional responsibility of serving as Edward III's chaplain and confessor. In fulfilling this office, Bradwardine was called upon to travel extensively with the king both at home and on campaigns and missions abroad. According to J. A. Weisheipl and Heiko A. Oberman, who have analyzed the text of the *Sermo Epinicius* ascribed to Bradwardine, he almost certainly accompanied Edward III on his French campaign of 1346 and witnessed the battle at Crécy on August 26.[10] They have also suggested that he participated in the negotiations for peace with France, having been appointed an envoy on October 22, 1346.[11] Moreover, during the late 1330s

and 1340s Bradwardine came to be regarded through his preaching, lecturing and writing as one of England's most gifted academic theologians. The culmination of his ecclesiastical career occurred in July of 1349, when he was consecrated as Archbishop of Canterbury at Avignon.[12] Originally elected to this office by the monks of Canterbury in 1348, Bradwardine had been unable to take up the office earlier, owing to the king's resentment that the monks had acted without first consulting him. Edward III's candidate, John Ufford, filled the office instead; but, when he died from the plague, the king acknowledged Bradwardine's election. Unfortunately, Bradwardine himself soon fell victim to the plague and died on August 26, only one month after his consecration.

In spite of his remarkable achievements as a natural philosopher and public servant Bradwardine's reputation in the twentieth century is based on his theological works, the interpretation of which has generated considerable controversy. The source of this controversy is the long-established strain in historical literature which connects Bradwardine's predestinarian thought with Wyclif's. Whatever the true nature of his influence on Wyclif's theology, however, it is clear that Bradwardine arrived at his conclusions about God in a way which was altogether different from Wyclif's: whereas Wyclif's theology developed out of his philosophical studies, Bradwardine's was the product of a deeply spiritual conversion which occurred while he was still studying in the arts faculty.[13]

The often-quoted autobiographical account of this conversion experience in the *De causa Dei* tells of Bradwardine's sudden disillusionment with the discussions of grace and free will which he sometimes heard as a student of philosophy. He laments his early attraction to the "Pelagian" notion, which pervaded philosophical speculation at Oxford, "that we are the masters of our own free acts, and that it stands in our power to do either good or evil, to be either virtuous or vicious."[14] It

was not sophisticated arguments or even faithful contemplation which transformed his opinion. Rather, he says:

> . . . before I had become a student of theology, the truth before mentioned struck upon me like a beam of grace, and it seemed to me as if I beheld in the distance, under a transparent image of truth, the grace of God as it is prevenient both in time and nature to all good deeds - that is to say, the gracious will of God which precedently wills, that he who merits salvation shall be saved, and precedently works this merit of it in him, God in truth being in all movement the primary Mover.[15]

This revelation subsequently inspired Bradwardine to devote his considerable energy and talent to refuting the arguments of his opponents, whom he labelled the "modern Pelagians." His opinions about grace and free will matured throughout his academic career and he apparently refined his views both by engaging in debates with his peers and by incorporating his ideas into his sermons after 1335. The *De causa Dei* itself presented a scathing attack on the views of Bradwardine's adversaries. Far from being an open-ended speculative treatise of the type which abounded generally in the 1320s and 1330s, this work was consciously polemical. In it Bradwardine applied the full vigor of his exceptionally analytical mind to the vindication of the absolute necessity of God's will as first cause in every human act. Bradwardine so forcefully defended his conclusions that readers of the *De causa Dei*, from the fourteenth century to the twentieth century, have objected to his apparently rigid determinism. Fourteenth-century critics simply complained that his conception of God's relationship to humanity unnecessarily restricted human free choice. They tried to refute his claims by attacking Bradwardine's definitions of time, eternity and contingency and so emphasized, as Bradwardine himself had done, the interconnection of natural philosophy and theology.

After the Reformation, however, the fourteenth-century approach to Bradwardine's theology was all but abandoned in favor of one which stressed his advocacy of an Augustinian form of predestination. Thus Bradwardine came to be

regarded as precursor to the Reformation. In the nineteenth and early twentieth centuries, historians saw Bradwardine primarily as a theologian and made almost no attempt to investigate the philosophical principles which influenced his religious thought. Even now, studies of Bradwardine's theology have not been entirely freed from such concepts as nominalism, Ockhamism and determinism, themes which have dominated treatments of fourteenth-century theology since the late nineteenth century. Moreover, no treatment of Bradwardine has tried to incorporate both his theological and his scientific texts into a single study of his life and thought. Bradwardine has emerged, therefore, as a fascinating but enigmatic figure whose interests pulled in many different directions. Some historians, in studies of Bradwardine's contemporaries, have recently begun to challenge the assumptions of the traditional interpretation of fourteenth-century intellectual life by closely examining the philosophical foundations of late medieval theology.[16] Bradwardine's provocative ideas about the relationship of natural philosophy to theology also deserve to be reconsidered in this way.

Since the late nineteenth century, Bradwardine's reputation as a scholar has rested on his supposed contributions to two distinct intellectual movements: early modern science (through Galileo to Newton) and Protestant Reformation theology (through Wyclif to Luther). Bradwardine's treatments of geometry and physics are well-known to specialists in the history of science. His theological works have received even broader recognition because of his supposed influence on Wyclif. Historians such as Sebastian Hahn, Gotthardt Lechler, Herbert Workman and J. F. Laun, who pioneered the study of Bradwardine's writings at the turn of the century, stressed the connection between Bradwardine's and Wyclif's approaches to predestination.[17] Aside from Wyclif's role in exposing some of Bradwardine's theological views, however, this association with Wyclif has actively harmed his reputation, not so much by implicating him in the Wycliffite heresy as by distorting

his views in order to force them into forms which are recognizable components of Wyclif's thought.

Some of the problems of this traditional approach have been corrected in two major studies of the *De causa Dei*: Gordon Leff's *Bradwardine and the Pelagians* (1957) and Heiko A. Oberman's *Archbishop Thomas Bradwardine, A Fourteenth-Century Augustinian* (1958).[18] Because of their emphasis on theology and their tendency to concentrate only on the *De causa Dei*, neither historian does full justice to Bradwardine's contributions to fourteenth-century thought. Nevertheless, their profound disagreement over Bradwardine's determinism still dominates discussions of his theology. Their differences of opinion arise less from variations in their reading of Bradwardine than from their assessments of his position in fourteenth- and fifteenth-century scholarly debate. Leff presents Bradwardine as a theological radical whose determinism struck at the heart of the prevailing philosophical attitude of the early fourteenth century. Oberman, by contrast, portrays Bradwardine as a conservative Augustinian who was merely trying to defend a moderate, orthodox view concerning God's prescience and will against nominalist or Ockhamist attacks. These variations in interpretation arise fundamentally from divergent views of the intellectual climate of the early fourteenth century. The differences between Leff's and Oberman's approaches to Bradwardine suggest, therefore, that there is still room for discussion of such topics as Bradwardine's purpose in writing the *De causa Dei*, the composition of his audience, his sources and the impact of his work on his contemporaries and successors. One of the central aims of this dissertation, therefore, is to resolve some of the questions suggested by the debate between Leff and Oberman by considering those questions from the perspective of Bradwardine's view of time.

Bradwardine's work in natural philosophy had also begun to receive attention by mid-century. If the commentators on the *De causa Dei* rarely mention

his scientific achievements, however, the historians who have examined his writings on physics and mathematics have been just as disinclined to discuss his theology. Apart from some critical editions, moreover, there have been no full-length studies of Bradwardine's scientific work comparable to the monographs of Leff and Oberman. Anneliese Maier, Marshall Clagett, James Weisheipl and John Emery Murdoch have made the greatest contributions to our knowledge of Bradwardine's scientific work through their specialized studies of his writings. None of these, however, has explored either the full range of his scientific thought or the relationship between his conception of natural philosophy and his theology.

Fortunately, interest in Bradwardine has remained strong in the last three decades, and, despite the absence of fresh attempts to examine his thought as a whole, he still attracts the attention of historians of late medieval intellectual and religious life. The major thrust of current research is to determine as accurately as possible what Bradwardine said and did between 1325 and 1349. To achieve precision in dating Bradwardine's career, historians have tried to examine the entire corpus of his writings as well as the works of contemporaries with whom he conversed. Lauge Olaf Nielsen, Hüner Gillmeister, Niels-Jorgen Green-Pedersen and Jean-Françios Genest have enlarged the body of printed material on Bradwardine with their editions of some of his less known texts.[19] Historians like Zenon Kaluza and Katherine Walsh have made good use of this fundamental research and have succeeded in correcting errors about Bradwardine's position in the schools at the beginning of the fourteenth century.[20] Since they are most interested in Bradwardine's relationship with men such as William Ockham, Adam Wodeham, Thomas Buckingham and Nicholas Aston, these historians have concentrated on the common philosophical and theological concerns in their thought, although there is ample opportunity for comparisons of their natural philosophy as well.

This dissertation contributes to the current phase of research by presenting a synthetic study of one aspect of Bradwardine's thought. Though many historians have remarked in passing on the mathematical structure and geometric precision of his arguments in the *De causa Dei*, none has yet examined this text from the perspective of his previous writings on mathematics and philosophy. A fundamental concept in many of Bradwardine's works is his definition of time, both in theological and in natural terms. By exploring the approach to time in a series of his texts and by comparing his opinions with those of his contemporaries, I hope to establish the context for the assertions about time, contingency, divine foreknowledge and predestination which he presented formally in the *De causa Dei*. The questions which I shall address are: 1) To what extent does Bradwardine's view of time make him a determinist? 2) How did his conception of time as a physical entity influence his theology, and how did he reconcile his Aristotelian physics with his Augustinian theology? 3) Is there any correspondence between Bradwardine's approach to time and the approaches of his "Pelagian" adversaries, particularly William Ockham, and, if so, what is the significance of that correspondence? 4) How does Bradwardine's view of time fit into his theological and scientific thought as a whole? Through a systematic analysis of Bradwardine's writing about time, I shall describe the close relationship between natural philosophy and theology in fourteenth-century academic discussions using a wider spectrum of Bradwardine's responses to these discussions than any historian has yet considered for this purpose.

This dissertation will consist, therefore, of three parts. In two introductory chapters, I shall try to provide the historiographical context for studying Bradwardine's view of time by reviewing the antecedents of late medieval discussions about time. Chapters Two and Three will summarize the medieval debate about time and issues related to time from Peripatetic discussions in the fifth century B. C. to Bradwardine's immediate thirteenth-century predecessors. These

chapters will emphasize the importance of the legacy of classical approaches to medieval discussions of time. Although long-standing tension between Plato's metaphysical and Aristotle's more physical approaches to time lay at the heart of the medieval debate, many other thinkers were drawn to the problem of time and made significant original contributions. By the fourteenth century, a rich and varied literature on time and subjects relating to time had become the foundation of the arts curriculum, and no trained philosopher or theologian could escape its influence. Time was one of the many concepts which emerged in philosophical and theological debates in the schools. Discussions of such topics as contingency, continuity, infinity and motion all depended on explicit or implicit definitions of time and thus assured frequent reference to the various aspects of time. To understand Bradwardine's positions on these issues it is necessary to establish the character of academic debates about time at Oxford on the eve of his arrival.

Chapters Four, Five and Six present a systematic examination of four of Bradwardine's treatises written in the 1320s which reveal the major elements of his approach to time. The tracts *De proportionibus* and *De continuo*, both dating from the late 1320s, are examples of Bradwardine's contribution to Oxford's achievements in the physical sciences in the late Middle Ages. Bradwardine's reputation as a mathematician rests on his innovative solutions to problems in classical physics involving motion, velocity and infinity. Since these topics all demand specific reference to time, the *De proportionibus* and the *De continuo* define Bradwardine's view of time as a physical concept. Both treatises set out to endorse Aristotle's natural philosophy, but Bradwardine's penetrating mathematical analysis of velocity and continuity completely transformed Aristotle's original positions. In the former text, Bradwardine appeared to accept Aristotle's definition of time but reshaped the physical description of motion which underlay it. In the latter text,

Bradwardine used time to illustrate how one might apply the characteristics of purely mathematical continua to physical continua, both permanent and successive.

Bradwardine's *De incipit et destinit* and his *De futuris contingentibus* are primarily philosophical works which address two different aspects of the question of foreknowledge. In the *De incipit et destinit*, Bradwardine argued that the future must be considered contingent because the human mind cannot predict with certainty any future event. In the *De futuris contingentibus*, however, he maintained that the future is not really contingent, since God, being outside time, knows all of his creation in a single eternal present. These texts represent Bradwardine's earliest attempts to work out the contradictions between human and divine perspectives on time, eternity and knowledge, which he later explored at greater length in the *De causa Dei.*

Chapter Seven will concentrate on Bradwardine's mathematical and philosophical approach to time as he defined it in the *De causa Dei.* This analysis will reveal that he did not see a conflict between his modified Aristotelian conception of the physical universe and his passionate Augustinian theology. A close examination of his conception of the role of time in creation, sin and grace will demonstrate that it is impossible to evaluate Bradwardine's theology without reference to his natural philosophy and will consider why many previous studies of the *De causa Dei* have not approached the treatise in this way. Bradwardine's unique method for synthesizing the two rather distinct views of time which came out of these traditions reflects an intellectual outlook which links him at once with such predecessors as Thomas Aquinas, Anselm and Grosseteste and contemporaries such as William Ockham, Thomas Buckingham and Robert Holcot. To look at the *De causa Dei* from the perspective of the single issue of time and in light of Bradwardine's earlier considerations of the same problem is a novel and fruitful

method for studying not only this significant text but also Bradwardine's thought as a whole.

Throughout my investigation of Bradwardine's view of time, I shall try, wherever possible, to point out the connections between Bradwardine and Ockham, who, though they are often portrayed as antagonists, actually shared many attitudes toward science and theology and together helped to give the early fourteenth century its distinctive intellectual character. In a concluding chapter, I shall attempt briefly to trace this legacy in their younger contemporaries, especially Thomas Buckingham and Robert Holcot, in order to show how ideas were disseminated in the mid-fourteenth century, a period of unusually vigorous philosophical and theological speculation. The burden of this chapter will be to show that these younger scholars, usually described as Ockhamists on account of their nominalism and hence as Bradwardine's enemies, actually had a much more complicated relationship with their masters: they sometimes rejected aspects of Ockham's metaphysical approach to time in favor of Bradwardine's views and they were equally engaged in the attempt which dominated fourteenth-century academic life to reconcile theology with new discoveries in natural philosophy. The discussions about time between the younger and the more established scholars reflect, therefore, the wide range of debate in the first half of the fourteenth century over the most effective way to relate natural philosophy and logic to theology in an age of expanding scientific knowledge. More important, however, the ideas of these younger scholars provide the best possible context for evaluating Bradwardine's attempt to promote his geometrical synthesis of Aristotle and Augustine at a time of substantial reevaluation of all ancient authorities.

CHAPTER TWO

CLASSICAL AND EARLY MEDIEVAL VIEWS OF TIME

Bradwardine's views about time, like those of most other medieval thinkers, were influenced by classical discussions of the subject. We shall see that Bradwardine and his contemporaries were very familiar with the full range of classical treatments of time and were aware that most medieval approaches to time relied on definitions or concepts derived from Plato and Aristotle. Indeed Plato's and Aristotle's discussions of time encompass even earlier discussions which significantly influenced medieval views. Classical philosophers not only tried to solve the difficulties of measuring, describing and defining time, but they also struggled to explain time's cosmological significance. Their debates produced a vocabulary for analyzing time which has been used extensively even into recent times, but was especially important in late medieval discussions.

Before attempting to assess late medieval approaches to time in general and Bradwardine's view in particular, it is necessary to establish the characteristics of the classical and early medieval discussions of time. This chapter begins, therefore, with a short assessment of thought about time among the pre-Socratic philosophers, followed by a more thorough analysis of the ideas of Plato, Aristotle and Plotinus, each of whose concepts made tangible contributions to late medieval debates. Next will come a synopsis of Augustine's approach to time, which, because of its highly original and compelling synthesis of classical and Christian traditions, became a foundation for discussions of time throughout the Middle Ages. Finally, Boethius'

view of time will be surveyed briefly. Boethius' writings about eternity enriched Augustine's approach by broadening the range of questions which Christian thinkers should consider in their speculations about time; they became a major source for Bradwardine's own position on eternity. This survey of approaches to time from the pre-Socratic philosophers to Boethius will serve both to introduce the concepts which shaped late medieval discussions of time and to provide a context for evaluating Bradwardine's conception of time.

The earliest attempts to understand time arose, quite naturally, out of curiosity over astronomical phenomena. Long before philosophers had begun to contemplate the significance of time as a metaphysical entity, human societies had become skilled in reckoning time through lunar, solar or planetary cycles. The characteristic feature of the view of time in ancient Mediterranean cultures, however, was the absence of a conception of time which was distinct from individual events. In his analysis of views of time in the ancient world, P. E. Ariotti contrasts the "multiple times" of the Egyptians, Babylonians and Hebrews, in which chronologies were marked by changes in natural phenomena, with the notion of some ancient Greeks of a single time representing a neutral frame of reference for establishing sequences of events.[1] The first evidence of a trend towards the singularization of time is found not among philosophers but among Greek, poets who created a separate nature for time by embodying its characteristics in a god, Chronos.[2] Some Greek thinkers, however, rejected deified time and began to explore alternative conceptions of time, as well as other features of the natural world such as space and motion, as abstract cosmological principles. Although these early natural philosophers had difficulty separating concepts of time from those of motion and space, their more sophisticated understanding of the practical aspects of time helped them to refine their ideas with increasing success.[3]

The first debates about the nature of time in the Western tradition emerged from the teachings of two pre-Socratic philosophers, Heraclitus of Ephesus and Parmenides of Elea. Heraclitus' main contribution, aside from his insistence that the natural order was not created or influenced by anthropomorphic gods, was his idea that natural occurrences and processes are cyclical[4] but that the changes which take place in the course of these cycles are nevertheless real.[5] The Pythagoreans adopted this principle of cycles and, in their attempts to analyze every aspect of nature in terms of number, gave time a mathematical definition. The most concise expression of the Pythagorean view of time is Archytas of Tarentum's statement that time is "the number of a certain movement, or also, in general, the proper interval of the nature of the universe."[6] Although some modern commentators confuse Archytas' understanding of "number" with Aristotle's more precise use of the term and therefore try to interpret Archytas' statements from an Aristotelian point of view, it is more accurate to see Archytas' definition of time as representative of a completely separate Pythagorean approach to time.[7] Archytas' significance lies not in his influence on Aristotle but in his introducing into the Western philosophical tradition the concept of absolute and mathematical time.[8]

In contrast to Heraclitus, Parmenides and his followers doubted that time and the changes which time seems to engender existed at all. Parmenides himself argued that both motion and time are unreal because they lack permanence.[9] The cornerstone of his philosophy was the rejection of all multiplicity and change. His student, Zeno, the best known adherent of the Eleatic system, tried to prove that motion and time cannot exist with his four arguments against movement, or "paradoxes." All four paradoxes hinge on the apparent contradiction that motion, time and space can be conceived either as infinitely divisible and continuous or as indivisible and therefore discontinuous. Although his proofs of the unreality of motion, time and space are contrary to the evidence of sensory observation, his

objections to contemporary definitions of time raised important philosophical questions which subsequent thinkers had to address. It is ironic, of course, that major advances in the philosophy of time should have been prompted by one who denied time's very existence,[10] but the critical approach of the Eleatic school to infinity and continuity had an equally strong influence on the mathematization of time in the late Middle Ages and beyond.[11]

A more direct influence still on medieval views about time was made by Zeno's contemporary Plato, who synthesized elements of both Parmenides and Heraclitus in his own philosophical system. Like Parmenides, Plato believed that reality could be found only in what was eternal and unchanging. Along with Heraclitus, however, Plato acknowledged that the changes which human beings constantly experience are significant and have an aspect of reality about them which must be accounted for in any study of nature. Plato tried to resolve this dilemma by distinguishing the flux, succession and sensibility of changing human experience from certain eternal forms, ideas and values which give shape to ever-changing human perception.[12] In Plato's cosmology, there is a creator and the reality of creation depends on the existence of eternal being. Since creatures obviously are not eternal, both because they pass in and out of existence and because they change continually throughout their lives, they lack both being and eternity. Still, the "becoming" of creatures is analogous to the "being" of the creator, just as the time in which creatures experience this "becoming" resembles the creator's eternity. If creatures could share directly in the perfect being of the creator, there would be no time.[13]

Although Plato thought that time is essentially unreal, he wrote extensively about the characteristics of time and the relationship between time and eternity. These treatments proved to be highly influential both in the classical period and throughout the Middle Ages. His most concise statements about the nature of time

appear in his early dialogue, the *Timaeus*, an allegorical poem about creation. In it, the protagonist, Timaeus, asserts that time was created along with the rest of the universe and its existence depends on the existence of the universe: "Time, in fact, came to be with heaven, that, as they were born together, they might also be destroyed together, if they ever should be destroyed, and was fashioned on the model of the everlasting, that heaven might be as like to it as might be."[14] When asked why the creator (God) had made the universe in the first place, Timaeus answers that God had wanted to bring order and harmony out of the primordial chaos. Because God is good and desires only the good for his creation, ". . . he put mind in soul and soul in body in fashioning the universe, so that he might be the creator of a work that was fairest and best."[15] The mind and soul of the universe are discerned in the regularity of its motion: whatever order and harmony exist in the universe are due to the intelligence which God has imparted to it. Because it possesses the characteristics of mind and soul, the universe is an animal, a complete animal in which all other intelligible animals and visible creatures are contained.[16]

Pleased at his creation of a living, moving universe, God wished to perfect it further by making it even more like the divine model of an animal. Because the model animal is eternal, however, and something created can never be eternal, God made "a moving image of eternity, and in the very act of ordering the universe he made an image of eternity abiding in it as unity, an eternal image proceeding according to number."[17] This image of eternity is time. The things which we use to measure time, such as days, seasons and years, did not exist before the universe was created but came into existence when and because the earth was made. The parts of time which we call past and future are therefore created forms of time which are not eternal. Eternal being simply is and does not become younger or older because of time, just as the cycles and processes of change which we observe in sensible objects do not occur in eternal being. Time imitates eternity, however; and, consequently,

we can understand at least something of the nature of eternity by studying its image in time.[18]

As "an image proceeding according to number," time depends for its existence on the orderly, measurable motions of created bodies. In the *Timaeus*, Plato suggests that the regular movements of the sun, moon, stars and planets determine and preserve the "numbers of time." These orderly celestial motions allow us to measure time with mathematical precision. In contrast to the ancient Greek religious tradition, which, for example, conceived of a year as a progression of seasons, Plato defines the year much more precisely as the amount of time it takes for the sun to leave and return to its position at the winter solstice. Similarly, a month is defined by the time it takes for the moon to complete its phases.[19] Thus time and motion are completely interrelated and are measures of each other. Like a clock, the heavenly bodies moving through space provide an absolute standard of time which is independent of human perception.[20]

The conception of time which Plato presents in the *Timaeus* is precise, thoughtful and appealing. It gracefully reconciles the Eleatic demand for attributing reality only to changeless being with Pythagorean observations about the connections among motion, time and space. By making time coterminous with the universe, it gives time, theoretically at least, a definite beginning and end. It establishes the characteristics of time in such a way that one can observe and comprehend them. Unfortunately, the *Timaeus* does not resolve all of the problems which Plato's predecessors had raised regarding time and, in fact, presents entirely new ones. Certain difficulties arise simply from the metaphysical language which Plato uses in the *Timaeus*. Such words as "God," "creation" and "goodness," which function perfectly well in Timaeus' allegorical explanations for the natural order, also have explicit religious connotations which Plato almost certainly does not intend. Moreover, he consciously chooses his metaphors not to render a

scientifically accurate account of creation but "to awaken in the soul of the reader an insight into the nature of the universe and its motions that could be produced . . . in no other way."[21] Literal interpretations of Plato's specific remarks about motion and time can lead to serious misunderstanding of his real intentions, as the subsequent discussion of Aristotle's criticism of Plato will illustrate.

The problem of misinterpreting Plato's view of time is not confined, however, to his contemporaries or to those who take his metaphors too literally. Sometimes confusion arises from the reader's unwillingness to admit that inconsistencies in Plato's account of creation could be the result of Plato's own mistakes, especially when those readers have been trained to use a philosophical vocabulary which insists on precise definitions for every term. D. Corish notes, for example, that many readers refuse "to believe that when Plato speaks in the *Timaeus* of a situation before time existed he is merely contradicting himself. Plato must be deliberately using the fanciful language of the myth here . . . because 'no sane man' could believe that there was anything before time."[22] Corish suggests that it is more likely in this case that Plato simply contradicted himself because he was "not quite used to the full logical demands of temporal theory."[23] Whether or not the contradiction was deliberate, however, it is still true that many commentaries on Plato's view of time from the classical period to the present involve the sorting out of Plato's seemingly ambiguous position on "time before time" and eternity.

The most significant source of confusion over Plato's ideas about time is his failure to consider all of the ramifications of his cosmological system. Although he discussed various aspects of continuity and divisibility in the *Timaeus* and other works, he offered no consistent treatment of these concepts, which were at the heart of the conflict between the Eleatics and the Pythagoreans. Moreover, his cosmology of time neglected completely the role of the human observer and thus sidestepped many important questions concerning the objectivity or subjectivity of time. More

important still, Plato never resolved the paradox that time depends on the uniform and continuous motion of the heavenly bodies, when, in fact, these bodies, being themselves created, can never attain perfect continuity and uniformity. He openly admitted in the *Republic* that the heavenly bodies are incapable of providing a perfect order for time when he stated: "The genuine astronomer . . . will think it absurd to believe that these visible material things go on forever without change or the slightest deviation . . . ."[24] Plato's failure or unwillingness to account fully for the discrepancies which existed in his description of creation stimulated subsequent studies of time, motion and space. In spite of all its deficiencies, however, Plato's conception of time stands as a remarkable intellectual achievement which suggested for the first time a precise relationship between eternal being and the created, sensible world.

Advances on Plato's conception of time followed quickly through the speculations of his student Aristotle. Although he neglected to acknowledge his indebtedness to his teacher, Aristotle's philosophy reveals his great dependence on Plato. Aristotle cannot be credited with the full measure of originality which he claimed for himself, but his systematic reevaluation of Plato's work and his powerful insights into the problems of time which Plato had posed without resolving make his comments on time extremely important in their own right.[25] More significant still was his profound influence on almost all areas of medieval thought, including natural philosophy, logic and theology. Through Aristotle's imaginative synthesis of classical natural philosophy, medieval thinkers were introduced not only to a large body of information about the natural world but also to a sophisticated theoretical framework for analyzing it. Any study of medieval conceptions of time requires, therefore, some knowledge of Aristotle's contributions to the subject.

Aristotle's principal discussion of time is found in Book IV of his *Physics*. In chapters 10 to 14 of this book, Aristotle addressed such problems as the nature of

the present, the reality of time and the relations among time, space and motion.[26] Like Plato, Aristotle affirmed the inseparability of time and change and defined time as the number (or measure) of motion.[27] Aristotle demonstrated in the development of these themes, however, that his understanding of motion and other physical concepts was much more sophisticated than those of Plato as developed in the *Timaeus*. Aristotle was prepared to accept Plato's assertion that time depends on the regular movement of the heavenly bodies and so is coterminous with the universe, but he was troubled by Plato's apparent willingness to define time solely in terms of celestial motion. Moreover, because Aristotle saw time as an integral part of nature and the reality of nature was paramount in his philosophy, he could not conceive of time as unreal, as Plato had done.

Since his purpose in the *Physics* was to examine natural phenomena as sensible objects, not to provide a cosmological explanation for them, Aristotle was concerned with space, motion and time as features of observable reality. He did not begin his analysis of time with the kind of creation myth which appears in the *Timaeus*; his arguments move in the other direction, from precise definitions of sensible phenomena to more general principles concerning natural processes. Throughout his analysis of time there is the implication that Plato's account of time lacked scientific foundation. So while Aristotle frequently ended up reaffirming his teacher's conclusions, his different interpretation of fundamental concepts and his more analytical outlook produced a conception of time which was quite distinct from Plato's.[28]

Aristotle's fascination with the physical world led him to study change and consequently time, the medium in which change occurs. Aristotle thought that, although time is real in itself, it cannot be observed without observing some change, because we can only perceive time in conjunction with change or motion: "... when the state of our minds does not change, or we have not noticed its changing, we do

not think that time has elapsed."[29] The paradox of time is that, while it requires change for its existence, it cannot be defined solely in terms of movement: change or movement happens within things, often at irregular rates, but time is always uniform, distinct from objects and universal.[30] Aristotle tried to resolve this dilemma by defining time as a kind of number, but not the discrete arithmetic numbers which the Pythagoreans and Plato had applied to celestial measurement. Unlike ordinary mathematical units, units of time do not have a minimum value. In other words, time is not a number in the sense that it is composed of distinct, indivisible units which we can count as if we were counting objects. Instead, a unit of time is a measurable segment of the continuum of time in which a motion occurs. As such, a unit of time can vary in duration according to the motion being measured, unlike arithmetic units which all must have identical value.

Therefore, Aristotle concludes that "time is not a movement, but only a movement in so far as it admits of enumeration." Furthermore, because "we discriminate the more or the less [of things] by number, but more or less movement by time," time is a kind of number.[31] Thus Aristotle conceives of time as a magnitude consisting of a succession of connected parts. Because it has no minimum it can be divided infinitely and proceed, through addition, without end. As a continuous entity, it cannot have a beginning or an end; and, because the world is eternal, time must be also: ". . . these was never a time when there was not motion, and there will never be a time where there will not be motion."[32]

After attempting to define time as an aspect of motion, Aristotle goes on to consider its attributes, making use of an analogy between time and a line. The now of time can be seen to represent a point on a line; the infinite distances on either side of the point represents past and future respectively. Like a point on a line, the now of time both connects past and future and also serves as a limit to each. Although Aristotle contends that the now functions simultaneously in these two

ways, he is careful to note that these functions are essentially different. The major problem with the line analogy is that a point on a line is stationary, whereas the now is continually moving from past to future.[33] According to Aristotle, alluding again to the complementarity of time and motion, the now is more like a point moving along a line. Aristotle is careful, however, not to pursue this analogy too far. The motion of a moving point is absolutely dependent on sequential movement in any direction. Time, however, is continuous and must always move forward from past to future. Thus Robert Cushman observes: "Aristotle insists that the 'before-and-afterness' of time is conceptually separable from motion, but in the actuality of physical change it is not so separable."[34]

In addition to his more careful evaluation of the physics of time, Aristotle's greater awareness of the role of human perception in defining time represents an advance over Plato's conception of time. Aristotle never went so far as to say that time is in any way subjective or that its existence depends on human observation of motion. Still, Aristotle's dissatisfaction with Plato's remote, objectified, celestial time led him to consider the relationship between absolute time and the human perception of it. In his analysis of the now, for example, Aristotle took the trouble to examine the morphology of time. He was interested in how such expressions as "suddenly," "presently," "long ago" and "lately" help to illustrate the function of time in the process of change.[35] On other occasions, as we have seen, he considered whether time could exist without consciousness; and, although he failed to explore this question in any great detail, he identified an important teleological problem about time which others, most notably Augustine, would later develop more fully.[36] Unfortunately, Aristotle, preferring to concentrate on the physical characteristics of time, never reached a firm position on this confusing issue. His contribution was mainly to point out that the issue of consciousness was a valid consideration in any philosophical treatment of time.

It is easy to see how Plato's conception of time might be misunderstood if one were to approach it from the perspective of Aristotle's definitions of motion, number and measurement. The vocabularies of the two philosophers are similar enough to cause confusion, and commentators have struggled with ambiguities of terminology from classical times to the present. Despite this confusion, indeed to some extent because of it, Plato's and Aristotle's views about time have exerted tremendous influence on almost all subsequent approaches. This brief summary of their ideas about time does not include analysis of all the specific points in the Platonic and Aristotelian discussions about time which are relevant to this dissertation: their opinions about continuity, infinity and contingency are more appropriately placed later in this dissertation. The purpose of this summary is simply to introduce the fundamental concept of time's relationship to motion and change which persisted in definitions of time from the classical period until the late Middle Ages.

The discussion about time entered a new phase in the third century A. D. when the philosopher Plotinus tried to rehabilitate Plato's cosmological system. In his treatise "On Eternity and Time," Plotinus enlarged his predecessors' conceptions of time by giving time a moral dimension. Plotinus' cosmology, while largely dependent on Plato's, nevertheless reflects the influence of Aristotle's methods of systematic analysis. His investigation of the problem of time proceeded according to a well-organized critical review of all previous efforts to describe the distinction between time and eternity. This analysis clearly reveals his unwillingness to accept without question what Plato and Aristotle had said about time. After refuting both non-Aristotelian and Aristotelian theories, Plotinus went on to develop his own approach which integrated many of his predecessors' views into a substantially new perspective on the problem of time.[37] His purpose was to demonstrate that time is not merely a created and therefore imperfect measure of the universe, as Plato had

claimed. Plotinus thought instead that time belongs to a higher order than that of the created universe and has a special relationship to eternity. His philosophical system, in which time and eternity played a major part, attracted a wide audience. His followers, often called the Neoplatonists because of their adherence to many of Plato's fundamental definitions and assumptions, produced a variety of interpretations of Plotinus' view of time. Because Plotinus and his followers had an undisputed influence through Augustine on early Christian and medieval views of time, some understanding of their philosophy of time is essential for this study.[38]

As the title of his treatise suggests, Plotinus considered it necessary to focus on the interdependence of time and eternity. His initial descriptions of these two concepts varied little from Plato's: time relates to the "sphere of becoming and the sensible universe," while eternity relates to the "everlasting nature."[39] According to Plotinus, we can arrive at a superficial understanding of both becoming and the sensible universe through intuition but it breaks down when we try to probe more deeply. Although he felt assured that the "ancients of happy memory" had found answers to the paradoxes of eternity and time, Plotinus wanted to make his own inquiry so that he could discover the truth for himself. He thought this inquiry should begin with eternity rather than time, "for if we know what the unchanging model is, perhaps we can thereby arrive at a knowledge of its image, which we call time."[40]

After considering various definitions of eternity, Plotinus concludes that eternity encompasses every feature of the intelligible world, including motion and rest, difference and identity. Eternity, says Plotinus, is

> the life that is forever unchanging and possesses all its reality in the present. There is no succession involved in this life, since nothing has passed and nothing is to come, but whatever it is it is always .... Since there is nothing that it can come to possess that it does not already possess and nothing that it loses of what it possesses, we cannot say of it that it was, or will be, but only that it is. Thus we find that eternity is the life of

> being in its very being, at once whole, complete and entirely without succession.[41]

Plotinus later attributes to Plato the notion that the eternal nature is bound up with unchanging being: Plotinus calls the unity of the eternal nature with unchanging being the "One." Then he enlarges Plato's cosmology by inserting another level between the One and the sensible world. He makes the One the source of all unity and goodness but without being or real knowledge. Eternity rests in the intermediate stage of "intelligible essence . . . which may be thought of as an unmoving circle which has the One or the Good as its center, and it is this proximity to the very source of all unity that gives to the intelligible essence the kind of life we call eternity."[42]

Turning now to time itself, Plotinus claims that time exists on the next step below eternity in a series of states which link the sensible world with the One. He begins his analysis of time with a review of three categories of theories about time's relationship to motion. First, he challenges the thesis that time is identical with motion on the grounds that motion is *in* time and must therefore be distinct from it. Motion, moreover, can be sporadic and cease, while time remains continuous.[43] His arguments against this thesis rest heavily on Aristotle's assertion that all things moving or at rest are in time; and, in spite of a few minor discrepancies, Plotinus largely accepts Aristotle's definition as far as it goes. The chief difference between their approaches centers on Aristotle's apparent lack of interest in investigating the relationship between the sensible world and the One.[44]

Plotinus then criticizes a second theory of time which denies time any existence apart from that of the moving sphere. Like Aristotle, Plotinus dismisses this theory as untenable, though his method of refuting it is different from Aristotle's.[45] Finally, Plotinus refutes the theory that time is an extension of motion on the grounds that the extensions of all the many kinds of motion are too irregular

to account for the uniformity of time.[46] Nor can Plotinus wholly accept Aristotle's argument that time is the number or measure of motion. Time certainly cannot be the measure of particular motions, since "if we are to make time a measure of motion and at the same time preserve the unity and continuity that we realize it possesses, we cannot think of it as the measure of all motion, but only of a single, uniform motion, specifically that of the universe."[47]

On the surface, this position simply qualifies Aristotle's own view without opposing it. Another of Plotinus' criticisms of Aristotle is more serious, however, because it calls into question the validity of Aristotle's technique for defining time. To describe time in terms of motion is acceptable on a superficial level, he says, but this approach cannot tell anyone what time actually is.[48] Plotinus therefore looks to Plato for a cosmological explanation of time which takes into account the relationship between time and eternity.

Nonetheless, Plotinus' cosmology is more complex than Plato's for it is based on a hierarchy of levels of existence instead of Plato's two-fold division between perfect eternal being and the "becoming" of the sensible world. Within this hierarchy Plotinus places the intermediary of "soul" between eternity and time: "Soul must precede time because we understand time to be related somehow to the motion of the universe that is the product of soul; and time must precede motion, in the order of nature, because we say that motion is in time."[49] Plotinus' view of time, clearly echoing Plato's, can be summarized as follows:

> Time is an image of eternity, therefore, as life on a lower level of perfection. Its striving to be as like eternity as possible is the reason for its constant progress, in order that it may be a whole in succession as eternity is a perfect whole without succession. This striving explains why time will never end, for its complete fulfillment is always beyond it. Time does not proceed according to number because ideal number is fixed at a higher level, and to think that the soul produces in accordance with number conflicts with the infinity of time.[50]

Plotinus' conclusions about time, then, though undeniably influenced by Aristotelian physics, came out of a cosmological system which depended in large measure on Platonic philosophy.

Plotinus did not follow Plato in every respect, however, particularly in metaphysical matters. The essence of Plotinus' theory of hierarchy of being is the succession from lower to higher orders of existence. Whereas Plato regarded time as a true image of eternity and a source of order and harmony on which one could model one's moral life, Plotinus perceived time as only one stage in a long series of states of being which link the individual to eternity.[51] Plotinus attracted many disciples who embraced both the moral tone and the emphasis on levels which characterize Plotinus' philosophy. In fact, the Neoplatonists after Plotinus increased the number of spheres in the hierarchy, even to the point of dividing time itself into spheres, which resulted in many subtle variations in Neoplatonic approaches to time.[52] Modern philosophers have dismissed these approaches to time as too complicated and untenable. Historians, theologians and philologists, on the other hand, have made considerable efforts to understand the Neoplatonists because of their tremendous influence on Christian and Islamic thought in the early Middle Ages.[53] Neoplatonic ideas are particularly important in any discussion of medieval views of time because early Christian thinkers drew heavily on Neoplatonism when they wished to provide a philosophical basis for their theological insights into time and eternity. The moral outlook of the Neoplatonists as well as their unique rendering of the relationship of time and eternity had an especially strong effect on two of Bradwardine's most important sources, Augustine and Boethius.

While the ancient Greeks and the Neoplatonists gave the problem of time a special philosophical significance, Augustine transformed it into a theological problem as well. His most thorough and concise treatment of time appears in Book XI of his *Confessions*, in which he presents time as a quality which arose out of

creation. Although he based his arguments firmly on the words of Genesis, and in addressing the problem of time, desired only to arouse in himself and others greater love of God,[54] his analysis of time reflects the influence of his classical education. Augustine's contribution to the study of time is important not just because he invested time with theological significance: his attempt to solve the problem of time was also highly original. Indeed, his "psychological" solution to the problem of time has influenced discussions of time from the fourth century to the present.

Augustine's view of time has received, therefore, a great deal of attention from modern theologians, historians and philosophers. Their chief concerns have been to explain what Augustine had to say about time and such related issues as eternity, memory, creation, free will and contingency, but they also regard the question of Augustine's indebtedness to his predecessors as a crucial one. Those who emphasize the continuity between classical views of time and Augustine's view focus on his special reliance on Neoplatonism, which he had followed before his conversion to Christianity. Others, who wish to stress Augustine's originality, argue that many accounts of Augustine's dependence on the Neoplatonists are exaggerated.[55]

It is undeniable that Augustine's conception of time depended on certain concepts which he borrowed, consciously or unconsciously, from the Greek philosophical tradition which formed the basis of his education. Like Plato's *Timaeus*, Augustine's essays on time in the *Confessions* and the *City of God* have a strikingly poetic quality: they both rely on symbolism and imagery rather than on logical deduction to convey the mystery of creation. Nevertheless, Augustine's conclusions about time also echo Aristotelian themes. Augustine says that time is the measure of motion and that nothing exists of time except the present, which is indivisible. Augustine shared with classical philosophers the tendency to analyze time according to its parts, past, present and future. He agreed with them that time

came into existence only with creation and had a counterpart in eternity. Augustine's main divergence from Plato and Aristotle was that, while they were content to describe or explain time (a characteristic feature of Greek philosophy), he wanted to discover the meaning of time in both its human and divine contexts.[56] His fascination with the mysterious elusiveness of time and its effect on the sensible world led him to ask a broader range of questions than Plato and Aristotle had done. Augustine's originality stemmed from his insight: "Few men," observes Herman Hausheer, "have been as intensely sensitive to the pathos of mutability, of the rapidity, transitoriness, and irreversibility of time."[57]

Augustine's conception of time, moreover, was greatly enhanced by his reading of the Neoplatonists. Richard Sorabji remarks that many of Augustine's mystical impulses towards time and eternity were derived from or reinforced by his reading of Plotinus. Sorabji cites Augustine's discussion with his mother about the eternal life of the saints as an example of Augustine's dependence on Plotinus' concept of "the life which is wisdom." Augustine writes:

> Life is that Wisdom by which all these things that we know are made, all things that ever have been and all that are yet to be. But that Wisdom is not made: it is as it has always been and as it will be for ever - or rather, I should not say that it *has been* or *will be*, for it simply *is*, because eternity is not in the past or in the future. And while we spoke of the eternal Wisdom, longing for it and straining for it with all the strength of our hearts, for one fleeting instant we reached out and touched it. Then with a sigh, leaving *our spiritual harvest* [Rom. 8:23] bound to it, we returned to the sound of our own speech, in which each word has a beginning and an ending - far, far different from your Word, our Lord, who abides in himself for ever, yet never grows old and gives new life to all things.[58]

Augustine's image of the soul striving beyond simple understanding to attain a higher spiritual state and his association of that experience with feelings of passion and shock are strikingly reminiscent of Plotinus' writings about striving towards the One.[59]

Sorabji warns, however, of the danger of reading too much of Neoplatonic philosophy into Augustine's conception of time and eternity. Just because Augustine was familiar with Neoplatonism and often seemed to express his ideas in Neoplatonic form does not mean that he accepted Neoplatonism uncritically. More often than not in his direct references to the Neoplatonists, Augustine portrayed their ideas as uninformed, imperfect versions of Christian truths: their assertion that God's mind contains the ideal forms was an implicit acknowledgement of God as creator of all being; their recognition of three levels of reality, the One, the World Intellect and the World Soul, reflected their acceptance of the Trinity.[60] Thus Sorabji concludes that Augustine's relationship to the Neoplatonists was a complex one of "initial acceptance and of subsequent borrowing, adapting, distancing himself and urging them to follow."[61]

Augustine begins his discussion of time in the *Confessions* with an exclamation of frustration, which sets the tone for his own uniquely psychological approach to time: "if no one asks me [what time is], I know; if I try to explain it to someone, I do not know."[62] His investigations into the nature of time start with an account of creation, which, like Plato's creation story in the *Timaeus*, emphasizes the non-existence of time before creation and posits a divine goodness as the motive for creation. Augustine departs from Plato in insisting that God created the universe not out of pre-existing chaos but out of nothing. Paying particular attention to the text from Genesis "In the beginning God created heaven and earth," Augustine argues that Scripture attributes a beginning to every creature. Because time involves change, it also is a creature, and so has a definite beginning. Therefore neither time nor the world is eternal. Augustine has no patience with people like the Manicheans, who impertinently ask what God was doing before the moment of creation.[63] In his view, Scripture clearly tells us that there was nothing before creation: one cannot even say that God was before creation because, perfect and

immutable, God has no before and after. God simply is in a motionless eternity.[64] Augustine is not speaking here, however, of any kind of eternity that human beings, bound in time, can comprehend or experience. In fact, Augustine sharply opposes Plato's and Aristotle's arguments in favor of the eternity of the world. Because the world, and thus time, had a definite beginning in the event of creation and will continue according to principles established by God, it is neither eternal, nor does it share in any way in God's capacity for everlasting being.[65]

Augustine was not satisfied simply with refuting the opinions of his predecessors or with determining the characteristics which time does not have. His real goal was to discover what time really is like, to the extent that a human being can actually recognize its features. His treatment of time in the *Confessions* involves, therefore, a transition from an ontological discussion of the origins of time to a psychological analysis of the effects of time on the soul.[66] In fact, from Augustine's point of view, human experience, subjective as it is, must be paramount in any discussion of time because, although time could still exist in a created world without people, in the world which God actually created, it is people who measure time in their minds. Like all other creatures, humans live and change in time; but, because they have souls, they can transcend, in certain respects, the limitations of creation. Their souls make them more like God and make God's eternity more accessible to them. Thus humanity stands between time and eternity and the soul is the tool for measuring and interpreting time.[67]

Augustine's ultimate conception of time is based on his observation that time seems to have three parts, past, present and future; that it proceeds in a single, irreversible direction; and that it consists of a succession of segments which are easily perceived but are extremely difficult to analyze in any rigorous way. These observations raise serious problems about the nature of time because they seem to present contradictory evidence. Of the three "parts" of time, only the present seems

actually to exist, because the past is "no more" and the future is "not yet"; but if the present is always moving forward, how can we determine exactly where the present is? Moreover, we can think of past times as having long or short duration, but can one really measure something that no longer exists? Indeed, we cannot even measure the present, for every duration of time has its own sequence of past, present and future.[68] Augustine points out that even the hour

> is made of fleeing moments; so much of the hour as has fled away is past, what still remains is future. If we conceive of some point of time which cannot be divided into even the minutest parts of moments, that is the only point which can be called the present; and that point flees at such lightening speed from being future to being past, that it has no extent of duration at all. For if it were so extended, it would be divisible into past and future; the present has no length.[69]

Nevertheless, says Augustine, we cannot deny that we think of the world in terms of the concepts of past, present and future, even though we can develop no standard for determining when the present actually is. The present remains a crucial concept because it distinguishes past and future. Its function in making this distinction depends, however, not on some objective continuum such as the motion of heavenly bodies but on the mind itself. Augustine concludes his speculations on the relationship of the present to past and future with the suggestion that

> perhaps it would be more correct to say: there are three times, a present of things past, a present of things present, a present of things future. For these three exist in the mind, and I find them nowhere else: the present of things past is memory, the present of things present is immediate intuition (*contuitus*), the present of things future is expectation. . . . By all means continue to say that there are three times, past, present and future; for though it is incorrect, custom allows it.[70]

Augustine's approach to time, then, is consciously subjective, at least to the degree that he believes that the parts of time are realized and measured within the mind. This emphasis on the mind emerges from Augustine's acceptance of an Aristotelian

description of time as successive, continuous and infinitely divisible. Augustine wanted to protect the eternity of God from anything changeable[71] without sacrificing his belief that the human mind is capable of understanding God's activity in the world. Therefore he had to place the human capacity to understand time in the soul.

If the present has no extension, and past and future do not exist, how then do we measure time? Augustine answers that we measure time in the memory. Through the power of our minds we can create and measure segments of time which bear no resemblance to the actual succession of individual moments. The memory is a spiritual power which allows images in the soul to be measured: as such, it can stop the course of time and stabilize it.[72] Using the example of the recitation of a poem, Augustine describes how the memory not only makes the various aspects of time accessible to human experience but also represents the unity of parts and whole in every aspect of human life:

> Suppose that I am about to recite a psalm that I know. Before I begin, my expectation is directed to the whole of it; but when I have begun, so much of it as I pluck off and drop away into the past becomes the matter for my memory; and the whole life of the action is stretched out between my memory, in regard to what I have said, and my expectation, in regard to what I am still to say. But there is a present act of attention, by which what was future passes on its way to becoming past. The further I go in my recitation, the more my expectation is diminished and my memory lengthened, until the whole of my expectation is used up, when the action is completed and has passed wholly into my memory. And what happens in the case of the whole psalm happens for each part of the whole, and for each syllable; and likewise for any longer action, of which the canticle may be only a part: indeed, it is the same for the whole life of man, of which all man's actions are parts; and likewise for the whole history of the human race, of which all the lives of all men are parts.[73]

Augustine recognizes previous definitions which associate time with motion as valid insofar as motion occurs in time: we might even use the motion of an object to measure time; but the act of measurement takes place entirely within the soul.

Observations of individual motions become images which the mind uses to determine intervals. Augustine's emphasis on the mind as an active agent in defining time had bearing on many of his other theological positions which involved the soul's activity, particularly in regard to the Trinity.[74] By stressing the connection between time and the soul Augustine offers a psychological answer to a metaphysical problem, or, as many commentators would argue, he transforms the metaphysical problem of time into a psychological one.

This transformation had consequences in all areas of Augustine's theological system, but it was especially important in those discussions which involved some explanation of God's understanding of human activities. Here Augustine had to address the paradox that God, omniscient and outside of time, allows his creatures to act freely within time. Augustine readily admitted that he had trouble in resolving this problem but he ultimately concluded along Platonic lines that God created time so that his creatures, in all of their limitation and imperfection, could exercise their wills under his divine guidance. It was the spiritual contrast between the finiteness of human experience and the infinity of God, not the physical contrast between time and eternity which most fascinated Augustine. According to Robert Jordan, "Augustine's investigation of time is a study in contingency, finiteness, creatureliness, dependency, incompleteness, imperfection - a study of the limitations of being that characterize *any* finite entity, that entity which *is*, but which is not He Who Is. Time exists because there are existent things in the universe which are just so much reality, but no more. The existence of only one of these things is of genuinely intimate concern to man - himself."[75] Time thus becomes more than a cosmological problem: it is a problem of moral philosophy, bound up with the religious life of humanity.[76]

The fundamental problems of time arose, therefore, not only in Augustine's formal discussions of time in Book XI of the *Confessions* but also explicitly or

implicitly in many other contexts. Most notably, he approached the whole problem of God's foreknowledge and human free will from the perspective that God's knowledge in his timeless present that a person will sin does not compel that person, living in earthly time, to sin. In Augustine's opinion, God's eternal foreknowledge actually safeguards the freedom of the human will since will is a divinely created gift. Indeed, he remarked in the *City of God*:

> Our wills are ours and it is our wills that affect all that we do by willing, and which would not have happened if we had not willed. But when anyone has something done to him against his will, here, again, the effective power is will, not his own but another's. But the power of achievement comes from God. . . . Therefore, let us never dream of denying his foreknowledge in the interests of our freedom, for it is with his help that we are, or shall be, free.[77]

Although in this case, divine knowledge, not time, was the main issue, Augustine's definition of the relationship between time and eternity provided the basis of his solution to a difficult cosmological and theological dilemma.

Because Augustine's theology had such a lasting impact on medieval theological discussions of all sorts, it is not surprising that his ideas about time appear repeatedly in the works of his successors. Comparisons between Augustinian and Greek philosophies of time reflect both his dependence on an established vocabulary and list of concerns and also his remarkable originality. Augustine's analysis of time is important because through it later thinkers were introduced to principles of classical philosophy which retained many of their original features in spite of Augustine's reinterpretation of them. Moreover, since Augustine's writings soon came to be considered theologically central, his philosophical treatment of problems such as time legitimized not only a philosophical approach to theology but also an acceptance of ideas whose origins were in a non-Hebraic pre-Christian tradition.

Augustine's psychological view of time and eternity is closely related to that of Boethius, whose speculations on the nature of eternity greatly influenced discussions about time throughout the Middle Ages. Although Boethius was not interested in time as such, his definition of eternity hinges on the contrast between human temporal existence and the non-temporal existence of God. Boethius was a scholar of considerable skill, who not only composed several original works on logic, theology and natural philosophy but also embarked on the ambitious task of translating all the writings of Plato and Aristotle into Latin. Although he completed only a fraction of this work, he was successful in introducing many classical concepts into medieval scholarship in their original form. Unlike Augustine, whose philosophical impulses were always directed towards theological ends and whose assimilation of classical ideas was almost subconscious, Boethius openly advocated the study of philosophy, particularly ancient Greek philosophy, for its own sake. In addition to his contribution to the debate about time and eternity, Boethius added to the medieval literary tradition Aristotle's logical system of categories and suggested a method for organizing disciplines of learning which formed the basis of the medieval academic curriculum. His best known work, the *Consolation of Philosophy*, is an allegorical account of his conversion to the belief that philosophy, defined as the love of wisdom, the pursuit of wisdom or the quest for God, is the highest human aspiration.[78]

It is not surprising, therefore, that Boethius' conception of time bears the mark of his study of the ancient Greeks, the Neoplatonists and Augustine. Boethius shares with Augustine a psychological view of time and eternity: both saw the problem of the relationship of time and eternity as a matter of interaction between God and the human soul, rather than simply an explanation of a phenomenon of nature. Some modern commentators judge Boethius' treatment of these problems superior to Augustine's because of Boethius' special philosophical training.[79] His

approach to eternity in the *Consolation of Philosophy* involves an attempt to prove a theological assumption about the eternity of God using philosophical means without reference to Scripture. To this end Boethius states:

> That God is eternal, then, is the common judgement of all who live by reason. Let us therefore consider what eternity is, for this makes plain to us both the divine nature and knowledge. Eternity, then, is the complete possession all at once of illimitable life. This becomes clearer by comparison with temporal things. For whatever lives in time proceeds as something present from the past into the future, and there is nothing placed in time that can embrace the whole extent of its life equally. Indeed, on the contrary, it does not yet grasp tomorrow but yesterday it has already lost; and even in the life of today you live no more fully than in a mobile, transitory moment. . . . Therefore, whatever includes and possesses the whole fullness of illimitable life at once and is such that nothing future is absent from it and nothing past has flowed away, this is rightly judged to be eternal and of this it is necessary both that being in full possession of itself it be always present to itself and that it have the infinity of mobile time present [to it].[80]

Boethius' argument that eternity is completely distinct from the sequential character of human time is entirely in keeping with Augustine's view because it emphasizes both the divine nature of eternity and the difficulty human beings have in grasping either time or eternity.

Recognizing this difficulty, Boethius attempts in another passage to explain what he means by "the complete possession all at once of illimitable life." He agreed with his predecessors that eternity is neither simply a limitless duration of time nor a state of static atemporality.[81] His analysis of the misunderstanding of eternity in his treatise *On the Trinity* offers a remarkably clear rendering of the classical conception of eternity. Boethius thus contends:

> What is said of God, [namely, that] he is always, indeed signifies a unity, as if he had been in all the past, is in all the present - however that might be - [and] will be in all the future. That can be said, according to the philosophers, of the heaven and of the imperishable bodies; but it cannot be said of God in the same way. For he is always in that for him *always* has to do

> with the present time. And there is this great difference between the present of our affairs, which is *now*, and that of the divine: our now makes time and sempiternity, as if it were running along; but the divine now, remaining and not moving, and standing still, makes eternity. If you add *'semper'* to 'eternity' you get sempiternity, the perpetual running resulting from the flowing, tireless now.[82]

For Boethius, then, eternity is not a sterile condition which removes God from the temporal reality of his creation, however hard it might be for us to understand how this can be so. Boethius' God transcends time: indeed, as Anthony Kenny observes, he might be pictured "as surveying the battle-ground of human existence from a high tower above, with past, present, and future as different parts of the field open to divine vision."[83]

Boethius also, like Augustine, tries to consider how his conception of divine eternity relates to human experience. In the first place, he addresses the question of whether the world is eternal. Preferring not to rely, as Augustine had done, on the authority of Scripture, Boethius looked to Plato and Aristotle for inspiration. It was Plato's view which had the greatest sway in Boethius' conclusions:

> So what is subject to the condition of time is not yet such as rightly to be judged eternal, even if, as Aristotle believed of the world, it never began to exist, and does not cease, but has its life stretched out with the eternity of time. For even if its life is infinite, it does not include and embrace the whole extent of that life all together, since it does not yet possess the future and already lacks the past. . . . Hence those are not right who hear that Plato thought this world had no beginning in time and will have no end, and who conclude that the created world is in this way made co-eternal with the creator. For it is one thing to be drawn through an endless life, which is what Plato attributed to the world, and another to have embraced equally the whole presence of a life which cannot end, which is clearly the special characteristic of the divine mind. Nor should God be thought older than created things by some amount of time, but rather by the peculiarity of his nature which is simple. . . . Thus if we want to apply names appropriate to things, let us say, following Plato, that God indeed is eternal, but the world perpetual.[84]

Boethius' argument that the world is not eternal because it was created and exists under the influence of time corresponds to Augustine's assertion that time had its origin in creation. While Boethius does not deny creation, however, he is not prepared to go so far as Augustine in claiming that creation has a definite beginning and end. He prefers Plato's designation of the world as perpetual, which suggests that worldly time, though not identical with eternity, bears some relation to it. This opinion, though hardly orthodox in the Augustinian sense, nevertheless came to be considered theologically valid, thanks to the widespread influence of Boethius' writings throughout the Middle Ages.[85]

Boethius' ideas are more in keeping with Augustine's on a second aspect of the problem of time's relation to eternity, that of God's foreknowledge. We have already seen that Augustine proposed the solution that God sees all human action at once and that his knowledge that a person will act in a particular way does not constitute coercion. Boethius takes a similar position, but his treatment, having been derived from carefully argued philosophical premises, is clearer than Augustine's. Boethius declares in the *Consolation of Philosophy* that God can know the future without manipulating it because God exists in a state of eternal presentness: "Embracing the infinite lengths of past and future, [he] considers everything as if it were going on now in a simple mode of awareness."[87]

The appeal of Boethius' argument lies in its comprehensibility and simplicity. He defines God's relationship to the temporal world in such a way as to free human will from the necessity of God's foreknowledge without denying that God indeed knows every possible human act in his eternal present. The problem with Boethius' conception of eternity, from the Augustinian perspective, is that it fails to take into account evidence from Scripture of God's intervention in the world. Boethius' philosophical account of divine knowledge makes no provision for grace; and, although Augustine had arrived at the same conclusion as Boethius about God's

capacity to have knowledge while ensuring the freedom of his creation, Augustine, as a theologian, could not avoid the elements of Christian revelation which complicate the discussion. The persistence of both Augustinian and Boethian traditions throughout the Middle Ages indicates the compelling nature of the problems of time and eternity for medieval thinkers. Even Boethius, who did not devote much attention to these issues, strongly influenced medieval discussions of time and eternity, not the least because he consciously introduced classical approaches to topics which fascinated medieval thinkers. Thus interest in time and eternity flourished in the West during the early Middle Ages, particularly in the late eleventh and twelfth centuries, when such thinkers as Anselm, Peter Abelard and Garlandus Compitista all made useful contributions to the debate.

In almost all of his major works, Anselm referred to the themes of time and eternity and to the philosophical and theological problems which arise from them. Historians have long recognized that Anselm was influenced by Augustine, even though he did not have access to the *Confessions*. It is not often considered, however, that Anselm was also familiar with Boethius' views on time as set forth in his commentaries on Aristotle's *Categories*.[88] Although it is difficult to ascertain the exact source of influence, it is clear that Anselm's treatment of time involves geometrical definitions which bear greater resemblance to a classical tradition than to an Augustinian one. Not only did Anselm, like Plato and Aristotle, use mathematical terminology to describe the nature of time and eternity, but he also held the Aristotelian opinion that eternity differs from time because of its incapacity for measurement. Anselm argued that the distinction between time and eternity rests on the fact that time is a sequence of parts, while eternity is whole, without parts and dimensionless.[89] In order to emphasize this point, he compared the unity of eternity with the unity of the Trinity: "We do not think of God as having grades of different standing, for He is one; nor, when we show how the Son is 'of' the

Father, or the Holy Spirit of Father and Son, do we construct intervals in eternity which is beyond all time."[90]

While Anselm's view of time was mathematical, Abelard and Garlandus treated time as a grammatical or dialectical problem. Drawing on both Greek sources and Augustine's discussions of the ambiguities of tensed language, Garlandus showed that grammatical limitations can interfere with an adequate metaphysical definition of time.[91] Abelard also discussed the grammatical problems associated with time, but he went beyond these to address some of the underlying philosophical and theological roots of these problems. He pointed out, as Augustine had, that the simplest way to teach students about time is to direct them to the revolutions of planets and stars; but Abelard agreed with Augustine that this approach is theoretically incorrect because the existence of time "must be independent of any one means of measuring it."[92] Abelard also recognized the difficulty in describing durations of time which consist of continuous series of points, saying: "time is either indivisible, like the present moment which we call an instant, or it is composite, like an hour, a day, a week, a month, a year, which is made up of different instants following one another in succession, past, present and future."[93]

Anselm, Garlandus and Abelard, therefore, all focused on the practical problems of measuring and describing time which were central features of ancient Greek discussions of time. Although they obviously drew on classical treatments, however, their own approaches reflect the logical and philosophical interests of their own age. Augustine and Boethius helped to shape these later discussions not so much by dictating the course that investigations about the nature of time should take, as by providing access to the rich and varied history of the subject in an age of scarce literary resources but keen and inquiring minds.

This brief survey of the origins of medieval discussions about time reveals several important themes. First, the problem of time had been the subject of

rigorous philosophical speculation in the Western tradition from an early age. Second, discussions of time are intimately bound up with, and must be viewed in terms of, thinking about creation, God and eternity. Third, as the main contributors to the discussion addressed the views of their predecessors, the debate about the nature of time became increasingly complex and approaches to the problem more varied. By the time of Boethius, philosophers and theologians could draw on Pythagorean, Platonic, Aristotelian, Neoplatonic and Christian explanations of time; they could conceive of time mathematically, astronomically, metaphysically or psychologically; and they often used more than one approach to explain the anomalies of time.

The legacy of this long discussion for the later Middle Ages rests not just on the sources of ideas it provided, but also on the inspiration it gave to thinkers to explore the complicated and frustrating problem of time in all of its manifestations. Each generation to approach the subject of time brought to the discussion its own concerns as well as the accumulated wisdom of the past. It is a testament to the major innovators on this topic, Plato, Aristotle, Plotinus, Augustine and Boethius, that no age has been able to dismiss completely their insights about time. In fact. one can hardly begin to evaluate the emergence of time as a philosophical and theological topic in the late Middle Ages without understanding these men's ideas about time.

CHAPTER THREE

THIRTEENTH-CENTURY APPROACHES TO TIME

During the century and a half before Bradwardine, the problem of time arose within the context of the general discussions of Aristotelian philosophy which had become common among Western scholars by the late twelfth century. A major stimulus to these discussions was the increased accessibility of Aristotle's writings through new translations from Arabic into Latin. Much of this work was accomplished in Spain, where Muslim, Jewish and Christian thinkers had mingled for centuries. By the mid-twelfth century, Muslim scholars not only had translated a large number of Greek philosophical texts into Arabic but also had produced an impressive array of commentaries, especially on Aristotle's writing, which reevaluated classical philosophy from the perspective of Islamic theology. Although some scholars in Spain and Northern Europe rejected non-Christian natural philosophy and tried to resist its influence, many more welcomed translations of Aristotle's writings on physics, astronomy, biology and cosmology which had not been readily available for study in the early Middle Ages.[1] The influence of these translated texts on Western thought was considerable and had direct bearing on subsequent discussions of time in the thirteenth and fourteenth centuries.

The appeal of this new body of literature was its comprehensive treatment of natural philosophy. According to Étienne Gilson, Western medieval thinkers embraced the Greco-Arabic tradition of natural philosophy with great enthusiasm because Scripture did not provide them with an adequate cosmology, that is, a "scientific and metaphysical description of the structure of the universe," for genuine

philosophical study.[2] Certainly by the thirteenth century, Western thinkers had become interested in many topics which belong more in the category of natural philosophy than in theology. Classical works on physics, biology, astronomy and mathematics, along with their Muslim commentaries, excited curiosity both by suggesting new questions which one might ask about the natural world and by conveying specific information or observations about natural phenomena.

Unfortunately, both Aristotle and the Muslim scholars who commented on his writings usually failed to distinguish their opinions about the natural world from their religious beliefs. Many conservative Christian thinkers in the thirteenth century were alarmed, therefore, by the rapid spread of "pagan" philosophies which appeared to obscure, when they did not actually contradict, accounts of creation found in Scripture. In the first half of the thirteenth century, some conservatives tried unsuccessfully to abolish the teaching of Aristotle at the universities, or at least restrict Aristotelian studies to his works on logic. More moderate thinkers attempted in various ways to reconcile Aristotle with Christian thought, but few accomplished this task convincingly. In spite of strong efforts to forestall it, Aristotle's scientific and metaphysical thought was firmly established in the university curriculum by the end of the thirteenth century and young scholars turned with vigor to classical problems of cosmology which they encountered in their studies of that material.

The purpose of this chapter is to examine late twelfth- and thirteenth-century discussions of time in light of this rediscovery of classical natural philosophy. The significance of this period for Bradwardine's generation of scholarship arises from the characteristic enthusiasm of thirteenth-century thinkers for combining philosophical, scientific and theological evidence in their answers to metaphysical questions. Time, as we have already seen, lends itself to a multi-disciplinary investigation; indeed one could argue that a successful study of time is impossible

without such an approach. In the twelfth century the Muslim philosopher Averroes and the Jewish philosopher Moses Maimonides reinterpreted Aristotelian views of time and eternity both philosophically and in light of monotheistic theology. Their work provided an important legacy for such influential Western scholars as Albertus Magnus, Thomas Aquinas, Robert Grosseteste and John Duns Scotus, who tried in various ways to reconcile theological truth with the concepts and methods of Aristotelian natural philosophy. Although these thinkers did not exert equal influence on Bradwardine, and their ultimate conclusions about time varied considerably, their struggles to understand time offer valuable insights into the unsettled intellectual climate into which Bradwardine entered early in the fourteenth century.

Any discussion of the revival of Aristotelian natural philosophy in the Christian West must consider the important contributions of Averroes. An active participant in the vibrant, international academic community of twelfth-century Spain, his studies included theology, jurisprudence, medicine, mathematics and philosophy. In addition to his work as a judge, he composed several original treatises on a variety of topics. His fame in northern Europe, however, rested chiefly on his commentaries on Aristotle.[3] In these commentaries, Averroes set about the task of establishing the relationship between Aristotelian philosophy and religious truth revealed through the Koran. Not wishing to stray too far from orthodoxy, he openly acknowledged the miraculous nature of the Koran, which brought truth to all people whatever their capacity to receive it. According to Averroes, anyone could understand the Koran's superficial and symbolic meanings, but only highly trained scholars could hope to penetrate its hidden messages. In addition, he contended that the highest aim of human speculation must be philosophy, because every other kind of speculation, including theology, is tainted with the distracting elements of emotion and faith.[4] Therefore, those who are

capable of finding truth should turn their attention to the philosophy of Aristotle, who provides both an explanation for the natural order and a method for investigating it. In fact, Averroes went so far as to proclaim: "The doctrine of Aristotle is the supreme truth because his intellect was the zenith of human intellect. It is therefore rightly said that he was created and given to us by divine providence, so that we might know all that can be known."[5] Although few Christian thinkers were prepared to regard Aristotle as the zenith of the human intellect, Averroes' powerful portrayal of Aristotle had a positive influence on many Latin scholars.

Averroes' commentary on Aristotle's view of time reflects both his profound respect for his teacher and his own preoccupation with philosophical problems. Averroes was troubled by Aristotle's definition of time as the number of motion because it did not adequately distinguish time from motion. Averroes felt compelled, therefore, to examine the source of Aristotle's dilemma without openly criticizing any of Aristotle's statements. In his analysis of Aristotle's view of time Averroes included several insights on the nature of time which Avicenna had advanced in his own commentary on Aristotle, although he did not acknowledge his indebtedness.[6] Averroes' main complaint was that, by linking the concepts of time and motion too closely, Aristotle seemed to imply that one had to observe motion to experience time. This theory presents many difficulties, not the least of which is the anomaly that the heavenly bodies continue to measure time even under conditions which prevent human observation of their motion.[7] To resolve this dilemma, Averroes suggested that the experience of time is not related to the individual perception of earthly or celestial motion: our capacity to sense change is inadequate to the task of accounting for the regular and continuous passage of time.[8] Although, like Augustine, Averroes seemed at first to stress the importance of perception in assessing the nature of time, his approach was not a psychological one. While the

occasion of a motion might allow us to perceive time, Averroes argued, time itself does not depend merely on our observation of motion. Because we are always both in a state of change (*in esse moto*) or in a state which anticipates our essential capacity for change, we perceive time subjectively. The objective, ordered passage of time is assured, however, by the circular motion of the celestial sphere: all movement and change depend on its motion, which continues in an orderly fashion whether or not we can comprehend its course. Without departing from Aristotelian principles, therefore, Averroes nevertheless reconsidered and refined Aristotle's problem of explaining the interrelationship of time and motion.[9]

Averroes' most original contribution to the medieval debate about time and his chief advance over Aristotle arise from his insistence that time is a fundamental feature of material being, which must possess the capacity to move and change.[10] This theme is revealed in Averroes' comment on possible interpretations of Aristotle's teaching on time. Here Averroes made a distinction between perception of time based on our direct experience of local motion and our universal acknowledgement of a uniform temporal order which applies whether or not we observe change. According to Averroes, the latter position best expresses Aristotle's opinion because it is based on his teaching about the uniform motion of the heavenly bodies.[11] After examining the main principles of Aristotle's temporal theory Averroes concluded that when Aristotle defined time as the number of motion, he was talking not about any observable or measurable motion but about the particular motion of the celestial sphere.[12] Averroes thus clarified Aristotle's position to the point of over-simplification in order to protect Aristotle from the criticism that his theory of time was ambiguous. Consequently, his reevaluation of Aristotle helped to define in terms comprehensible to medieval scholars the problem of time as both a philosophical and a physical problem. Because it made no reference to theological truth, many Muslim and Christian thinkers refused

wholly to accept Averroes' interpretation of Aristotle's temporal theory, although they hungrily read his commentaries for information about Aristotelian metaphysics.[13] This fascination with Aristotle accounts for the wide circulation and influence of Averroes' ideas in northern Europe in the thirteenth and fourteenth centuries.

Averroes' contemporary, Moses Maimonides, also relied heavily on Aristotle, but he was interested as well in other ancient philosophical traditions, such as Neoplatonism. His writings demonstrate an impressive knowledge of contemporary philosophical discussions, including Averroes' work. Unlike Averroes, however, Maimonides believed that faith was a prerequisite for seeking philosophical truth, and his most widely read book, the *Guide for the Perplexed*, is primarily a work of theology. In this book, Maimonides modified Averroes' argument that the highest form of intellectual activity involved the study of Aristotelian metaphysics. He presented divine law and philosophy as two equally valid areas of inquiry, both of which are necessary for establishing a rational confirmation of faith.[14] Maimonides hoped to show that it was possible for an educated, perceptive person to reconcile physical principles with the literal meaning of the Scriptures. Although he looked to a variety of sources of scientific knowledge, he relied most heavily on Aristotle for explanations of natural phenomena. Maimonides' critical approach to both Aristotelian physics and Muslim theology and his firm attachment to the Old Testament made the *Guide for the Perplexed* a valuable resource for Christian scholars, despite its largely unsystematic structure.[15]

In addition to his general influence on medieval Western theology, Maimonides contributed specifically to the discussion of time through his comments on the eternity of the world. Although he accepted much of Aristotle's physical theory, he could not accept Aristotle's argument that the world had had no beginning in creation. Since he could find nothing in Aristotle's writings to prove

that the world had not been created by God, Maimonides felt justified in rejecting this element of Aristotelian physics in favor of the scriptural doctrine of creation in time. On the other hand, Maimonides admitted that creation in time cannot be proved. Therefore, acceptance of creation in time cannot serve as a philosophical principle for proving theological truths such as the existence of God.

Maimonides based his proof of God's existence on an entirely different kind of argument: being is necessary and requires a primary mover or cause, which is God. According to this argument, God exists as the primary agent of creation, whether he made the world from nothing in time or whether the world existed from all eternity.[16] The importance of Maimonides' discussion about eternity in the medieval debate about time does not rest in any clarifying remarks that he made about time itself. It was rather his attitude that biblical principles could be defended without physical proof that caught the attention of Christian thinkers of the thirteenth century. Both Averroes and Maimonides provided examples of how the philosopher might try to solve cosmological problems by considering both philosophical and theological evidence. More important still for this study, by turning their attention to the problems of time and eternity they emphasized the inadequacy of approaching time exclusively either from a theological or a philosophical perspective.

The thirteenth-century scholar Boethius of Dacia offers an example of how Averroes and Maimonides influenced Christian thinkers. In addition, his discussion of eternity indicates the ambiguity of medieval studies of time which did not readily separate the philosophical from the theological aspects of this problem. Boethius' analysis of time and eternity is based on Averroes' conviction that philosophy is the best kind of intellectual activity and therefore completely avoids theological considerations. Although he never went so far as to deny the value of faith, Boethius ascribed to the philosopher the capacity to achieve the experience of

greatest human pleasure through the contemplation of the "prime principle," that is, the eternal, the immutable and most perfect. In his treatise *On the Sovereign Good or On Philosophical Life* Boethius echoes Averroes' admiration for philosophical inquiry, claiming that

> . . . each one finds his delight in what he loves, and his greatest delight is what he loves most, and since the philosopher supremely loves this Prime Principle . . . it follows that the philosopher finds his supreme delectation in this Prime Principle and in the contemplation of its goodness, and that this delectation is the only right one. That is what a philosopher's life is, and whoever does not lead it does not live right. Now I call 'philosopher' any man who, living according to the right order of nature, has attained the best and ultimate end of human life.[17]

Such views made Boethius an easy target for conservative theologians who wanted to discredit the idea that philosophy, particularly Aristotelian philosophy, could achieve good without being informed by faith. Modern scholars still disagree over whether Boethius was really a "pagan" philosopher or truly wanted to protect the role of faith in his philosophical system.[18]

In any event, even Boethius, with his enormous reverence for both Aristotle and Averroes, could not accept all of their conclusions about time and eternity. When he set about to write his own account of the eternity of the world, his main source was neither Aristotle nor Averroes, but Maimonides.[19] Boethius chose the complex problem of eternity to illustrate his thesis that there is no conflict between Christian faith and philosophy. His argument rests on his belief that natural philosophy - the observation of the world as it actually is - has no connection with speculation about the possibility of supernatural creation. Like Maimonides, Boethius believed that neither the eternity of the world nor its creation in time could be proven through demonstrable arguments, although he showed a greater willingness than Maimonides to accept the possibility of an eternal world.[20] Moreover, in an attempt to correct the misconceptions of his predecessors, Boethius

followed an argument proposed by Maimonides to demonstrate that Aristotle had not successfully proven the eternity of the world.[21] Preoccupied as he was with the thirteenth-century debates concerning the relationship of faith to reason, Boethius felt compelled to find a way of balancing his own deep commitment to philosophy with the religious concerns which dominated his age. His reading of Maimonides helped him to envision the problem of eternity as a significant but abstract problem which the methods of neither theology nor natural philosophy could solve.[22] His conclusion that faith and reason should not be forced to compete in the search for truth is an approach which was not regularly taken in the Middle Ages. Nevertheless, his atypical approach focuses attention on the struggle between faith and reason which influenced all medieval discussions of time. Indeed, those fourteenth-century theologians who eventually did try tentatively to separate faith from reason were disturbed by the implications their speculations had for both theology and natural philosophy.

More common in the thirteenth century than Boethius' separation of faith and reason was the attempt to integrate natural philosophy and Scripture into a consistent whole. Sometimes the integration involved the synthesis of Greco-Arabic and Christian traditions into a single philosophy, but most Christian thinkers did not go that far. In this context, it is useful to look at the view of time presented by the Dominican scholar Albertus Magnus. Albertus is widely regarded as one of most influential and gifted scholars in northern Europe in the mid-thirteenth century, not the least because he was the teacher of Thomas Aquinas between 1245 and 1248. Although Albertus was both a prominent churchman and an avid student of philosophy, it is hard to classify him either as a theologian or as a philosopher. His voluminous writings, consisting mainly of translations and commentaries on an extremely wide range of topics, reflect both his broad interests and his encyclopaedic knowledge. In order to enrich his theological studies, Albertus

wanted to have experience with every branch of learning, including, logic, metaphysics and natural philosophy. Though he was aware that Greco-Arabic learning sometimes conflicted with the Western Christian tradition, Albertus nevertheless believed that the truths of one tradition could be applied usefully to intellectual enquiries in the other. He therefore encouraged his contemporaries to master as much scientific and philosophical material as possible, regardless of its origin. Albertus was not primarily concerned, however, to build his own philosophical or theological system out of the information which he accumulated in his studies. For this reason, Albertus is often identified as a scholar in the general sense rather than as a theologian or a philosopher.[23]

It is not surprising, then, that Albertus' view of time is a composite of several theories which were available for him to consider. His reading of classical works and the commentaries of the Muslim philosophers gave him a good introduction to Greco-Arabic approaches to time, while his knowledge of Augustine and the other Church Fathers provided him with information concerning the biblical doctrines of time and eternity. Albertus' specific theory of time combines passages from Scripture with classical descriptions of creation. According to Gilson, Albertus accepted a classical interpretation of Scripture which held that God's first act of creation was to make four coevals: "matter, time, the empyrean heaven and angelic nature."[24] Albertus followed Proclus in placing matter first since "being" depends logically on the existence of matter. After characterizing the various kinds of matter which God created, Albertus discussed the distinctions between the philosophical and the theological approaches to matter. For theologians, matter is the single substance out of which God fashioned the universe in six days; for philosophers, most notably Aristotle, matter is the subject of change, and, since there are many kinds of change there must be many kinds of matter.

Albertus accepted both positions, claiming that it is not a contradiction to say "that all matters are one and the same with respect to the work of creation, and that matters are generically different with respect to the generically distinct sorts of forms which they receive."[25] Having established the nature of being, Albertus went on to define time as the "duration that is proper to each different type of being." He then recalled the well-established distinction between the human experience of time and God's experience of an ever-present now. Albertus defined eternity as the "limitless duration proper to the uncreated *esse* of God, which is the act of divine essence."[26] Time, by contrast, belongs to the realm of corruptible being and so is defined as the measure of motion or change. Like Augustine, Albertus conceived of time as a series of fleeting nows and contended that time could only be known by the soul.

In another sense, however, time is an inherent quality in all existing things "because the process of their passing from potency to act is a successive one, and, consequently, of its own nature, it implies a before and after that are susceptible of measurement."[27] Just as with matter, time is described in completely different ways by theologians and philosophers. Theologians see time as the measure of any change, divisible or indivisible, spiritual or corporeal; and they apply it to all created things, including angels, for whom time has neither a before nor an after. Philosophers, on the other hand, think of time as a measure of continuous motion which always includes a before and an after: it is the fleeting now or "the mode of duration proper to being that is becoming."[28] Again, Albertus contends that the two views do not contradict each other, for "just as every sort of substance has its own kind of matter, every sort of duration has its own kind of time; mutations in intellective faculties and wills are measured by their own time; mutations in heavenly bodies are not in the same time as the mutations of sublunary beings."[29]

In his analysis of the philosophical definition of time, although he mentioned other sources, such as Avicenna, Themistius, Alexander of Aphrodosias, Theophrastus and Porphyry, Albertus most closely followed Averroes.[30] He largely accepted Averroes' reevaluation of Aristotle and, in restating it in his own words, succeeded in clarifying it further.[31] Like Averroes, Albertus wanted to prove that the various times which creatures experience really constitute a single unified time: if they do not, it would be impossible to measure time at all. It is the uniform motion of the heavens which provides a fundamental reference by which all other motions and times are numbered.[32] Albertus' active role in the medieval discussion of time, then, was not one of original insight, but instead one of informed commentary. His conclusions that philosophical and theological approaches to matter and time do not contradict each other cannot legitimately be called a synthesis because he made no further effort to bring them together. On the other hand, as an active proponent of both kinds of knowledge, Albertus would have opposed any claim that there are certain questions which either faith or science alone can answer. Both his specific views about time and his opinions about knowledge in general had bearing on subsequent discussions of the problem of time.

Albertus' student, Thomas Aquinas, is credited with the effort to achieve an actual synthesis between Christian doctrine and Greco-Arabic learning. Although Aquinas did not have Albertus' encyclopaedic knowledge, his writing demonstrates a much greater sensitivity to complex philosophical problems. Because one of the main objectives of Albertus' ministry was to encourage theologians, especially in the Dominican Order, to have a thorough understanding of classical philosophy, Aquinas, as Albertus' student, was exposed to a wide range of philosophical traditions. During three years of study under Albertus, Aquinas heard him lecture on moral philosophy and on the Bible. Albertus' published lectures on Psalms, Jeremiah and Daniel date from the period of Aquinas' study with him. At the same

time he was preparing a paraphrase of Aristotle, a commentary on Book IV of Peter Lombard's *Sentences* and lectures on the Apocalypse and Gospels.[33]

The young Aquinas took seriously his teacher's devotion to classical learning and soon became familiar both with Aristotle and with the Arabic commentaries, particularly those of Averroes. Unlike Albertus, however, Aquinas was not satisfied with acquiring and assimilating many sources of learning to support the broadly based, almost cosmopolitan kind of theological speculation which is characteristic of Albertus. Aquinas' special gift was for philosophical analysis, and so his preference was to produce a more conscious synthesis of Scripture, patristic writings and classical philosophy than Albertus had ever attempted to achieve. For this reason, Aquinas' writings have almost as much significance in the field of philosophy as they have in theology, which was in Aquinas' eyes the more important discipline.

Considering the nature of his training and his interest in philosophy, it is not surprising that Aquinas frequently mentioned aspects of time in his own writing. As a synthesizer he found it necessary to examine time both as a spiritual and as a physical phenomenon. On the one hand, he had to take into account the biblical explanation of time as a part of creation as well as Augustine's psychological approach, which emphasized the function of the soul in defining time. On the other hand, he wanted to acknowledge the Aristotelian approach to time, which provided a more objective explanation of time's relationship to space and motion. When he set out to discuss the nature of eternity, moreover, Aquinas was well aware of the long debate over time's relationship to eternity which dated from Plato's treatment of this issue.

Aquinas' own views on time are scattered throughout several of his works, including his commentaries on Lombard's *Sentences* and on Aristotle's *Physics* as well as his own *Summa theologica*. Hence, Aquinas' references to time arise in many different contexts. In every instance, however, he approached the problem of

time in a way which demonstrates both a good understanding of the Aristotelian position and a respect for Christian authority. He carefully combined Platonic, Aristotelian and patristic opinions to produce his own view, which, though not unique, provided a reasonable guideline for reconciling contradictory traditions. His work of synthesis, which his contemporaries and followers read avidly, helped to transform old ideas into new subjects for debate. Aquinas' writings about time are important, therefore, not so much because of their originality, as because they reintroduced the problem to scholars whose expertise in classical physics was becoming increasingly mature.

A useful way of beginning a review of Aquinas' view of time is to examine what he had to say about eternity, for, like many of his predecessors, he thought that the two concepts were interrelated. Aquinas accepted the standard distinction between the eternity of God, who is perfect and unchanging, and the transitory existence of created being. Like Augustine, Aquinas stressed not only God's all-encompassing nature but also his active participation in everything he creates. Thus Aquinas states in the *Summa theologica* that God "is infinite and comprehends within himself the plentitude of all perfection of all being," whereas every creature is mutable.[34]

Aquinas then proposes the distinction between God's complete perfection and the mutability of creation as the principle for distinguishing time from eternity:

> Some seize on this as the difference between time and eternity, that time has a beginning and an end, but eternity not. This difference, however, is quite incidental and not essential; for even granting that time always was and always will be, there remains this difference between them, that eternity is simultaneously whole, whereas time is not. Eternity is the measure of permanence; time the measure of change.[35]

Aquinas' view of time and eternity reflects the influence of both the Platonism of Augustine, which emphasizes time as a function of creation, and the Aristotelian position that time is a function of change.

Much of Aquinas' discussion about time and eternity can also be seen as a modification of Augustine's psychological view of time. In Aquinas' opinion, the distinction between time and eternity is important not just because it allows the memory to separate past and future but because it facilitates the attainment of different kinds of knowledge:

> The higher reason and the lower reason, of which Augustine speaks, are in no wise distinct faculties. For he says that by the former a man is intent on things eternal, contemplating them in themselves and consulting them for his rule of conduct, while by the latter he is intent on things temporal. Now these two, namely eternity and time, are so related that one is the medium in which the other is known. For in the order of discovery, we come to the knowledge of things eternal through things temporal, according to the words of St. Paul, *the things of God are clearly seen, being understood by the things that are made*. On the other hand, in the order of interpretation, we judge of temporal things in light of eternity and dispose of temporal matters according to eternal laws. The higher and the lower reason, then, are one and the same faculty, distinguished only by different habits and active functions. Wisdom is attributed to the higher reason, scientific knowledge to the lower.[36]

Aquinas also observes that Augustine's conception of memory underestimates the complexity of the relationship between the intellect and time. Pastness, for example, can be applied either to an object or to an act of knowing an object in the past. In the case of an object, its being in the past, present or future is incidental; but in the second case, "the pastness of an act can be essential to the intellect, for our act of understanding is a particular activity at a certain time."[37] In Aquinas' more highly developed ideas about sense, intellect and knowledge, it is not accurate to confine the conception of past, present or future to the mind alone. Aquinas

therefore advocated a broader approach to time which also included Aristotelian observations about motion and change.

How, then, does Aquinas define the human experience of time? First of all, he emphasizes that time has both intellectual and physical dimensions and is a state which affects only created beings:

> Because our knowledge is enclosed in the order of time, either directly or indirectly, the time-factor enters into our calculations, and our knowledge reckons things as past, present, or future. Past, in memory; present, in experience; future, by anticipation in present causes. Future events are either certainties, when they are wholly determined in their causes, or conjectures, when they can usually be forecast, or unknown, when their causes are not yet committed to action.
>
> God, however, is entirely above the order of time. He is at the peak of eternity, surmounting everything all at once. Thence the stream of time can be seen in one simple glance.[38]

Aquinas shows here his agreement with Augustine and Boethius that God, being above time, sees all creation as a totality, whereas his creatures must experience existence as a continuous succession of nows; this notion has important implications for subsequent discussions of human will and contingency.[39] Moreover, although God actively participates in his creation, he does so in a way that does not change him: "Since God is outside the whole scheme of creatures, though all of them are ordered to him, and not conversely, it is clear that while creatures are really related to God, in God there is no real relation to creatures, but only a logical one."[40] The two main features of Aquinas' view of time, therefore, are that God created time for a specific purpose along with the rest of the universe, and, ultimately, that the measure of time is the divine will, which is eternal. It is pointless to ask precisely when God created time because such a question implies that there was time before creation by which one could measure the event, and this is impossible.[41]

Second, Aquinas acknowledges that our perception of time depends to some extent on motion. In fact, much of his language about time reflects his dependence

on the Aristotelian tradition: time is *aliquis motus*, an aspect of motion; time is a continuum; time is a number which arises from the division of motion; time is an image of motion.[42] Just as he refuses to accept Augustine's view of time uncritically, so Aquinas also draws out of Aristotle the themes which best support his own view while dismissing what he thinks is incorrect. Although he discusses time in terms of motion according to the Aristotelian tradition, for example, Aquinas recognizes that the concept of motion itself poses serious difficulties for the natural philosopher. In his commentary on Aristotle's *Physics* he prefers to describe the relationship between time and change, rather than time and motion, because "any process is a kind of change and [even] what happens suddenly is temporal, for it is what happens in a moment of time. Time itself is defined in terms of change."[43] Nor can Aquinas accept what he considers Aristotle's rather primitive assertion that time and motion are essentially different aspects of the same phenomenon. In his commentary on Aristotle's *Metaphysics*, therefore, Aquinas asserts that "Aristotle was convinced that motion was everlasting, and time likewise. But his arguments [in the eighth book of the *Physics*] are probable and not cogent, except perhaps as disproofs of some early physical theories about the inception of motion."[44]

This criticism of Aristotle rests on the distinction which Aquinas liked to make between eternal and created being: "For time itself is contained in the universe, and therefore when we speak about creation we should not inquire at what time it happened."[45] The only appropriate context for the question whether the world existed before time is a purely logical one in which one can consider "an instant before any other instant."[46] So, although Aquinas was fascinated by the philosophical implications of time and eternity for creation and made repeated references to this topic in his commentaries on Aristotle, his theological impulse was to accept Augustine's conception of time and matter as created and not eternal. Aquinas' willingness to discuss the question of the eternity of the world and even to

suggest ways of treating it without contradicting scripture nevertheless reflects his strong desire to reconcile Christian and Greco-Arabic traditions.[47]

Aquinas also demonstrated his capacity for synthesis in his analysis of time as a continuum. Although we think of time as a succession of before and after, we cannot grasp the now which is fleeting and unsubstantial. Neither is it a simple matter to measure time by observing change for change has the same characteristic as time: both "have potentiality mingled with actuality."[48] The now of time shares certain features with a point on a line, in that it represents part of a continuous sequence; but unlike points which make up a line, nows do not produce measurable substance. The now is like a point mainly in its capacity to connect past to future.[49] Because the now is dimensionless and has no substance, it cannot have number in the conventional sense: number is impossible without substance, continuum or quality.[50] To the extent that time can be measured, therefore, it must be measured in respect of the continuous succession of nows and not on the basis of the duration of a single now. Aquinas thus was forced to consider the same sorts of problems about time which his predecessors had faced, and his attempt at synthesis led him to accept both a modified psychological view of time as far as perception is concerned and a modified statement of Aristotelian physics regarding the measurement of time.

Aquinas' view of time, therefore, is a composite of several traditions. Modern commentators generally concede that his views were mostly in keeping with Aristotle and that Averroes' reevaluation of Aristotle strongly influenced him.[51] It has been suggested, however, that, unlike Aristotle or his teacher Albertus, Aquinas thought of time less as a factor in scientific inquiry than as a subject for philosophical inquiry, because he did not consider time, space or motion to be subsistent things.[52] Although he did not contribute much to the solution of problems involving the physical manifestations of time, he took the original step of

isolating some aspects of the problem of time from physical, theological and psychological considerations and so introduced a distinctly philosophical approach to time.

The type of intellectual activity which Albertus had tried to instill in Aquinas and other continental scholars had a counterpart in England. In some respects, the study of natural philosophy as an adjunct of theology became by the end of the thirteenth century an even stronger feature of the curriculum at Oxford than it was at Paris. The importance of this trend was two-fold for Bradwardine, who like many other students, benefited enormously from the vibrant interactions of logicians, natural philosophers and theologians who were active at Oxford at the turn of the fourteenth century. First, as the reputation of Oxford became identified increasingly with the physical and mathematical studies of such men as Roger Bacon and Robert Grosseteste, the arts curriculum at Oxford began to favor subjects like astronomy, mathematics and optics. Second, because Oxford continued to promote theology as most worthy of advanced study, the best arts students were encouraged to suspend their studies of natural philosophy in order to take higher degrees in theology, with the result that many young scholars left their "scientific" pursuits just when they were just beginning the most productive stages of their intellectual development.

Of the several thirteenth-century English thinkers who shaped intellectual life at Oxford, Robert Grosseteste and John Duns Scotus most influenced fourteenth-century approaches to time. While Duns' work was fundamentally philosophical and theological in nature and therefore speculative rather than empirical, Grosseteste's achievements are usually associated with his dedication to experimental science. Like Albertus, Grosseteste is noted for the breadth of his interests. Born in 1175, he studied at Paris and at Oxford, where he became a master of theology, and later served as the chancellor of Oxford.[53] The summit of his ecclesiastical career was his service as bishop of Lincoln between 1235 and 1253.

During his lifetime, he was not only an active administrator but also a productive writer. Before his election to the see at Lincoln he composed commentaries on the Bible and on Aristotle. After 1235 he was engaged in translating Aristotle from Greek to Latin. Throughout this entire period he regularly composed original treatises on a variety of topics in natural philosophy, including logic, mathematics and optics, for which he is best known.[54]

The source of the view that Grosseteste advocated a kind of experimental science is his commentary on Aristotle's *Posterior Analytics*. In this treatise Grosseteste explored Aristotle's claim that the purpose of natural philosophy is to acquire demonstrable knowledge of observable phenomena. A. C. Crombie develops the thesis that Grosseteste derived from Aristotle the notion that "scientific knowledge, properly speaking, was the demonstrative knowledge of things through their causes, and its instrument was the demonstrative syllogism, which established the connexion between premisses and conclusions, or causes and their effects, through the middle term."[55] In his commentary on the *Posterior Analytics* Grosseteste seemed to envision science as an intellectual activity which applied observation and mathematical precision to the examination of matter. Indeed, he claimed that real science is "the comprehension of the truth of those things which always behave in a given manner, and in mathematics both the premisses and conclusions are known in this way . . . . Therefore, to know simply and most appropriately is to understand the unchanging cause of a thing in itself, . . . and this knowledge is the most special goal of this [metaphysical] science and is acquired by demonstration most properly so called."[56] On the basis of this and other passages from Grosseteste's writings, Crombie argues that Grosseteste devised a theory of scientific investigation which became the foundation of modern empirical science. Grosseteste's extensive commentaries on many topics in natural philosophy and his

praise of mathematical applications to physics lend support to Crombie's interpretation.

More recently, however, this view has been questioned. Eileen F. Serene suggests, for example, that Crombie has placed too much emphasis on Grosseteste's and Aristotle's concern for demonstration, since they were primarily concerned not with empirical but rather with logical verification of natural phenomena. Furthermore, Grosseteste's philosophy was so heavily influenced by Augustinian Neoplatonism that it is misleading to overemphasize the connections between Aristotelian physics, Grosseteste's methods of inquiry and modern science.[57] Nevertheless, Grosseteste's belief that certainty comes as a result of divine illumination which only clarifies what already exists in the mind, encouraged natural philosophers to make careful observations and to interpret them in reasonable ways.[58] The most intriguing aspect of his philosophy, therefore, was not his experimental method but his conviction that questions about God and about the human capacity to understand the physical universe are fundamentally related. To the extent that Bradwardine shared the same conviction, he was undeniably one of Grosseteste's most successful followers.

James McEvoy develops at length Serene's thesis that Grosseteste's philosophy displays a subtle blend of Aristotelian and Augustinian elements. According to McEvoy, Grosseteste's cosmology was essentially Aristotelian. By carefully comparing Grosseteste's views to Aristotle's, however, McEvoy exposes significant deviations. While he readily accepted Aristotle's treatment of the physical aspects of time, for example, Grosseteste, like many of his contemporaries, rejected Aristotle's belief in the eternity of the world. Instead, Grosseteste advocated a cosmology which acknowledged the world's creation in time. Moreover, Grosseteste's enthusiasm for describing nature mathematically has no counterpart in Aristotle.[59] In his treatise *Concerning Lines, Angles and Figures*,

Grosseteste claims that there is a recognizable mathematical component in all natural phenomena: "all causes of natural effects can be discovered by lines, angles and figures, and in no other way can the reason of their action possibly be known."[60] According to McEvoy, this notion emerges with even greater force from his *Notes on Physics*, in which Grosseteste "describes God as a mathematician who established the basic indivisible units of space and time from which the whole extension of the material world is effected."[61]

Grosseteste also considered the validity of Aristotle's definition of time as a measure of motion, concluding that he had failed to demonstrate concretely the reality of time. In his own explanation of time, Grosseteste, like many before him, compared time to a line, arguing that, because both the line and time have a single infinite dimension, exact numerical measurement of either puts one "in an area of such difficulty that it lies almost beyond the scope of the human mind."[62] Nevertheless, although Grosseteste admitted that time defies accurate measurement, he believed, according to McEvoy, that there is "an ultimate foundation of the extension of space and time, a final unit and measure which determines their nature."[63] The human mind is incapable of comprehending the infinity of time and space, which consists of an extension of infinite points. Only God, who possesses wisdom "without number," can perceive and measure time and space accurately: for God an infinite number is as finite as the number two is for us.[64] Although Grosseteste did not go on to develop possibilities for coping with the difficulty of measuring time, his conception of time as the creation of a mathematical God helped to transform the problem of time into a geometrical one, a change which had an obvious impact on Bradwardine's thinking about time, space and motion.

The contribution of Duns Scotus to the medieval discussion of time is more philosophical than scientific. Duns was born in Scotland in 1266, a little more than

a decade after Grosseteste's death. He was a Franciscan who studied and taught in Paris, Oxford and Cambridge. Before his death in 1308 he composed an extensive array of philosophical works, including commentaries on Aristotle's metaphysical works, commentaries on the *Sentences* and several original treatises. His most important work, the *Opus Oxoniense*, appears to be a written compilation of the course which he gave at Oxford, but it contains his most mature reflections on many philosophical and theological problems and so has been called his "definitive work and masterpiece."[65] Even as a young student Duns showed a remarkable talent for metaphysical speculation which his teachers recognized and helped him to develop. Later as a teacher he earned the title of Subtle Doctor, which attests to the respect which he received from his students and peers.[66] Duns' thought deserves to be considered, therefore, not only because he proposed original solutions to a wide range of philosophical problems but also because he attracted a large following, particularly at Oxford.

Duns' philosophy must be seen in the context of the debate which raged in his day over the relative merits of Augustinian and Aristotelian metaphysics. Both sides accepted "the strict metaphysical transcendence of God over creatures." They disagreed when it came to defining the precise relationship of God to his creation.[67] In response to the burst of interest in Aristotelian philosophy in the second half of the thirteenth century, many conservatives complained that Christian interpreters of Aristotle, particularly Aquinas, stressed too much God's transcendence and urged instead a more Augustinian approach which did not depend on such a rigid separation of God and creation. Threatened by the radical Aristotelianism espoused by certain followers of Averroes, theologians from many schools, including some Dominican masters, raised opposition to even the moderate Aristotelianism of Albertus and Aquinas. The most vocal opponents of Aristotelian philosophy, however, were the Franciscans.[68] As a Franciscan, Duns responded to the dispute

not by taking a side but by trying to synthesize a new philosophical system which preserved the best features of both approaches. To achieve such a synthesis, he criticized both traditions with great skill and insight.[69] His comments on time and space in particular reflect his subtle reconsideration of both Aristotelian and Augustinian metaphysical theory.

In his analysis of time as a phenomenon of nature, Duns readily accepted Aristotle's definition of time as the measure of motion. In the *De rerum principio* Duns confirmed Aristotle's assertion that motion and time are different aspects of the same thing.[70] Duns also maintained, however, the validity of Augustine's view that the human experience of time is subjective because time consists of a continuum of unanalyzable nows. To support his synthesis of the two positions Duns recounted Aristotle's story of the sleepers of Sardis which illustrates how our sense of time comes from the subjective experience of before and after rather from the objective observation of motion. When the sleepers awoke they failed to realize that any time had passed because the last now of their former consciousness was linked to the first now of their waking; thus the intervening time was essentially lost to them. Duns then related Aristotle's story to the common experience of falling asleep and awakening in a dark place: usually we cannot tell what time it is without referring to an external source of information.[71]

This is not to say that there is no objective basis for time, but merely that we cannot easily recognize it. Our perception of time relies on our perception of the sequence of past, present and future, which has nothing to do with motion itself, though it does involve change.[72] Duns warns us not to confuse his acknowledgement of the difficulty of measuring time with an acceptance of Augustine's position. In Duns' opinion Augustine erred by conceiving of time purely subjectively and by failing to "consider it a property of real things."[73] Nor does

Duns entirely accept Aquinas' objective conception of time, which identifies the unity of time with "the unity of the first heaven, by which all motion is measured."[74]

Because he wished to preserve some features of Augustinian subjectivity while retaining the basic objectivity of Aquinas' view, Duns attempted to reconcile the two approaches. Thus he proposed that "time and motion are objectively (*in re*) identical, but conceptually (*formali ratione*) diverse. According to its *esse materiale*, time exists in things; according to its *esse formale*, in virtue of which it is to be called time in the truest sense, it depends on the mind and exists in the mind."[75] Duns insisted that his view was in keeping with Aristotle and Averroes, both of whom stressed that time has a universal nature as the number of motion and a subjective nature, because the number of time is determined by the mind.[76] Although time is the objective measure of motion, we perceive time subjectively as a continuum of past, present and future.

Duns next suggested that the real problem with previous efforts to understand time lay in the tendency of some of his predecessors to identify time and motion when, in fact, they are significantly different:

> Motion, therefore, taken in its strictest sense, does not include in its notion the concepts of before and after, except potentially, in so far as these may be added to it by thought. But time includes them formally in its concept and is therefore partially subjective, being a measure of motion. It is plain, then, that from the standpoint of the objective world motion is more real than time, for motion is in its essence the continuous flux whose being is not derived from thought, but quite independent of it. Time, consequently, has a feebler being than motion, and is less real.[77]

The relationship between time and eternity rests on this concept of time's weakness compared to motion. Time is the measure of change in corruptible being; eternity, because it is completely removed from time and is a feature of God's perfect, unchanging being, cannot be measured. Between time and eternity is the aevum, which governs such created beings as angels and heavenly bodies which have a

beginning in time, but only potentially an end, because they do not pass in and out of existence as earthly creatures do.[78]

Duns' synthetic view of time was essentially a reconsideration of his predecessors' distinction between time and motion from the perspective of their distinction between time and eternity. In forging this synthesis, Duns was especially indebted to Aquinas' own efforts to reconcile Aristotelian and Augustinian views of time. Like Aquinas, Duns ultimately failed to provide a solution to the problem of measuring duration when time is defined as having both objective and subjective characteristics. Duns admitted that there must be some principle which explains time, aevum and eternity in terms of each other, but he was unable to propose either a mathematical or a philosophical principle which determined precisely how they coexist.[79] Thus he was caught up in the same dilemma over time which had frustrated natural philosophers and theologians since the classical period.

In many respects, therefore, temporal theory itself seems to have developed little in the late twelfth and thirteenth centuries although Christian thinkers learned to approach the problems surrounding time with increasing sophistication. The prevailing tendency of the age either to correct the Aristotelian position or to integrate Aristotelian and Augustinian principles was not confined to the problem of time, which was only one of many philosophical and theological problems under discussion in this period. The real achievement of thinkers like Albertus, Aquinas, Grosseteste and Duns was not that they solved any of these problems but that they embraced new ways of seeking the truth about the connection between natural phenomena and God's plan for creation. The foundation of these accomplishments was the body of scientific and philosophical material which had become available at the end of the twelfth century. By the end of the thirteenth century the energetic interplay between advocates for Greco-Arabic learning and their conservative critics had given way to a more serious debate about the possibility of reconciling the two

traditions. It was during this troubled phase of speculation that Bradwardine entered Oxford as a young student in the early fourteenth century.

CHAPTER FOUR

MATHEMATICS, PROPORTIONALITY AND TIME

If the thirteenth century was the age of Aristotelian revival in the medieval universities, the early fourteenth century was a period of great diversification in the application of classical philosophical methods to problems of contemporary interest. The basic tools of propositional logic and Euclidean mathematics which accompanied the Aristotelian revival allowed fourteenth-century thinkers to develop a variety of new approaches to long-standing philosophical dilemmas about complex issues such as time. The expansion of the curriculum in natural philosophy, especially at Oxford, encouraged students to conceive of old problems, even theological ones, in new ways.[1] This movement has been called the "mathematization" of theology because fourteenth-century theologians not only discussed theological questions in physical and mathematical terms but in some cases adopted the axiomatic model of Euclidean geometry to present their theological arguments.[2]

Bradwardine's academic work provides an excellent illustration of this tendency towards "mathematical" theology. His mastery of Euclidean geometry and Aristotelian physics is a central feature of all of his major treatises. Indeed, Bradwardine achieved such a high standard of mathematical logic that he was able, both in philosophical and theological texts, to launch devastating attacks against his opponents. Unlike most of his contemporaries, who composed lengthy and exhaustive refutations of their opponents' views, Bradwardine took a much more subtle approach: he criticized his opponents by isolating the principles which

underlay their primary assertions and then systematically exposed their weaknesses them using the axiomatic methods of Euclidean geometry.[3] The next three chapters of this dissertation trace the development of Bradwardine's critical method through an examination of his treatments of time as a physical phenomenon and a philosophical problem.

Because Bradwardine's reputation rested, in his own age and for several centuries to follow, on his mathematical works, it is appropriate to begin to explore his views about time by reflecting on one of his early scientific treatises. The *De proportionibus*[4] clearly demonstrates the capacity for mathematical reasoning which characterize all of Bradwardine's works, including those devoted exclusively to philosophical or theological topics. Written in 1328, when Bradwardine was just embarking on his theological studies, the *De proportionibus* proposed an unusually precise mathematical language for describing various kinds of motion than had been available previously. His colleagues at Merton not only received it enthusiastically themselves but, by their frequent references to it in their own treatises, helped to ensure its circulation among all the European universities. Indeed, by the end of the fourteenth century, the *De proportionibus* had become standard academic reading and its principles profoundly influenced physical speculation of all sorts for at least another century.[5]

The significance of Bradwardine's mathematical approach to natural philosophy goes well beyond his attempt to discuss motion, space, time and other physical phenomena in terms of a well-ordered geometrical system. Bradwardine was certainly not original in his zeal for applying mathematics to physics nor were many of his observations about motion entirely correct, at least if judged by modern standards. In her study of late medieval physical theory, Anneliese Maier portrays Bradwardine as a precocious thinker handicapped by the rudimentary level of mathematical knowledge in the early fourteenth century. Referring to the depth of

his mathematical insight, Maier comments: "One might almost say that Bradwardine would have wanted to write the *Principia mathematica philosophiae naturalis* of his century,"[6] but she goes on to demonstrate why he was unable to do so. Bradwardine's generation lacked the knowledge of certain aspects of higher mathematics such as logarithms and the calculus which are necessary for developing a comprehensive mathematical description of the problems which interested them. Moreover, when Bradwardine left Oxford a few years after writing the *De proportionibus*, his concentration on natural philosophy in an academic setting came to an end. In spite of these obstacles, however, Bradwardine produced in the *De proportionibus* a mathematical approach to physics which stimulated interest in natural philosophy for several generations. The *De proportionibus* is also an important historical text. Through it, the historian can discover how scientific information passed from scholar to scholar and how thinkers like Bradwardine responded to the views of their predecessors. The obvious sources for Bradwardine's speculations about motion are Aristotle's *Physics* and Euclid's works on geometry, but medieval thinkers such as Robert Grosseteste and Roger Bacon offered precedents for applying mathematics to physics which also influenced Bradwardine's scientific works.[7]

The purpose of this chapter is to analyze the *De proportionibus*: first, as a text of general interest in the history of late medieval science; second, as an extension of Bradwardine's mathematical thought which originated in his short treatise, the *Geometria Speculativa*; and third, as an illustration of his analytical approach to time. Although the *De proportionibus* is not specifically devoted to the problem of time but only concerns time as an incidental feature of motion, it helps to clarify Bradwardine's conception of the relationship between time and motion. This discussion of the *De proportionibus* will suggest that Bradwardine's scientific thought was firmly rooted in an Aristotelian tradition and that, despite his

willingness occasionally to correct or modify Aristotelian definitions, he largely adopted Aristotle's description of the physical universe. The novelty of Bradwardine's work lay in his attempt to use geometry to reconcile contradictions in traditional physics which previous Aristotelians such as Avicenna and Averroes had been unable to resolve because they did not supplement their philosophical approaches to physics with mathematical analysis.

A review of the main themes and structure of the *De proportionibus* emphasizes the significance of this work in early fourteenth-century scientific thought. In his introductory remarks Bradwardine set out both his intentions for the treatise and also his general views about the applicability of mathematics to the study of physics:

> Since each successive motion is proportionable to another with respect to speed, natural philosophy, which studies motion, ought not to ignore the proportion of motions and their speeds, and, because an understanding of this is both necessary and extremely difficult, nor has as yet been treated fully in any branch of philosophy, we have accordingly composed the following work on the subject. Since, moreover (as Boethius points out in Book I of his *Arithmetic*), it is agreed that whoever omits mathematical studies has destroyed the whole of philosophic knowledge, we have commenced by setting forth the mathematics needed for the task in hand, in order to make the subject easier and more accessible to the student.[8]

Following this preface, Bradwardine spelled out in four chapters precisely how he proposed to establish Aristotle's thesis concerning the proportionality of motion, proceeding from general definitions and properties of proportions to criticism of four attempted revisions of Aristotle, to a discussion of the relationship between force and resistance, and, finally, to an analysis of the principles of circular motion, which was commonly held to be the most regular and perfect kind of motion. Bradwardine's insistence on defining the problems surrounding motion mathematically and according to Euclidian patterns of suppositions sets his analysis

apart his predecessors, who had not appreciated the advantages of approaching studies of motion in this way.

Beyond the insights which this introduction provides into Bradwardine's purpose in the *De proportionibus*, it reflects his commitment both to the Aristotelian tradition, which identified the study of nature with the study of motion, and to the Platonic tradition, which emphasized mathematics as the appropriate language for philosophical and scientific discourse. The rest of the *De proportionibus* reveals, however, that Bradwardine did not wish to use mathematics in a purely Platonic way, that is, as a description of a natural order which could be perceived through philosophical speculation. Nor was he content with an Aristotelian approach to motion, whose theories did not take into account sufficiently the axiomatic principles of mathematics.

The *De proportionibus* not only incorporated features of these ancient schools of thought, both of which had been widely pursued in the thirteenth century, but it also presented a novel approach to natural philosophy based on a mathematical view of nature. Bradwardine's work on the proportionality of motion helped to push discussions of natural philosophy in new directions and to encourage speculation among his peers, principally his colleagues at Merton, the Oxford "Calculators." It is useful, therefore, to look at the antecedents of his mathematical thought, both in the ancient sources of Plato, Aristotle, Euclid and Boethius and among his more immediate predecessors. Only then can his views be seen in the appropriate context and the themes which have particular significance for his view of time be adequately isolated and evaluated.

Bradwardine's convictions about the applicability of mathematics to nature stemmed from a long debate which dated from the classical period. Because the classical philosophers had often approached the problem of time mathematically and described time geometrically, the philosophical issues which shaped this debate

deserve attention.[9] The disagreement between Plato and Aristotle over the role of mathematics in natural philosophy was fundamentally cosmological. Plato's view of the material world rested on his belief that being is composed of four elements, earth, air, fire and water, each particle of which is a definite, regular geometrical shape. The unity of the universe and the course it takes in its development come from the mathematical rule of geometric proportion. Thus one cannot attain complete knowledge of the sensible world without comprehending the mathematical framework which determines its forms. According to Plato, therefore, the pursuit of natural philosophy demands the contemplation and the analysis of mathematical laws which govern the form of matter, not the observation of natural phenomena as such.

Although Aristotle considered mathematics an extremely useful tool for scientific investigation, he completely rejected the notion that all knowledge of the world must be expressed in the abstract terminology of mathematics. Such an approach would make it impossible to consider sensible qualities which are at the heart of physical investigation. Thus he remarks in the *Metaphysics*:

> . . . in his investigations [the mathematician] first abstracts everything that is sensible, such as weight and lightness, hardness and its contrary, and also heat and cold and all other sensible contrarieties, leaving only quantity and continuity - sometimes in one, sometimes in two and sometimes in three dimensions - and their affections *qua* quantitative and continuous, and does not study them with respect to any other thing.[10]

The mathematician, moreover, shares in the process of scientific investigation by evaluating information, but he does not dominate it. In the discipline of astronomy, for example, " . . . it is the business of the empirical observer to know the fact, of the mathematician to know the reason for the fact."[11] Without denying the validity of mathematics as a scientific resource, Aristotle minimizes its position in natural philosophy on account of its inability to express real, sensible features of the

universe. His conflict with Plato centers on their divergent views about the nature of reality itself.

Both sides in this dispute found their way into early medieval philosophy. Augustine and Boethius focused on the Platonic concept of the mathematical order of nature and asserted that creation proceeds according to numerical principles in the mind of God. It was Boethius, however, who also established the medieval classification of disciplines along Aristotelian lines.[12] Throughout the earlier Middle Ages, such thinkers as Hugh of St. Victor, Thierry of Chartres, Gilbert of Porrée, William of Conches and Clarembaud of Arras recognized the distinctions between mathematics and physics although they were not entirely free from the temptation to emphasize the transcendence of numbers in the natural order. In his *Didascalicon*, for example, Hugh of St. Victor accepted aspects of both Aristotelian and Platonic approaches to mathematics. On the one hand, his conception of scientific disciplines was rooted in Aristotle's notion of sensible entities. He distinguished between mathematics, which treats abstract things such as lines and surfaces, and physics, which concerns real things. Thus mathematics "has its business in the consideration of things which, though actually fused, are rationally separated by it. . . . The business of physics, however, is to analyze the compounded actualities of things into their elements."[13] In his treatment of the soul, however, Hugh accorded to the study of numbers a metaphysical reality far greater than Aristotle had ever acknowledged. In fact, for Hugh "number itself teaches us the nature of the going out and the return of the soul."[14]

Bradwardine's immediate predecessors in the thirteenth century wrestled with the same ambiguity about the proper role of mathematics in natural philosophy. This conflict is best illustrated by Grosseteste, who tried to integrate physics and metaphysics along mathematical lines. Grosseteste is best known for his development of the "metaphysics of light," a system which sought to define the

function of light in the creation of the universe. He did not confine his speculations to natural philosophy; theology, epistemology and metaphysics all contributed to his synthesis. Although his use of light to explain the creative forces of the universe had Platonic origins, many of his concrete statements about mathematics and physics were more in keeping with Aristotelian principles of natural philosophy. Grosseteste might have been attracted to Neoplatonic discussions of light because of his interest in giving natural phenomena mathematical explanations. His consideration of the Neoplatonists and the Muslim philosopher Alkindi led him to develop a "light metaphysics" based on geometrical optics, which he hoped could be verified experimentally.[15] Basing his system both on the geometrical concepts of Neoplatonism and on Aristotle's scheme of four elementary spheres, Grosseteste tried to accommodate the ideas of both traditions in a single physical system which was also thoroughly in harmony with his Christian theology.

In his commentary on Aristotle's *Physics*, Grosseteste expressed a view concerning the proper relationship between mathematics and time which was later echoed by Bradwardine. Grosseteste asserted that mathematics and physics

> have much common ground and because of this a physicist can easily make the mistake of thinking that mathematical being is physical being and that physical being is mathematical being; and so that he [Aristotle] himself will not in this science [physics] suppose something purely mathematical to be a demonstration on the assumption that it is physical, or omit something physical on the ground that it is mathematical, he subtly shows the difference between physics and mathematics so that it may be possible to distinguish what belongs to this science and what not. And so I say that there are three things, namely, physical body, magnitudes which belong to physical bodies, and accidents of bodies purely speaking. Mathematicians abstract magnitudes from motion and matter and have as subjects abstract magnitudes, and from these they demonstrate accidents which are *per se* accidents of magnitudes. But the physicist does not demonstrate *per se* accidents of magnitudes as belonging simply to magnitudes, but he demonstrates the figured magnitudes of physical bodies as belonging to physical bodies in so far as they are physical.[16]

Thus Grosseteste affirmed Aristotle's distinction between the abstract analysis of the mathematician and the observation of sensible qualities which is the proper task of the natural philosopher.

In his geometrical treatise, *Concerning Lines, Angles and Figures*, Grosseteste emphasized the essential place that mathematics holds in physical investigations. According to Grosseteste, the mathematician helps the physicist to elucidate the structure of things by providing a system for describing natural phenomena.[17] In a continuation of this treatise entitled *De natura locorum*, Grosseteste stressed the necessity of mathematical analysis in the study of light. As a conclusion to his discussion of reflection and refraction of light, for example, he claimed:

> These rules, foundations, and fundamentals having been given by the power of geometry, the diligent investigator of natural things can in this manner specify the causes of all natural effects. And he can do this in no other way, as has already been shown in general, since every natural action is varied in strength and weakness according to the variation of lines, angles and figures.[18]

Through this study of light and his commentaries on Aristotle, Grosseteste achieved a balance between Platonic and Aristotelian views which gave mathematics a prominent place in natural philosophy while preserving the integrity of investigation based on the observation of sensible qualities. In Grosseteste's view, the world is not composed of mathematical entities, but it exists in patterns which mathematics can explain and describe once observations have been made.

Another thirteenth-century thinker who stressed the importance of mathematics to scientific inquiry was Roger Bacon. In his *Opus maius* Bacon argues that Aristotle himself placed the highest value on mathematics as a method for determining the causes of things:

> But only cause leads to true knowledge (*scientia*), or at least it does so far better than effect, since Aristotle says in the *Posterior Analytics*, book I, that we think we know when we

> know the causes. Therefore, since demonstration, as he says in the same place, is a syllogism causing us to know, demonstration by cause is necessarily far more powerful than demonstration by effect. . . . Therefore, since in natural things demonstration by cause is obtained by means of mathematics, and demonstration by effect is obtained through natural philosophy, the mathematician is better able to obtain true knowledge of natural things than is the natural philosopher.[19]

Mathematics maintains this advantage over natural philosophy because it can be used to create an internally consistent and self-verifying argument. Bacon contrasts science, which, "full of doubts and sprinkled with opinions and obscurities, cannot be verified except through other sciences," with mathematics, which "remains certain and verified to the limits of verification."[20] It is the philosophical rigor of mathematics, whose principles can be mastered by any educated person, which makes it indispensable for any advanced study of nature.

Bacon was certain, therefore, that mathematics could enrich the full range of human inquiry, including theology, not by reducing all subjects to numerical or geometrical forms, but by providing a precise vocabulary for describing those subjects. Like Grosseteste, moreover, Bacon believed that knowledge of God and the Scriptures depended on the scientific investigation, aided by mathematics, of all natural phenomena: "the theologian must know the things of this world if he wishes to understand the sacred text."[21] This progression of mathematics from a simple tool to a necessary language for natural philosophy and finally to a component in theological speculation underlay all discussions of mathematics in the early fourteenth century and must be taken into account in any investigation of Bradwardine's use of mathematics in his philosophical and theological studies.

Bradwardine's position on the role of mathematics in philosophical inquiry, as it emerges in the *De proportionibus* and even more fully in the *De continuo*, developed out of his early studies in elementary geometry. Since geometrical analysis is the hallmark of all of Bradwardine's work, it is worthwhile to look briefly

at one of his earliest treatises, the *Geometria speculativa*.[22] Bradwardine's purpose in writing this work was to organize the material on geometry which had been presented in lectures required for the master of arts degree. More a notebook than a treatise, the *Geometria speculativa* did not display particular originality although its clear and effective structure ensured its wide circulation among other students, first at Oxford but soon beyond England as well. The primary influences on this work, naturally, were Aristotle and Euclid, on whose texts the lectures on geometry were based. Bradwardine also drew on Boethius' *Arithmetica* and perhaps his *Musica*, as well as the Arabic commentaries on Aristotle.[23] The contents of the *Geometria speculativa* covered all the major topics of elementary geometry, including the definitions of points, lines and angles; Euclidean theorems regarding these definitions; an analysis of polygons and circles; an examination of ratios; and a study of regular solids and spheres.[24] Although Bradwardine occasionally took time to explore a current controversy over a geometrical problem, his treatise was essentially a systematic review of basic terms and concepts as they had been presented in the lectures. His arrangement and treatment of standard topics nevertheless reflect his own style of mathematical thinking and reveal many of his philosophical assumptions.

The *Geometria speculativa* nevertheless reflects some of the theoretical problems which mathematicians encountered in the thirteenth and early fourteenth centuries. One controversy which has already been mentioned was, of course, the question of how to use mathematics in the pursuit of natural philosophy. The mathematicians themselves complicated the discussion by taking different positions in the debate. Some mathematicians, following the Platonic tradition, argued that mathematics was a fundamentally conceptual activity; that is, they stressed the abstract qualities of mathematics and preferred to concentrate on abstract problems which were removed from any reference to physical reality. Others, who were more

sympathetic with the Aristotelian approach to physics, tried to make mathematics conform to sensible qualities and so have been called realists.

In the discipline of geometry, each side could claim to hold the ideologically stronger position. The conceptualists, being aware of the abstract nature of geometrical definitions and manipulations and comforted by the traditions of Platonism and Neoplatonism, argued quite convincingly that an understanding of geometry could reveal the mathematical basis of nature without any reference to the sensible world. The realists, on the other hand, claimed that geometry would be an empty discipline if it were not used to explore the physical world which directed and shaped human existence. Both sides encountered problems in defining the proper scope of geometrical studies. As A. G. Molland points out, "the realist may have had difficulties in adapting his geometry to the physical world, but the conceptualist could not easily find grounding for a mathematical natural science."[25] According to Molland, who has studied the *Geometria speculativa* at considerable length, Bradwardine's early position in this debate placed him near the realists. Because his analysis of geometrical subjects in this text routinely involved a statement of relevant Aristotelian principles, an exposition of the problems to which these principles generated and a brief consideration of possible solutions. In fact, the text came to be seen not as a general work on geometry as such, but as an Aristotelian manual, "gathering together all the geometrical conclusions which are most needed by students of arts and the philosophy of Aristotle."[26]

It is in the *Geometria speculativa*, for example, that Bradwardine first addressed the dilemma of infinity, a necessary concept in Euclidian geometry which directly contradicts Aristotle's assertion that the world is finite.[27] We shall return to this problem later in the discussion of the *De continuo*, but it is interesting to note here that, by referring to the problem at all, Bradwardine showed that he was already thinking about the difficulties of applying mathematical principles to natural

phenomena. Bradwardine also showed awareness of the opinions of Aristotle's medieval commentators, as when he discussed Averroes' interpretation of Aristotle's views concerning space. Indeed, Molland argues that, at least in the case of the *Geometria speculativa*, Bradwardine revealed much greater concern for theoretical questions than for technical issues such as geometrical exactness, though he did pay careful attention to the special problem of measurement.[28]

In the context of the *De proportionibus*, the most interesting section of the *Geometria speculativa* is the one which deals with ratio theory. Bradwardine first distinguishes between arithmetic ratios and the much wider range of geometric ratios and then devises a definition which would apply to both types. Thus he states:

> Because the intention of 'ratio' is extended and applied to almost all things that are mutually comparable according to greater and less, it can be defined in accord with this general concept: A ratio is a certain habitude of some things that are mutually comparable one to the other. For example, of a number to a number, a magnitude to a magnitude, a sound to a sound, a time to a time, a motion to a motion, a humour to a humour, a heat to a heat, a taste to a taste. But geometry ascribes the intention of 'ratio' to magnitude and has it to be defined thus: A ratio is a certain habitude of two qualities of the same genus, one to the other. I say 'of the same genus' because only such are mutually comparable.[29]

Bradwardine goes on to distinguish between rational and irrational ratios along the lines of Book V of Euclid's *Elements*:

> Ratio is divided into two species which are received in comparison with proportionally diverse quantities. For some quantities are communicating or commensurable, some incommunicating and incommensurable. Commensurable quantities are those for which there is a common quantity measuring them. One quantity is said to number another if when taken according to a certain number [taken a certain number of times] it produces it [the second quantity], as a foot line [produces] a two-foot line and a three-foot line. Therefore, a two-foot line and a three-foot line are communicating quantities which a foot line numbers by Two and Three. But quantities for which there is no common quantity numbering them are called incommensurable. Of this kind are the diagonal and side of a square. According to this,

> therefore, there are two species of ratios, namely rational and irrational. A rational ratio is found (*debetur*) in commensurable quantities, and it is the only one that is found in numbers. But an irrational one fits incommensurable quantities, but in nowise numbers. Whence it is manifest that the whole consideration of ratio concerns geometry, because every ratio is of magnitude, but not every ratio is numerable.[30]

Bradwardine's explanation of ratios rests initially, then, on the logical distinction between things which have a common denominator and those which do not. He was not primarily interested, however, in demonstrating this distinction mathematically. In evaluating this feature of Bradwardine's ratio theory, Molland suggests that Bradwardine's flexibility on this point helped him to develop his broader theories of ratios in series, or, in other words, his theory of proportions.[31]

At the heart of Bradwardine's theory of proportions is the concept of denomination, that is, the quantity or quality by which two commensurable things can be compared. He points out that both rational and irrational ratios can be denominated, though, of course, in different ways:

> A rational ratio therefore is immediately denominated by some certain number, for, since it is of commensurable quantities, it is necessary that the lesser or some part of the lesser should number the greater according to some number, on account of which Euclid says that of any two commensurable quantities the ratio of one to the other is that of a number to a number, and this will be clearer below. This species is divided in every mode, in which ratio is divided in arithmetic. For one is a ratio of equality, another of inequality. . . .
>
> An irrational ratio is not in this way immediately denominated by some numerical ratio, because it is not possible that some part of the lesser should be number the greater according to some number. But it turns out that an irrational ratio may be mediately denominated by number. For example, the ratio of the diagonal [of a square] to the side is half of a double ratio, and so other species of this ratio receive denominations by number.[32]

Bradwardine's logical analysis of irrational ratios continues with a further distinction, first introduced by Euclid, between ratios of lines which are commensurable in length only and ratios of lines which are commensurable in

respect of both length and power. He provides a method for producing an infinite series of irrational ratios by manipulating terms of previous ratios through division:

> Each species can be divided into as many species as there are ways for lines to be thus or thus incommensurable, for not only can lines be incommensurable in length only when they are as diagonal and square, but in other ways perhaps infinite [in number]. I speak similarly of lines incommensurable in length and power, because they are not only those that are taken as means between side and diagonal, and the means between the mean and them, and further the means between these and those, and so on indefinitely, but also many others.[33]

Although it is expressed primarily in abstract terms in the *Geometria speculativa*, this logical framework of ratio theory is the starting point in the *De proportionibus* for further consideration of a physical phenomenon, motion.

When Bradwardine returned later to the problem of ratio and proportionality, his intentions were much more specific; and the resulting work was much more original. He nevertheless drew on a large body of commentary whose contributors spanned the classical and medieval periods. As the *Geometria speculativa* indicates, proportional theory was widely discussed among Latin and Muslim mathematicians and was applied to the problems of arithmetic, algebra and geometry. Bradwardine expanded the scope of proportional theory in the *De proportionibus* by applying it to physics as well.[34] It was at this stage that his tendency towards realism, first suggested in the *Geometria speculativa*, fully emerged and his dedication to an Aristotelian physical theory became firmly established.

Bradwardine's originality lay not so much in his support for the idea that mathematics should be at the disposal of natural philosophy, for, as we have seen, he was not the first to make this claim. His reputation as an innovator rests instead on his fortunate application of proportional theory to a mechanical problem which had previously defied mathematical analysis. Bradwardine did not, of course, come close to articulating the principles of advanced mathematics which later allowed

Newton to explain the properties of motion more elegantly and, in a modern sense, more accurately; but his recognition that elementary geometry and algebra are inadequate for describing such concepts as force, velocity and resistance had a profound effect on future scientific investigation. Bradwardine's insight that the natural philosopher required a better mathematical language, coupled with his conviction that natural philosophy could not be well understood without mathematics, explains why historians associate Bradwardine with Galileo as formulators of modern scientific thought.

In the *De proportionibus* Bradwardine was chiefly concerned with demonstrating how the theory of proportions could be applied to the study of velocity so as to defend Aristotle's laws concerning natural motion.[35] According to Aristotle, the universe is finite, and the change which occurs within it is successive and takes place within time. Aristotle went on to define change as a kind of motion: change takes place as motion overcomes natural resistance in a successive, though not necessarily uniform, manner. Change, then, requires space, time and the superiority of a moving force over a resisting force. Yet Aristotle also admitted that some kinds of change do not appear to fit this definition. He affirmed, for example, that the heavenly bodies move even though they are not subject to any resistance; and although the heavenly bodies cannot be equated with time, an observer can measure time by marking their movements.

As we have already seen in the discussion of Averroes' criticism of Aristotle's view of time, Aristotle himself neither resolved this problem nor provided enough information for his successors to do so on his behalf. Medieval Aristotelians were willing to accept that a distinction had to be made between the two kinds of natural motion, that is, motion against resistance along straight lines as experienced on earth (rectilinear motion) and the free motion in the celestial sphere. They nevertheless believed that both kinds of motion should conform to the same laws.[36]

The search for these laws within the framework of Aristotelian physics as it was understood in the thirteenth and fourteenth centuries provides the context for Bradwardine's thesis about proportions.

In the thirteenth century considerations of the nature of motion focused on the differing explanations of two Muslim thinkers, Avempace and Averroes. Avempace's approach to the problem of the relationship of resistance to force in motion, based as it was on logical definitions of the celestial sphere, was essentially Platonic. He argued that, because heavenly bodies move at a steady rate and do not appear to encounter any resistance, the resistance which affects sublunary motion must be impeding a force which would otherwise move at a steady, absolute speed.[37] In other words, all motion would proceed at a determinate rate both in heaven and on earth if resistance were eliminated. Avempace reduced this theory to a simple arithmetic equation: v=f-r, that is, the velocity of an object is equal to the amount of force which overcomes the resistance which impedes it. This theory was in conflict with Aristotelian principles because it was based on a narrower definition of motion than Aristotle would accept. Avempace assumed that all motion is fundamentally regular, orderly, and consistent, which directly contradicted Aristotle's observation that motion is a kind of change. According to Aristotle, many motions, such as the motion of fire or that of a growing plant, are too irregular and complex to be accurately described with a simple mathematical formula like Avempace's.

Admittedly, Aristotle and his followers failed to provide an alternative theory. Averroes in particular struggled with this problem without producing a coherent solution. His suggestion, for example, that the heavenly bodies actually do encounter resistance, on the grounds that resistance is a necessary cause of the successive nature of motion, led him to conclusions which contradicted other Aristotelian positions and did not shed much light on the problem of comparing

different types of motion.[38] Nevertheless, Averroes' criticism of Avempace's theory of motion focused attention on the weaknesses of classical physics and stimulated discussions of those weaknesses throughout the thirteenth century. In spite of Averroes' objections, however, the simplicity of Avempace's explanation of force made it appear the more reasonable approach, and it won adherents even among those who sympathized most with Aristotle. H. Lamar Crosby observes that Thomas Aquinas, Roger Bacon, Pierre Jean Olivi and Duns Scotus were all influenced to some extent by Avempace's view.[39]

Bradwardine's contribution to this debate involved his mathematical insight into the rather vague use of the concept "ratio" within the Aristotelian tradition. Aristotle's law of motion states that the speed of a moving object depends on the *ratio* of its motive power (force) and its resistance: $v=f/r$; but his analysis of the relationship between force and resistance suggests that he had no rule in mind for calculating the force of any particular moving object. When Averroes turned to the same problem, he restated Aristotle's position without making it clear whether he believed that the ratio between force and resistance was a simple proportion or, if so, how such a simple proportion could explain changing rates of speed or irregular motions. Averroes simply declared, in opposition to Avempace, that "it is necessary that between the mover rand the thing moved there be a resistance.... [Therefore,] every motion will be according to the excess of the potency of the mover over the thing moved, and the diversity of motions in speed and slowness is according to this proportion which is between the two potencies and these resistances."[40]

What came to interest Bradwardine was the notion of "diversity of motions in speed and slowness." He was not satisfied simply to know that such a diversity had to exist whenever motion varied according to speed and slowness but wanted to be able to calculate this diversity mathematically. Thus, after giving an extensive review of the mathematics of ratio in the *De proportionibus*, he turned in the second

chapter to a refutation of common assumptions about the nature of motion. Bradwardine's first target was Avempace, whose theory he challenged on Aristotelian lines:

> Having looked into these introductory matters, let us now proceed with the undertaking which was proposed at the outset. At first, after the manner of Aristotle, let us criticize erroneous theories so that the truth may be the more apparent.
>
> There are four false theories to be proposed as relevant to our investigation, the first of which holds that: *the proportion between the speeds with which motions take place varies as the difference whereby the power of the mover exceeds the resistance offered by the thing moved.*[41]

Bradwardine based his criticism of Avempace on the observation (mathematical, of course, not experimental) that the halving or doubling of a force does not result directly in the halving or doubling of velocity. The relationship between force and resistance is proportional, so the change in velocity must proceed geometrically (that is, exponentially), not arithmetically:

> . . . it follows from [Avempace's] theory that, given two movers moving two *mobilia* through equal distances in equal times, the two movers, conjoined, would not move the two *mobilia*, conjoined, through an exactly equal distance in an equal time, but, instead, through double that distance. This consequence follows necessarily because the excess of the two movers, taken together, is twice the excess of each of them over its own *mobile*; for, just as anything having a value of 2 exceeds unity by 1, so two such '2's' (which make 4) exceed two '1's' (which make 2) by 2, which is twice the excess of 2 over 1. The foregoing holds in all cases in which two subtrahends are equally exceeded by two minuends.
>
> That the above consequence is false is evident from the foregoing argument in Aristotle, in Book VII of his *Physics*, where he demonstrates the following conclusion: 'If two powers move two *mobilia* separately, through equal distances in equal times, those powers conjoined, will move the two *mobilia* conjoined, through an equal distance in a time equal to the former one.' This argument of Aristotle is sufficient proof that the relationship between a single mover and its *mobile*, and a compound mover and its *mobilia*, is a proportional one.[42]

Bradwardine defended both Aristotle and Averroes from the charge that they perceived the diversity of motions as a matter of simple proportions:

> Nor can it be legitimately maintained that, in the passages cited, Aristotle and Averroes understand by the words 'proportion' and 'analogy,' arithmetic proportionality (that is, equality of differences), as some have claimed. Indeed, in book VII of the *Physics*, Aristotle proves this conclusion: 'If a given power moves a given *mobile* through a given distance in a given time, half of that power will move half the *mobile* through an equal distance in an equal time, because, 'analogically,' the relation of half the mover to half the *mobile* is similar to that of the whole mover to the whole *mobile*.' Such a statement, interpreted as referring to arithmetic proportionality, is discernibly false (as has already been made sufficiently clear in the first argument raised against the present theory). Moreover, regarding the same passage, Averroes says that the proportion will be the same 'in the sense that geometricians universally employ in demonstrations.'[43]

Even as Bradwardine defended the Aristotelian position, however, he enhanced it to make it conform to his own more sophisticated understanding of ratio theory. He similarly dismissed the next three theories, which relate to particular aspects of Avempace's original assertion. Throughout this discussion, Bradwardine repeatedly vindicated Aristotle and Averroes against the misjudgments of Avempace and his followers.

In his third chapter, Bradwardine suspended his criticism of others and offered a more positive approach to the problem of proportional motion, declaring confidently: "Now that these fogs of ignorance, these winds of demonstration, have been put to flight, it remains for the light of knowledge and of truth to shine forth. For true knowledge possesses a fifth theory which states that the proportion of the speeds of motions varies in accordance with the proportion of power of the mover to the power of the thing moved."[44] Arguing again that this proposition was thoroughly in keeping with the ideas of Aristotle and Averroes, Bradwardine actually suggested here a much more complex principle than any of his predecessors had ever stated either explicitly or implicitly.

Bradwardine's theory of the "proportionality of proportions," as it later came to be called, was based on his rejection of the traditional formulation of Aristotle's law of motion which claimed that velocity could be doubled either by doubling the force or halving the resistance. In the first place, although this particular ratio of force to resistance might be true in some cases, it could not be applied to all motion: most motions do not conform to a strict two-to-one ratio. Second, Bradwardine believed that a simplistic interpretation of Aristotle's law would suggest that any force can move any object, when in fact motion only takes place when force exceeds resistance. What was required instead was a new interpretation of the laws of motion which took into account the exponential character of force: to double a velocity, Bradwardine concluded, one does not double the force but squares it. Or, as Weisheipl explains,

> Bradwardine proposed a new law, maintaining that a double velocity must follow from the entire power-to-resistance ratio *duplata*, i. e., not multiplied by two, but squared, for twice a *proportio tripla* is one which contains the ratio 3:1 twice. But only the square of the ratio, i. e., only 9:1, contains twice the *proportio tripla*, for the ratio 9:1 is composed of 9/3·3/1. Thus only the ratio squared can give twice the velocity. Similarly, triple velocity follows from the ratio *triplata*, i. e., raised to the third power. Conversely, half the velocity would follow from the *medietas* of the ratio, that is, the square root of the ratio; one third of the velocity follows from the cube root, and so forth; thus the mover can never be less than the resistance. Bradwardine's exponential function was theoretically valid for all cases, and it eliminated the possibility of zero-velocity. Today the latter situation is taken care of by a logarithmic function.[45]

It is worth noting that, in spite of Bradwardine's originality in devising this fifth theory, neither he nor his contemporaries realized how great an advance he had made over his predecessors. Bradwardine, with abiding respect for Aristotle, merely assumed that he had discovered Aristotle's original intention; and his contemporaries responded to the fifth theory not so much because they perceived it

to be original as because it presented a plausible explanation of Aristotle's law of motion.[46]

In the final chapter of the *De proportionibus*, Bradwardine addresses the special problems of circular motion which Avempace's references to the celestial sphere had prompted. Bradwardine acknowledged that rectilinear and circular motion had different characteristics but insisted that both kinds of motion were subject to the same laws of proportionality. The purpose of the fourth chapter, therefore, was to demonstrate the influence of proportionality on the motions of geometrically different entities. His conclusion was, essentially, that proportional motion applies equally to a body moving in a circle or in a straight line. The speed of the moving body, not its path, is the most important factor for consideration.[47]

Thus Bradwardine united into one comprehensive rule the principles of linear and circular motion. His theory of proportionality could be used to explain both kinds of motion and to compare them to each other with a mathematical precision which had never been possible before. Because his system was purely descriptive and was based on no experimental evidence, Bradwardine did not realize that many of his specific claims do not actually correspond to the realities of motion. His main purpose, to defend Aristotle from claims that his laws of motion were vague and self-contradictory, was well fulfilled in the *De proportionibus*. More important for the history of science, his underlying assumption that acceleration involves geometrical proportionality was substantially correct, and his presentation of that thesis stimulated more successful studies of the problem of motion. His greatest contribution, however, was his enthusiastic demonstration that mathematics could and should be applied to practical problems in natural philosophy.

What does the *De proportionibus* tell us about Bradwardine's view of time? In answering this question it is important to remember that Bradwardine does not discuss time as a distinct concept in this treatise but refers to it only in reference to

other concepts, such as motion, velocity, distance and magnitude. Similarly, one must keep in mind the strong philosophical orientation of the treatise which is heavily influenced by his interpretation of Aristotelian physics. We can assume, then, that, in the context of this treatise, Bradwardine accepts Aristotle's definition of time as the number or measure of motion. Bradwardine takes it for granted that the most efficient way of comparing two motions is to compare the amount of time it takes for the moving bodies to traverse a given distance. Like Aristotle, moreover, he is always careful to include the aspect of time in calculations involving change or motion.

In Bradwardine's more elaborate system for relating the factors which influence motion, however, time becomes a more sophisticated entity than it was for Aristotle. Like distance or any other factor in the process of motion, time can be measured and is subject to the same kind of proportional analysis. Bradwardine makes this point most succinctly in his discussion of Aristotle's view of yet another factor in motion, the relative density of the medium through which an object moves. Bradwardine believes that in both the *Physics* and the *De caelo* Aristotle manifestly proves that time itself has a proportional character, that is, times can be compared to each other in simple ratios, since "the proportion of the times measuring . . . motions varies also in accordance with the proportion of the media (namely, that the longer time corresponds to the motion through the denser medium and the shorter time through the rarer medium)."[48] There is little doubt, therefore, that Bradwardine's approach to time in the *De proportionibus* was based both on Aristotle's concrete association of time with motion and also on his own more specialized understanding of the proportionality of motion.

Weisheipl observes, "The aim of Bradwardine's treatise was to determine a universal rule that would govern proportions between moving power and resistance, on the one hand, and distance and time on the other."[49] Implicit in Bradwardine's

rule was the notion that time is a measure of motion, because the time it takes for a motion to be completed determines the "quantity" of motion, just as the intensity of a motion determines its "quality."[50] This emphasis on time as a measure of motion accounts for Bradwardine's frequent references to "equal times" both in his quotations from Aristotle and in his own commentary. Discussions of "equal times" in the *De proportionibus* give one the impression, however, that Bradwardine, like Aristotle, was little interested in actually measuring motions. His acceptance of Aristotle's definitions of time and motion and his own mathematical instinct confirmed that time and distance were related to force and intensity in motion; moreover, Bradwardine realized that, for the sake of mathematical proofs, times and distances often had to be defined as equal, in spite of practical difficulties involved in making accurate measurements. Indeed, Bradwardine routinely ignored the empirical problem of measurement, preferring instead to prove his assertions through pure mathematical logic. His few attempts to support his assertions with empirical evidence amounted to the use of simple examples from everyday experience, such as Aristotle himself had often given. Thus, for example, he ended his refutation of Avempace with the common observation that,

> if a given mover were to exceed its resistance by a greater amount than another mover exceeded its own resistance, the former motion would be faster. Then, since a strong man exceeds anything he moves by a greater excess of power than a weaker mover (such as a boy, or a fly, or something of that sort) exceeds what it moves, he should move it more rapidly. Experience, however, teaches us to the contrary, for we see that a fly carrying some small particle flies very rapidly, and that a boy also moves a small object rather rapidly. A strong man, on the other hand, moving some large object which he can scarcely budge, moves it very slowly, and even if there were added to what he moves a quantity larger than either the fly or the boy can move, the man will then move the whole not much more slowly than he did before.[51]

This appeal to common sense certainly involved no experimentation and hardly illustrates the problem of force and resistance in motion. As an item of proof, it was

added merely to suggest a logical relationship between the "quality" and the "quantity" of motion.

The question now arises whether Bradwardine was aware, as he wrote the *De proportionibus*, of the philosophical implications of his new theory about motion for other scientific or theological topics, including time. Because he thought of the treatise as a clarification of what Aristotle had already said, we should not expect the *De proportionibus* to contain a self-conscious statement of its originality either as a scientific or as a philosophical text. Some historians regard the *De proportionibus* as an almost purely mathematical work which only indirectly addressed underlying philosophical issues. Thus Crosby says:

> Approaching the problem of establishing an adequate law of motion from the standpoint of a mathematician rather than that of a philosopher, it is the mathematical formulae which appear explicitly, and the philosophical theory on which they are ultimately grounded, that remains implicit. It is indeed, quite conceivable that Bradwardine might have been almost wholly unconcerned with the philosophical issues involved, but simply interested in demonstrating the mathematical fallacies implied in previous theories and in showing how a proper understanding of mathematics involved in the manipulation of exponential series could solve any objections against the classic notion that velocities are proportional to proportions of forces.[52]

In Crosby's view, then, Bradwardine perhaps unknowingly made philosophical assumptions that served his mathematics, but not the other way around.

Other historians have observed, however, that Bradwardine's approach to the problem of motion, though we might label it mathematical, had a firm and conscious philosophical basis. They see works like the *De proportionibus* as evidence of a general development in early fourteenth-century thought towards a new epistemology. In this context, Crombie remarks: "when Bradwardine rejected Avempace's 'laws of motion,' he made use of arguments similar to Ockham's, and it is difficult not to see a connexion in the common shift of the problem from the 'why'

to the 'how' which Ockham made as a logician and Bradwardine as a mathematical physicist."[53] Crombie bases this statement on the observation that, in his *Expositio super libros physicorum*, Ockham not only repudiated Avempace's doctrine but did so by relying on the same concepts of distance, time and force which form the foundation of Bradwardine's theory.[54] This is not to say, of course, that Ockham's approach to this topic was structurally identical to Bradwardine's. Quite the contrary: Ockham relied on logical distinctions and definitions which he expressed, for the most part, in a completely non-mathematical vocabulary,[55] whereas, as we have seen, Bradwardine's logic was fundamentally a mathematical or geometrical exercise. The convergence of Ockham's and Bradwardine's philosophy cannot be seen readily in the *De proportionibus*, but it becomes strikingly apparent in other works in which Bradwardine addresses broader philosophical problems such as infinity, continuity and contingency. We shall return to this point. Here it is sufficient to note that Bradwardine's mathematical studies can be seen to have a philosophical origin.

One of the major questions about early fourteenth-century philosophy involves the extent to which thinkers were empiricists. In pulling away from the debates about the "whys" of the physical world in favor of concentration on the "hows," fourteenth-century philosophers often had to leave the familiar ground of Aristotelian or Neoplatonic physics; and their success in making the transition to a new cosmology has often been questioned. In an attempt to defend late medieval philosophy from the complaint that the shift from metaphysical to empirical inquiry represents a decline, Ernest Moody argues that late medieval philosophy moved from a scholastic, theological orientation towards a more modern scientific outlook.[56] Moody sees the period in which Bradwardine lived and worked as a formative age when the cosmological and speculative philosophy of the Greeks became analytical, critical and modern.[57]

Moody's rather strong statement has been modified in recent years as further research on early fourteenth-century philosophy has uncovered more of the complexity of intellectual developments in this period. Thus John Murdoch has remarked that, if late medieval scholars seemed to turn away from traditional questions, it was not because they had lost interest in them but because they were searching for better ways of investigating them.[58] New analytical methods, the new language of proportions and new approaches to logic all advanced philosophical thought and theological speculation. In the absence of effective techniques for experimentation, thinkers who wanted to apply these philosophical innovations to physical problems were faced with the knowledge that they could not easily explain the realities of nature. Although their efforts to integrate philosophy and science were not immediately fruitful, however, their work provided a foundation for continued development in many branches of scientific and philosophical inquiry.

The contents and structure of the *De proportionibus* indicate that Bradwardine did in fact have a clear philosophical orientation when he wrote this work, even though his intention was not primarily to treat the problem of motion philosophically. He approached Aristotle's law of motion mathematically in the conviction that anything less than the precision of a geometrical method could not adequately express what Aristotle had meant. Bradwardine's geometrical language of proportions possesses its own order and logic, while the shape of its arguments rests on his analysis of the propositions of Aristotle, Averroes and their opponents. Crosby is correct, of course, in stating that in the *De proportionibus* Bradwardine did not attempt to consider explicitly the broader philosophical implications of his mathematical approach to motion. Full discussions of time, space and continuity, all of which have bearing on the problem of motion, are clearly absent. We should not assume, however, that Bradwardine had no thoughts on these matters, for he reflected upon them at length in other treatises. It is possible that Bradwardine had

only begun to work out his opinions on these issues when he wrote the *De proportionibus*. In any event, the clarity and orderliness of expression in this work serve to emphasize its mathematical orientation. One can therefore understand Crosby's identification of the text as one which, "through the introduction of mathematical analysis, . . . sets the stage for the quantitative measurement of physical processes, and, hence, that typically modern physics which was to appear with Galileo's wedding of mathematics and experimental observation."[59]

Still, the richness of the *De proportionibus* goes well beyond the mathematical concepts that it develops. The treatise establishes Bradwardine's Aristotelian inclinations as well as his capacity for revision of his predecessors' ideas. More important for this study, the *De proportionibus* introduces us to Bradwardine's way of thinking about physical problems such as time: although he shows a tendency towards realism and empiricism, his grasp of abstract mathematics was too acute for us to assume that he had not learned much from the Platonic tradition as well. In fact, Bradwardine's treatment of time in the *De proportionibus* in light of Aristotelian and Platonic notions reflects his particular interest in a much larger medieval debate about the physical reality of time.[60] Eventually, as the conclusion of the *De proportionibus* suggests, Bradwardine would be prepared to consider as well the theological dimensions of his work on proportions:

> Thus comes to completion this work, concerning the proportion between the speeds with which motions take place, by the grace of that Mover - from whom all motions proceed and between Whom and the thing He moves there exists no proportion - to Whom be honor and glory as long as there is any motion. Amen.[61]

We shall soon see how Bradwardine's mathematical thought came to influence both his philosophy of time and his understanding of God as Primary Mover.

CHAPTER FIVE

TIME AND CONTINUITY

Although the *De proportionibus* offers the best general introduction to Bradwardine's mathematical method and his Aristotelian leanings in natural philosophy, his *Tractatus de continuo* gives much more specific indications of his view of time. Bradwardine had already touched on certain aspects of continuity as early as 1323 in a treatise on beginning and ceasing[1] but his most sophisticated treatment of continuity dates from the late 1320s, shortly after the composition of the *De proportionibus*. Similar to the *De proportionibus* in method and tone, the *De continuo* surpasses Bradwardine's previous mathematical works to the extent that it confronts directly the fundamental problems surrounding infinity and continuity which underlay all medieval discussions of natural philosophy. In the *De continuo* Bradwardine relied almost entirely on Euclidean geometry to prove that continuous entities are infinitely divisible.[2] Bradwardine's main achievement in this treatise was to establish a theoretical correspondence between such abstract mathematical continua as lines, planes and spheres and the physical continua of temperature, motion and time. In this way he transformed a previously philosophical problem into a physical one which could be analyzed mathematically. As in the *De proportionibus*, Bradwardine went far beyond Aristotle in rationalizing and mathematizing the natural philosopher's approach to motion and change without deviating from the basic principles of Aristotelian physics.

Unlike the *De proportionibus*, however, the *De continuo* was a polemical work directed against a vocal group of contemporaries who claimed that continua are

composed of indivisible parts or atoms. Bradwardine, following Euclid and Aristotle, argued instead that all parts of a continuum must be infinitely divisible. By writing the *De continuo* Bradwardine entered into one of the most contentious philosophical and logical debates of the late Middle Ages. There has been some confusion over Bradwardine's position in this debate. Some historians, noting the significant differences between Bradwardine's and Ockham's approaches to Aristotelian physics, have assumed that Bradwardine had Ockham in mind when he wrote the *De continuo*. This interpretation fails to account for many similarities in their perceptions of natural philosophy. In fact, Bradwardine and Ockham agreed on many Aristotelian concepts, including the definition of continuity and the characterization of time and motion as physical continua. They even shared, to some extent, a common method for analyzing continuity and other physical problems. As Weisheipl has pointed out, Ockham and Bradwardine stood on the same side of the medieval debate about physics: Grosseteste, Walter Chatton and Henry of Harclay were the real targets of the *De continuo*, not Ockham.[3]

The topic of time provides a good focus for exploring the positions of both Ockham and Bradwardine in the larger debate over continuity which dominated thirteenth- and fourteenth-century studies of natural philosophy. Because they regarded time as the continuum which defines all other mathematical and physical continua, both Ockham and Bradwardine paid special attention to time in their discussions of continuity. Although they agreed completely on the nature of time itself, however, they disagreed about the nature of time's relationship to created matter. It is in this context, not in that of the inherent continuity of time that Ockham's rejection and Bradwardine's affirmation of Aristotelian physics must be seen.

The purpose of this chapter is to examine the late medieval debate about continuity in order to reveal the main features of Ockham's and Bradwardine's

conceptions of time. The first part of this chapter reviews the thirteenth-century controversy over Aristotle's confusing writings about continuity, to which Bradwardine and his contemporaries responded early in the fourteenth century. A second section explores Ockham's strategy for reconciling his Aristotelian ideas about time with a distinctly non-Aristotelian metaphysical system. A final section considers Bradwardine's view of time, as he expressed it in the *De continuo*, in light of Ockham's position. These discussions not only will help to isolate the source of conflict between Bradwardine's and Ockham's approaches to natural philosophy but also illustrate the centrality of temporal continuity in Bradwardine's own physical system.

Ockham's and Bradwardine's views about time were shaped by classical discussions which were revived by natural philosophers in the thirteenth century. All fourteenth-century studies of earthly or celestial motion, change and time required some reference to the definitions of infinity and continuity which Aristotle had originally proposed in his treatments of these topics. In fact, despite the tremendous variety of scientific subjects which late thirteenth- and fourteenth-century thinkers pursued, questions about continuity and infinity were at the root of almost all of them.[4]

It was Aristotle's portrayal of the interrelationship of continuity, motion and change that stimulated late medieval natural philosophy. In his discussions of motion, for example, Aristotle always contended that all sorts of movement and change, even if discontinuous, could be observed and measured because all change occurs within the framework of continuous time. This theme, which Aristotle developed most explicitly in his *Physics* and *De caelo*, is so prevalent in the whole of his natural philosophy that his medieval successors could hardly have avoided some consideration of it.[5] Bradwardine and his contemporaries at Oxford were deeply influenced by the Aristotelian preoccupation with infinity and continuity. Some,

however, tried to reconcile Aristotelian physics with the symbolic mathematics of the Platonic tradition, which led, predictably, to serious disagreements.

The main controversy in the late medieval debate over continuity had its origins in classical discussions of atomism. Aristotle, who devoted a large portion of his writings on physics to refuting the atomists, developed a theory about the infinite divisibility of continua which enjoyed wide acceptance in his own time and throughout the Middle Ages. Aristotle identified Democritus and Zeno as the chief proponents of the atomist theory. According to Democritus, all being consists of distinct, invisibly small atoms which are in perpetual motion in a void. Although they are all made of the same substance, atoms come in many shapes and sizes. The variety of objects which we observe in the material world is the product of the interaction of the atoms as they collide in space. All physical change results from the combination and recombination of these essential materials. Democritus applied his atomic theory to psychical change as well, claiming that even the immaterial world of soul and spirit is composed of atoms. To support the atomist theory Democritus devised an entire system of physical laws which explained how atoms maintain the constant motion necessary for development in a dynamic universe.[6]

Although Democritus' theory of atoms seemed to account for both the variety and change of the sensible world, it was immediately criticized for its emphasis on perpetual motion in a void: most ancient Greek philosophers believed that both perpetual motion and the existence of a void were impossible. Aristotle disagreed with the notion that atoms of matter could be isolated and indivisible and argued instead that the physical world was whole, continuous and unified. Aristotle's criticism of Zeno took a slightly different form from his criticism of Democritus. Whereas his objection to Democritus was essentially cosmological, he attacked Zeno primarily on logical grounds. Aristotle would not accept the validity

of Zeno's paradoxes which denied the reality of motion and change. Zeno was not in fact an atomist, but he cleverly exploited certain logical features in the Euclidean definition of continuity to the advantage of the atomists. Through his paradoxes Zeno tried to defend Parmenides' assertion that only one thing exists by exposing the contradictions in seeing nature as many bodies in motion. The essence of his argument was that, if every motion, time and distance were infinitely divisible, it would be impossible to traverse any given segment of a continuum: the runner of a race, for example, could never reach the finish line, no matter how he close got to it, because his distance from it would remain infinitely divisible at every point. Thus Zeno actually accepted the infinite divisibility of continua on the grounds that this principle proved the impossibility of motion. Of course, atomists, both classical and medieval, used the paradoxes not to deny motion as such but to put the discussion of motion on a different footing. For them, motion of a body only made sense as a reflection of the motions of the indivisible atoms which composed it. Although they regarded Zeno's view of motion as absurd, the late medieval atomists skillfully used his analysis of continuity to discredit the Euclidean position on infinite divisibility.[7] Through his elaborate refutation of Zeno, Aristotle unwittingly encouraged this alliance between Zeno and the atomists by showing how the paradoxes could be used to support atomist theory.[8]

Aristotle's criticism of Zeno had a much more positive influence, however, on natural philosophers like Bradwardine, who accepted the Euclidean definition of continuity. At the heart of Aristotle's attack on Zeno was his refusal to accept the premise of Zeno's paradoxes that the oneness of matter makes motion impossible. Aristotle also dismissed those philosophers who claimed that the universe is one and immovable because they could not explain change. Although their reasoning might be impeccable, their conclusions make no sense: "For indeed," says Aristotle, "no lunatic seems to be so far out of his senses as to suppose that fire and ice are one: it

is only between what *is* right, and what *seems* right from habit, that some people are mad enough to see no difference."[9] The only sensible way to approach nature, according to Aristotle, was to accept that change exists and to try to characterize it.

In Book V of his *Physics*, Aristotle defined continuity in terms which would eventually allow him to characterize change, time, space and matter as continuous. His definitions of the adjectives "successive," "contiguous" and "continuous" imply that continuity is the most specialized of the three because it contains elements of all three in unity. Since Aristotle's definitions of these concepts prevailed throughout the medieval period, they are worth presenting in their original form:

> A thing is in succession when it is after the beginning in position or in form or in some other respect in which it is definitely so regarded, and when further there is nothing of the *same* kind as itself between it and that to which it is in succession, e. g. a line or lines if it is a line, a unit or units if it is a unit, a house if it is a house (there is nothing to prevent something of a *different* kind being between). For that which is in succession is in succession to a particular thing, and is something posterior; for one is not in succession to two, nor is the first day of the month to the second: in each case the later is in succession to the former.
>
> A thing that is in succession and touches is contiguous. The continuous is a subdivision of the contiguous: things are called continuous when the touching limits of each become one and the same and are, as the word implies, contained in each other: continuity is impossible if the extremities are two. This definition makes it plain that continuity belongs to things that naturally in virtue of their mutual contact form a unity. And in whatever way that which holds them together is one, so too the whole will be one, e. g. by a rivet or glue or contact or organic union.[10]

Aristotle then distinguished successive from continuous beings, borrowing from the language of geometry. Although points and units can both be successive, only points can be continuous, since units represent distinct entities (like whole numbers) but points do not: points can touch each other and more points can exist between points, but no whole number can exist between the numbers one and two.[11]

These definitions are the foundation of Aristotle's theory of divisibility. According to Aristotle, nothing that is continuous can be composed of indivisible parts because continuity requires each part to be connected to another part. Therefore, each part possesses some aspect which belongs to other elements in the series and some aspect which does not. For example:

> a line cannot be composed of points, the line being continuous and the point indivisible. For the extremities of the two points can neither be *one* (since of an indivisible there can be no extremity as distinct from some other part) nor *together* (since that which has no parts can have no extremity, the extremity and the thing of which it is the extremity being distinct). . . . Nor, again, can a point be *in succession* to a point or a now to a now in such a way that length can be composed of points or time of nows; for things are in succession if there is nothing of their own kind intermediate between them, whereas intermediate between points there is always a line and between nows a period of time. . . . [Therefore,] everything continuous is divisible into divisibles that are always divisible.[12]

Thus Aristotle concludes that time, magnitude and motion are all subject to the same theoretical principles that govern continuity.

Indeed, for Aristotle, continuity is the universal concept which links motion, time and space. In the case of magnitude, for example, the infinity of a line is equivalent to that of time and motion:

> Since every motion is in time and motion may occupy any time, and the motion of everything that is in motion may be quicker or slower, both quicker and slower motion may occupy any time: and this being so, it necessarily follows that time also is continuous. By continuous I mean that which is divisible into divisibles that are always divisible . . . . And at the same time it is clear that all magnitude is also continuous; for the divisions of which time and magnitude respectively are susceptible are the same and equal. . . . [Therefore] if time is infinite in respect of its extremities, length is also infinite in respect of its extremities; if time is infinite in respect of divisibility, length is also infinite in respect of divisibility; and if time is infinite in both respects, magnitude is also infinite in both respects.[13]

Moreover, because magnitude is continuous, movement along a magnitude is continuous, as is the time in which the movement occurs. So Aristotle remarks in Book IV of the *Physics*:

> Now we perceive movement and time together; for even when it is dark and we are not being affected through the body, if any movement takes place in the mind we at once suppose that some time has indeed elapsed; and not only that but also, when some time is thought to have passed, some movement also along with it seems to have taken place. Hence time is either a movement of something or that which belongs to movement. Since then it is not movement, it must be the other.
>
> But what is moved is moved from something to something, and all magnitude is continuous. Therefore the movement goes with the magnitude. Because the magnitude is continuous, the movement too is continuous, and if the movement, then the time; for the time that has passed away is always thought to be as great as the movement.[14]

Aristotle presents us, then, with a view of motion, time and space which depends on the inherent continuity of each quality. Because they are all related to each other, time cannot be atomic if magnitude is not: in proving that a line is not composed of a finite number of distinct points, one can prove that time does not consist of indivisible instants.[15] In fact, although it is possible to conceive of an atomic theory of magnitude which does not require an atomic view of time, Aristotle so closely binds together time and motion that he is unable to see how the one could be atomic and the other not.[16]

Medieval debates about continuity reflect the legacy of Aristotle's criticism of atomism and his alternative approach. The Muslim philosophers were keenly interested in continuity, and some of them responded to Aristotle and Zeno by advocating a modified form of classical atomism. Both Muslim atomism and the objections of certain Muslim philosophers to Greek atomism influenced Latin thinkers.[17] Classical philosophers had either confined their discussion of atomism entirely to the physical world or, like Democritus, left their speculations about the

non-material world largely undeveloped. Medieval thinkers, however, took a wider approach to these topics. Of particular interest was the question of how infinity and continuity applied to God and his creation. Thirteenth- and early fourteenth-century scholars made the debate about infinity and continuity more complex by trying to analyze these concepts both as features of observable phenomena and as expressions of divine omnipotence. Thus Murdoch suggests: ". . . since God's absolute power extended to everything that did not include a contradiction, to invoke this power in examining infinity or continuity was to transfer one's analysis from the realm of the physically possible (within the confines of Aristotelian natural philosophy) to the broader realm of the logically possible."[18] This new way of thinking led to new approaches and innovative solutions to a problem which nevertheless retained its classical characteristics.

The late medieval discussions of continuity revolved around the classical debate over atoms or "indivisibles" but it was also tied to a newer preoccupation with infinity. In Book III of the *Physics*, Aristotle had denied actual infinity on the grounds that the universe is finite. The only infinity Aristotle would admit was the potentially infinite divisibility of a continuum: "since no sensible magnitude is infinite, it is impossible to exceed every definite magnitude; for if it were possible, there would be something bigger than the heavens."[19] Medieval philosophers generally accepted Aristotle's authority concerning infinity in the physical world but they went on to consider the possibilities of the actual infinities which God might create. From this avenue of speculation came the "paradox of unequal infinities" which Bonaventure helped to popularize in his discussion of the eternity of the world. Murdoch defines this paradox in this way: "if one allows the existence of actual infinities, then it appears that some infinities will clearly be greater than other infinities which are equally clearly part of the former; but it is axiomatic that all infinities are equal; therefore, in this instance a part is not less than, but equal to,

its whole - which is absurd."[20] Bonaventure's use of this paradox in his treatment of eternity stimulated a wide range of commentary[21] and reinforced the link between infinity and time.

While some philosophers resolved the paradox simply by using it to prove the impossibility of actual infinities, others faced the problem more directly by analyzing the differences between actual and potential infinities. These investigations were directly concerned with continua because, by virtue of its composition from infinitely divisible elements, a continuum is potentially infinite. The characteristics of potential infinities were investigated from a variety of perspectives, but most thinkers began their studies with mathematical analysis. Aristotle, of course, had said a great deal about the general nature of continua and the continuous quality of physical forces; but Euclid contributed an essential technical vocabulary for the study of infinity and so provided a mathematical framework for analyzing continua.[22]

Averroes' treatment of infinity, which was so influential in late medieval discussions of continuity, was based on just such a Euclidean framework for sorting out Aristotle's various comments about continua. In Book V of his commentary on Aristotle's *Physics*, for example, Averroes tried to simplify Aristotle's definition of the continuous as a special kind of contiguity. Averroes recognized that Aristotle had been correct to link continuity and contiguity in the case of physical entities but he pointed out how difficult it is to express this link with Euclidean mathematics. Two physical bodies must be contiguous for there to be any continuity between them; but, in abstract mathematics, it is not necessary to hold tightly to this definition. Instead, it is more convenient to say of mathematical entities (for example, lines, surfaces or solids) that, when two such bodies come together, their extremities are not contiguous but superimposed on each other: the extremities of each become one.[23]

Albertus Magnus helped to disseminate this notion of superposition in mathematical continua in the West by emphasizing superposition in his own commentary on Aristotle. In wrongly attributing the idea to Euclid instead of Averroes, Albertus put the whole discussion of continuity into a form which stressed the geometrical nature rather than the philosophical significance of the continuum.[24] As far as Albertus was concerned, it was Euclid who had provided the necessary vocabulary for explaining the contiguous qualities of mathematical entities, so the supposition theory should be credited to him as well.[25] Although Averroes' ideas undoubtedly influenced Albertus' approach, Albertus preferred to stress Euclidean themes in his study of Aristotelian continuity. Albertus thus helped to legitimize a geometrical approach to natural philosophy by illustrating how Euclid's methods for analyzing abstract entities could be applied to mathematical continua, and, by analogy, to physical continua as well.

Other attempts to apply Euclidean geometry to the problem of continuity led to controversy. Henry of Harclay, Chancellor of Oxford in 1312, believed, for example, that actual infinities could exist and that continua were composed of indivisibles. His solution to the infinity paradox rested on his acceptance of unequal infinities. Like Averroes and Albertus, Harclay used a Euclidean principle to distinguish between natural and mathematical continua. He agreed with Euclid's axiom that, in nature, every whole is greater than its parts. In abstract mathematics, however, a broader axiom could be exploited. Henry assumed that every infinity is whole in itself, even if it is a subset of another infinity: "that which (e. g., an infinite set) contains another thing (e. g., an infinite proper subset) and something else beyond it, or in addition to (*praeter*) it, is a whole with respect to the other thing."[26]

This assumption was soon criticized for its ambiguous interpretation of Euclid and its misrepresentation of Aristotle. The Franciscan William of Alnwick pointed out that Henry's distinction between infinities and their proper infinite

subsets did not imply that the latter were smaller, because only finite things have quantity, the necessary prerequisite for comparison of size.[27] In his commentary on the *Sentences*, given in Paris in 1342, Gregory of Rimini enlarged on William's observation. Himself an advocate of the existence of actual infinities, Gregory tried to explain how some infinities can exist as part of other infinities. In the sense that a whole is made up of parts, he argued, an infinite subset must be considered part of any infinity which includes it; but considered mathematically, those infinities become equal because each contains an infinite number of elements.[28] The approaches of William and Gregory to this problem reflect the medieval tendency in natural philosophy to distinguish physical continua from purely mathematical ones.

When Bradwardine set out to define his own view of continuity in the mid 1320s, then, he had to consider two major questions: how well does Aristotle's theory of infinite divisibility apply to physical and mathematical continua respectively; and how appropriate is geometrical analysis to the study of physical continua such as motion, time and temperature? His efforts to solve these problems show a striking similarity to those of Ockham. Both approached the subject of continuity along Aristotelian lines: they largely accepted Aristotle's method for refuting the atomist position and explicitly acknowledged the continuous nature of time and motion. Moreover, both exhibited the same tendency to isolate the analysis of physical continua from larger metaphysical considerations. In their works of natural philosophy both Ockham and Bradwardine approached physical continua as particular mathematical or logical problems and rarely connected such discussions with considerations of the philosophical significance of continuity. In this sense, their views represent a more authentic Aristotelianism even than those of their great predecessor Thomas Aquinas, whose discussions of continuity always began with an analysis of being.[29]

The differences between Bradwardine and Ockham on this issue are equally remarkable, however. Bradwardine was a staunch defender of Aristotelian physics: his mathematical transformation of Aristotle's physical theory was done in a spirit of respect and acceptance. Ockham, on the other hand, openly criticized the philosophical basis of Aristotle's physical system, while admitting that many of Aristotle's observations concerning motion, time and space were substantially correct. Nor were the analytical methods of Bradwardine and Ockham entirely compatible. Bradwardine chose a mathematical method along the lines of Grosseteste, while Ockham preferred the more traditionally logical approach of Averroes and Aquinas. If Bradwardine and Ockham actually influenced each other, as textual evidence seems to suggest, it is important to examine Bradwardine's view of the continuity of time in the context of Ockham's own views and his criticism of Aristotle.

In spite of an interrupted academic career and political involvements which drew him farther and farther away from academic circles in the last two decades of his life, Ockham is generally regarded as "the most influential philosopher of the fourteenth century."[30] This does not mean, of course, that he was immune from the influence of other thinkers, even young ones like Bradwardine, or that his ideas were revolutionary in every respect. An accurate appraisal of Ockham's influence must acknowledge both the conventional aspects of his philosophy and the subtle ways in which his contemporaries modified his ideas to suit their own arguments.[31]

Ockham's views about continuity and time illustrate well the complexity of the late medieval debate about natural philosophy, as well as Ockham's formative position in it, for they reflect both hearty acceptance and severe criticism of orthodox Aristotelianism. In addition to establishing the main features of Bradwardine's conception of time, the following comparison of Ockham and Bradwardine will help to clarify Ockham's role as a participant in a much larger

discussion among thinkers of different talents and at various levels of experience. Just as Bradwardine's views of time and continuity depend on an evaluation of his mathematical thinking, Ockham's views cannot be understood properly without reference to his metaphysical system. Although his critics claimed that his conception of reality made God a capricious and unfathomable force in the universe and thus undermined faith, Ockham always maintained that his primary goal was to exalt the complete freedom and omnipotence of God's will and to elevate faith above reason. In developing this thoroughly orthodox point of view, Ockham drew heavily on Aristotle and Averroes and was also deeply influenced by Duns Scotus, despite his fundamental disagreement with certain features of Scotist philosophy.[32]

Like every other thinker of his age, Ockham had to confront the contradictions in classical metaphysics before attempting to produce his own system. Along with Thomas Aquinas and Duns Scotus, Ockham wanted to reconcile Aristotelian philosophy and Christian doctrine but he was deeply dissatisfied with his predecessors' solutions. Ockham was as troubled by Aquinas' strong dependence on Aristotle as he was by the approach favored by Franciscans from Bonaventure to Scotus, which tried to moderate Aquinas' system through greater reference to Plato and Greek Neoplatonism.[33] Moreover, Ockham could not accept the thirteenth-century attempts to reconcile philosophy and theology because they made use of the principle of realism, defined by Ernest Moody as "the metaphysical and epistemological doctrine . . . that the human intellect discovers the particulars apprehended by sense experience in an intelligible order of abstract essences and necessary relations ontologically prior to particular things and contingent events, and that from this order the intellect can demonstrate necessary truths concerning first causes and the being and attributes of God."[34] The realists, in keeping with both Platonic and Aristotelian metaphysics, believed that objects have sensible qualities, such as size, color, number and location, which have

universal reality. A thorough analysis of an object would be impossible, therefore, without reference to these universals, which have significance beyond the individual characteristics of that object. To the extent that every object has size, for example, all objects share a common nature with respect to that universal quality. Aristotle's entire system of observation of matter involves close attention to this concept of universal qualities, and his extensive work in this area had a great impact on medieval investigations into both metaphysics and natural philosophy.

Ockham's main objection to realism was that it accorded sensible qualities a reality beyond the reality of a particular thing. Ockham believed instead that the human mind could directly apprehend the qualities of an object. Weisheipl explains that

> for Ockham, among the ten 'categories' of Aristotle, only individual 'substances' and individual 'qualities' were *res absolutae*, existing outside the human mind. All other things, such as quantity, motion, time, place, velocity and causality, were only terms (*termini*) or words (*nomina*) to stand for (*supponere*) nothing but the individual under some consideration of connotation of the mind, and did not represent the apprehension of the mind of some objective reality distinct from individual substances or individual qualities.[35]

Ockham's insistence that descriptive qualities were inherent in objects and had no independent reality did not constitute an entirely new idea: philosophers before Ockham had claimed, for example, that universal natures existed only as mental abstractions.[36] Through Ockham's influence, however, some young scholars began to argue that the common natures which the mind can recognize in various objects have no reality, even potentially or incompletely, but are only mental terms (*intentiones animae*) which have logical functions in propositions.[37] The adherents of this position, who came to be known as nominalists, not only provided a new direction for late medieval philosophy but also went far beyond Ockham himself in their criticism of medieval realism and orthodox metaphysics.

Ockham's views had implications for both natural philosophy and theology. His denial of the reality of universals outside the mind allowed him to reject the notion that God created individuals to conform with divine ideas: any similarities which exist between two individuals are the result of God's free choice and do not require an elaborate metaphysical explanation. Therefore the intellect, whether human or divine, should be directed towards comprehending the individual thing which exists.[38] Such a perspective can, on the one hand, call into question any intellectual activity which involves deduction from general principles. In this sense, Ockham's positions were at odds with the traditional Aristotelianism of medieval natural philosophy. In fact, Ockham used his new system of propositional logic to demonstrate that many of the principles which Aristotle had considered necessary and self-evident were not so.[39] Since Ockham offered no new cosmology to replace Aristotle's, one might say that he undermined late medieval science with his skepticism. On the other hand, Ockham's assertion that there might be several possible and equally valid explanations for a particular phenomenon, as well as his emphasis on the human capacity to analyze individual objects or events, had a stimulating effect on physical theory throughout the fourteenth century. Indeed, Moody goes so far as to say that Ockham's new approach to knowledge was instrumental in establishing "the intellectual environment in which later fourteenth-century philosophers explored new physical theories . . . [and so] laid the foundations for the scientific revolution of the seventeenth century."[40]

In his penetrating study of Ockham's physical theory, André Goddu provides a useful framework for understanding Ockham's opinions about continuity and time. According to Goddu, Ockham tried in his natural philosophy to maintain both the hypothetical necessity and the factual stability of the natural order, while at the same time defending God's omnipotence and freedom.[41] While he attempted to include a wide variety of metaphysical, theological and physical questions in his

logical system, Ockham realized that certain problems had to be treated in isolation from others. Goddu contends that Ockham borrowed Aristotle's methods of isolation and imagination experiments when he speculated about physical realities although Ockham's own ideas about God's relationship to humanity affected his use of these methods. Instead of merely accepting the principles of Aristotelian physics, Ockham was more likely to use isolation and imagination experiments to disprove their logical necessity and to assert the contrary: that abstract concepts and connotative terms can be reduced to subjects and their absolute qualities.[42]

One of Ockham's main philosophical goals, therefore, was to disengage natural philosophy from metaphysics. By emphasizing that sensible qualities are inherent in and inseparable from matter, Ockham tried to undermine Aquinas' synthesis of Plato and Aristotle, which established a link between forms in the world and forms in the mind.[43] Although he did not reject all aspects of Aristotle's physics out of hand, Ockham claimed that his theories had to be tested empirically, preferably by focusing on specific physical phenomena unhindered by metaphysical considerations. Bradwardine followed a similar analytical method by isolating physical problems in order to examine them geometrically. Goddu argues that Ockham's application of the principle of isolation to Aristotelian physics, together with other fourteenth-century criticisms of Aristotle, led to the complete rejection of Aristotelian natural philosophy by the seventeenth century. Since Ockham relied simply on logic as his empirical technique, however, he was not able to progress very far on his own in designing a new physical theory to take the place of the one he dismantled.[44]

When we turn to the question of Ockham's view of continuity, we find that he did not believe in the existence of indivisibles, an opinion which is consistent with his position on universals. Using the familiar illustration of points in a line, Ockham argued that one need not think of lines terminating with points: a finite line is

simply a line of a particular length.[45] In Ockham's linguistic analysis of points and lines, only individual, permanent points and lines are real. Ockham regarded Euclidean terminology as merely symbolic. Words such as "point," "line" or "instant" are not things in themselves but terms which stand for more complex concepts in a proposition; similarly, "motion" and "time" are not physical entities distinct from things which move or exist in time.[46]

Whenever Ockham approached the problem of time, he used the traditional Aristotelian vocabulary of motion and change, but his understanding of these concepts was considerably different from Aristotle's. Ockham's reluctance to consider any aspect of change as distinct from the object undergoing change constituted a major break with Aristotelian physical theory, especially in regard to motion and time. Since Aristotle had argued that everything which moves is moved by something and that all change comes about as the result of some kind of motion, the Aristotelian concept of motion had great metaphysical significance: Aristotle and his followers took it for granted that motion had a reality and purpose prior to and distinct from any object experiencing change. Ockham's identification of qualities with individual objects seriously undermined these metaphysical distinctions.

By the thirteenth century, as we have seen, discussions about motion, time and continuity had become extremely sophisticated. Consequently a debate ensued over whether motion (and, by analogy, time) was a flowing form (*forma fluens*), that is, a distinct, continuous entity, or a flux of form (*fluxus forme*), in which an object undergoes successive change.[47] In his effort to define motion as an inherent feature of a moving object rather than a separate force acting on the object, Ockham clearly sided with the second position.[48] As in all aspects of his philosophical system, Ockham did not abstract or analyze the characteristics of motion as general

principles. He argued that the only way to understand motion is to examine the motion involved in particular cases.[49]

Ockham emphasized the individual experience of change by describing change as a successive process of internal transformation.[50] Although his description of change as continuous follows Aristotle, Ockham's assertion that the form of the object undergoing change actually changes itself is at odds with Aristotle's theory of forms. Ockham's explanation of successive transformation reduced motion and time to sensible characteristics of objects and stressed the absolute individuality of every instance of change. Thus Ockham could argue that broad explanations of natural phenomena based on Aristotle's theories of motion were inadequate. The implications of this approach for theology were even more striking: if God does not need to create according to pre-existing forms and can change individuals directly without applying external forces such as motion, his actions cannot be predicted or explained by the Aristotelian or any other metaphysical system.[51]

Ockham's view of time was consistent with his view of motion both in its Aristotelian origins and in its ultimate emphasis on individual experience. Throughout his *Tractatus de successivis*, a compilation of three short works, Ockham presented the thesis that motion, place and time are inseparable from objects which are in motion, space or time. This view, Ockham contended, was fully in keeping with Aristotelian physics.[52] In a sense, of course, Ockham's description of change did concur with Aristotle's. It was widely accepted in the fourteenth century that change is continuous and can be observed only by examining the body undergoing change. Ockham argued, however, that his position made it easier to explain the difference between continuous motion (such as that of the heavenly bodies) and irregular change, a perennial problem for the Aristotelians. Nonetheless, Ockham

firmly stated that his theory was sanctioned and even suggested by Aristotelian physics.

Ockham begins his discussion of time in the *Tractatus de successivis* by positing that time, like motion and place, "is not something in itself totally distinct from a permanent thing."[53] He goes on immediately to point out that, as Aristotle says, time is inextricably bound up with motion and is part of the process by which an object is changed.[54] Time and motion therefore share the characteristic of being intrinsic in a particular body; they do not exist apart from the reality of matter. This assertion does not contradict Aristotle, who acknowledged himself that one cannot observe time without observing change in some physical body. Ockham continues in his interpretation of Aristotle by developing the orthodox principle that time and motion are really different aspects of the same phenomenon.[55] Because time is the measure of change in a particular object, moreover, it has no meaning outside the context of the motion of a physical body.[56] While this position is Aristotelian as far as it goes, Ockham does not develop it further. For Ockham, time is primarily empirical.[57]

Although time is an observable phenomenon which accompanies motion, it is not its own substance and therefore cannot have parts. Ockham clarifies the classical language about time by arguing that time does not consist of the parts past, present and future; rather, time is divided into past or future with respect to the individual objects which endure.[58] By analogy, says Ockham, one could imagine that a length of time is like a line which, being a continuum, can be divided infinitely. In reality, however, neither lines nor times exist as an infinite series of atoms or parts.[59] Certainly no one could physically divide these entities into as many parts as is theoretically possible. Thus the infinite divisibility of a continuum is, as far as Ockham is concerned, a reasonable theoretical and logical definition but also, as Aristotle himself freely admits, an extremely difficult one for the human

mind to comprehend.[60] Ockham therefore presents his thesis that time, motion and place are inherent in objects as a practical solution to the problem of recognizing infinities in physical matter.

In the case of instants, for example, Ockham argued that, whether they can be divided infinitely or not, instants nevertheless are inherent in real things and are not abstract, as some contemporaries (*moderni*) claim.[61] Ockham did not see any contradiction in holding this view while at the same time using Aristotle's own arguments for infinite divisibility of instants to refute Zeno's half-distance paradox.[62] Yet, while he willingly accepted the traditional position on the theoretical nature of the divisibility of continua, Ockham was reluctant to minimize the integrity of individual continuous entities. A continuum is not merely composed of its divisible parts: a finite line is simply a line, not an infinite series of points, just as a finite period of time is not a procession of individual instants.[63]

This review of Ockham's position on continuity and time serves to illustrate his ready acceptance of certain Aristotelian concepts and his firm rejection of others. Ockham had no difficulty in seeing time as the measure of motion or as the number of motion according to before and after.[64] He conceived of time as being both continuous and successive and admitted that time is discrete because "the mind divides motion into prior and posterior, and numbers the prior and posterior parts in motion."[65] With Aristotle he affirmed that the circular movements of the heavenly bodies provide a uniform standard by which one can measure other times and motions.[66] In fact, Ockham's teaching on continuity conforms to Aristotle's in every major respect with one significant exception. For Ockham, time was not some relation distinct from permanent things, as Aristotle had claimed, but was a relative or connotative name. To say "time is" is equivalent to saying "something is moved whence the mind measures how much another thing is moved."[67] This apparently minor distinction actually reflects the main thrust of Ockham's attack on

Aristotelian metaphysics, which he pursued in many contexts. In short, Ockham repeatedly showed his willingness to draw on Aristotle for explanations of certain natural phenomena but freely interpreted and revised Aristotle when Aristotle's ideas conflicted with his own logical principles.

In the *De continuo*, Bradwardine sought, as Ockham had sought, a way to make the concept of continuity more comprehensible. However, whereas Ockham had relied on propositional logic for this purpose, Bradwardine characteristically turned to geometry, even, at times, to the point of ignoring major logical problems which called into question his mathematical calculations.[68] Although both Bradwardine and Ockham conceived of continuity and time primarily in Aristotelian terms, Euclid's *Elements* provided the inspiration for Bradwardine's approach in the *De continuo*. As with the *De proportionibus*, moreover, Bradwardine emphasized in the *De continuo* the necessity of applying mathematics to the study of natural philosophy, remarking:

> No one studying physics can hope to succeed unless he uses mathematics and is helped by its aid and counsel, for it is a discipline which reveals every genuine truth, knows every hidden secret, and holds the key to every subtlety of letters; whoever, then, presumes to study physics while neglecting mathematics should know from the start that he will never make his entry through the portals of wisdom.[69]

In keeping with this assertion, Bradwardine made use of a mathematical argument in the *De continuo* to try to disprove the atomist position that continua are composed of indivisibles. In the course of this analysis, Bradwardine encountered Ockham's problem of explaining how the theoretically acceptable premise of infinite divisibility could be demonstrated in the physical world. Unlike Ockham, who had been content to define the problem without resolving it, Bradwardine attempted to devise a mathematical solution. In the *De continuo*, therefore, Bradwardine examined several kinds of continua, both physical and purely mathematical. In

general, his analysis of mathematical continua was more successful than his treatments of various physical continua, although his application of mathematical models to the continuity of time proved to be extremely fruitful.

Bradwardine tried in the *De continuo* to dismantle the atomists' position by demonstrating the absurdity of their main principles. Beginning with an extensive list of definitions, Bradwardine went on to develop one hundred and fifty-one propositions concerning continua, drawing primarily on geometrical arguments to establish his case against atomism. So mathematically meticulous was his procedure that he waited until Proposition 141 to state explicitly his thesis that a continuum cannot be composed of indivisibles.[70] This concept is implicit, however, throughout the work and, it dominates his analysis of both geometrical and physical continua. In the *De continuo* Bradwardine not only borrowed freely from Aristotelian physical theory but also derived his own position in favor of infinite divisibility from Euclidean mathematics. Often, as in the *De proportionibus*, Bradwardine used Euclidian concepts to correct Aristotle's analysis of a physical problem. In the case of Bradwardine's theory of imposition, for example, he demonstrated geometrically that two continua could overlap to form one continuum in order to avoid Aristotle's ambiguous distinction between continuous and contiguous elements.[71] The advantage of this theory for natural philosophy was that Bradwardine could use it to prove that physical continua such as motion and time can have discrete parts or segments and still remain connected to the rest of the continuum.

Bradwardine's main targets in the *De continuo* were the advocates of immediate indivisibilism, who believed that continua are composed of a series of indivisible points between which there are no additional points. With the aid of geometry, Bradwardine successfully refuted them. Realizing, however, that geometry alone could not conclusively disprove immediate indivisibilism, he did not even attempt to refute the theory of mediate indivisibility, which posits that between

any two indivisibles in a continuum there is always another indivisible.[72] In spite of its relatively limited scope, however, the *De continuo* achieved its main aim of undermining mathematically the principle of indivisibility on which all atomist theories depend.

Bradwardine begins his refutation of atomism with an examination of several types of continua, both mathematical and physical, and in the process he explicitly delineates his view of time. At the outset of the *De continuo* Bradwardine introduces his conception of time as a continuum in a series of definitions pertaining to continuous substances. After defining the continuum itself as a quality whose parts are mutually connected (*ad invicem copulantur*), he proceeds to distinguish between permanent continua, whose parts exist simultaneously, and successive continua, whose parts, in the words of Aristotle, succeed according to before and after (*succedunt secundum prius et posterius*). In definitions four, five and six Bradwardine gives solids, planes and lines as examples of permanent continua. Definitions nine and eleven establish time and motion as successive continua. Definition ten defines an instant as an atom of time. In these definitions, Bradwardine emphasizes the connection between motion and time by defining motion as a successive continuum measured by time (*continuum successivum tempore mensuratum*). Time, on the other hand, is measured not by motion but by its own successiveness: *tempus est continuum successivum successionem mensurans.*[73]

In definitions seventeen to twenty-two Bradwardine explains how the terms past, present, future, beginning and ending should be applied to successive continua.[74] These definitions provide the foundation for examining time by establishing that all successive continua are essentially temporal: they are not simultaneous but have some parts which exist before other parts. When one wishes to consider a successive thing or a particular segment of a successive continuum,

says Bradwardine, one must determine the first and last instants of its existence. Definitions nineteen to twenty-two, therefore, provide specific rules for making these determinations under various conditions.

In his propositions and corollaries Bradwardine was able to comment at greater length on the features of time which his definitions could only imply. Some aspects of time which Bradwardine considered in the treatise include the infinity of time, its relation to motion, its composition and the beginnings and endings of time segments. In pursuing these topics Bradwardine rarely strayed from an Aristotelian framework. His mathematical approach allowed him to focus on the physical and geometrical characteristics of time without reference to broader metaphysical or theological issues. In this way Bradwardine proved himself an advocate of Ockham's methods of isolation and imagination experiment. Bradwardine's analysis of infinity, for example, rests firmly on the classical Greek sources, particularly Aristotle's *Physics*.[75] Quite apart from any possible theological considerations, Bradwardine accepts that time is infinite in the Aristotelian sense, that is, it is infinitely divisible and moves in a forward direction. As a geometer, Bradwardine prefers to regard infinity as a fundamental concept uncomplicated by inappropriate logical concerns. He therefore points out the absurdities that could result from applying the concept of infinity to either singular or universal things.[76] In the process of condemning a logical argument which confuses universals with particular things, Bradwardine clearly categorizes time and geometrical points as universal infinities; for although a mountain of gold, say, is continuous throughout, it has physical limits which time and geometrical entities do not.

It is the infinity of time, moreover, which makes it the measure of finity in motion and space. Bradwardine explicitly states the connection between motion, time and space in his first proposition concerning continua which restates Aristotle's thesis that a continuous quality can be divided infinitely:

> 6 - Every body, surface, line and point can be moved uniformly and continually. 7 - In the case of two local motions which are continued in the same or equal times, the velocities and distances traversed by these [movements] are proportional, i. e., as one velocity is to the other, so the space traversed by the one is to the space traversed by the other. 8 - In the case of two local motions traversing the same or equal spaces, the velocities are inversely proportional to time, i. e., as the first velocity is to the second, so the time of the second velocity is to the time of the first. 9 - A [given] moving body can be moved at any speed whatsoever or a [given] space can be traversed by any [body] at all. 10 - The being or non-being [of finite things] is measured in a certain time.[77]

In an argument strongly reminiscent of those in the *De proportionibus*, Bradwardine establishes here the Euclidean principles that geometrical entities can be moved continuously and that the speed and position of a moving object can be varied.

Bradwardine turns next to the theories of proportional velocity which he first developed in the *De proportionibus* to prove that his conclusions about continuous motion in geometrical entities can be applied equally well to observable motions. The notable difference between his treatment of this subject in the *De continuo* and similar ones found in the *De proportionibus* is Bradwardine's explicit recognition in the *De continuo* of the role of time in the process of measuring motion. Although he had accounted for time in his calculations in the *De proportionibus*, it is only in the *De continuo* that he defines time as the continuous, uniform standard by which velocities can be measured. Moreover, supposition ten accords the continuum of time an even larger cosmological significance, for, if the being or non-being of finite things is measured by time, every created thing is subject to temporal limits.[78]

Since he was not concerned in the *De continuo* to explore the theological ramifications of his temporal theory, we should not be surprised to find him concentrating on the mathematical consequences of his very Aristotelian approach to motion, time and space. The majority of subsequent propositions which mention time follow the pattern of the *De proportionibus*, in which time appears as a necessary constant in measuring motion. Bradwardine's characteristic pattern in the

De continuo was first to illustrate some feature of continuity in purely geometrical terms and then to show how this feature influenced a physical continuum such as time, motion or temperature. After describing the continuity of points in a circle, for example, Bradwardine turns in proposition twenty-four to an analysis of uniform circular motion in which time provides the test and measure of uniformity.[79] In making this transition Bradwardine implicitly acknowledges that geometrical successiveness is a kind of timeless motion. The reality of motion in the physical world, on the other hand, depends on temporal definition. Time, therefore, is a prerequisite for all physical continua whether successive, as in motion, or permanent, as in space.

Thus Bradwardine shows early on in the *De continuo* that time is the central concept in his arguments that the continuity of proportional motion is equivalent to the continuity of a geometrical line and that motions, like lines, are infinitely divisible.[80] To demonstrate the divisibility of motion, Bradwardine once again begins with a purely geometrical proof. Propositions thirty-two through forty-two offer an elaborate Euclidean analysis of the divisibility of lines and angles, as well as a thorough discussion of the mediate divisibility of points. In the next eight propositions Bradwardine applies this analysis to motion. Rather than arguing positively that motion must be divisible, however, Bradwardine focuses on the absurdities of claiming, like the Pythagoreans and Henry of Harclay, that uniform motion and time are composed of indivisibles.[81] The actual form which this negative argument takes has little bearing on Bradwardine's view of time and offers no additional insight into it. Nevertheless, his constant repetition of the connection between the continua of time and motion reinforces the Aristotelian definitions of time which he presented at the beginning of his treatise.

Bradwardine's analysis of the composition of continua forced him to think about a more complicated problem, one which Aristotle himself had only partially

solved. Bradwardine's Euclidean models depended on the axiom that geometrical entities can be divided and that these divisions occur at specific points. However, although he could conceive of such points as atoms, he did not consider them indivisible, as his opponents did. In Bradwardine's view, physical continua are even less subject to an atomistic analysis than geometrical ones, which led him to declare in proposition 100: "It is manifest that no natural substance is composed of finite atoms."[82] There follows a geometric proof which demonstrates the equivalence of proportional velocities occurring in equal times by suggesting that the opposite conclusion, that motions occurring in equal times are not proportional on account of their composition out of distinct indivisibles, is unreasonable and contrary to principles already proven in the *De proportionibus*.[83] Because it was based on a negative argument, however, Bradwardine's distinctions between the two conceptions of the physical composition of continua are not entirely convincing.

Bradwardine's strategy against the atomists was more successful when he avoided altogether the issue of indivisible atomism and concentrated instead on the equivalence of continuity within motion. In proposition 105, for example, he drew on the principle of equal infinities to prove that equivalent continua have an equal number of components, whether those components are divisible or indivisible. Again, the continuum of time served as the necessary standard by which to measure this equivalence.[84] Bradwardine restated this position even more strongly in proposition 120, in which he added the dimension of varying speeds of velocities. Here he implied that it is the divisible nature of time which makes it possible to compare the relative speed of motions.[85] These considerations about the continuity of motion eventually helped Bradwardine to dismiss the theory that continua can be composed of immediate indivisibles. His whole theory of imposition rested, in fact, on his assumption that equivalent continua have the same number of components and so can be superimposed. In Bradwardine's view, then, time has the crucial

function in natural philosophy of bridging gap between the theoretical nature of geometrical continua and real, physical continua existing within a temporal framework.

In contrast to the *De proportionibus*, then, the *De continuo* provides a concrete definition of time according to Aristotelian principles. Bradwardine presents time as a successive continuum which can be divided infinitely into time-atoms or instants, which are themselves subject to further division. Time is, moreover, the single continuum which governs all other physical continua including motion, space and temperature. For all that, Bradwardine does not invest time with any independent physical reality, nor does he consider in any depth how time can be used practically to measure other continua: time is a measure of motion, but motion is not a measure of time according to Bradwardine's initial definitions. This vagueness actually helps Bradwardine to make time a pivotal concept for comparing geometrical and physical continua by means of Euclidean language.

Bradwardine's view of time is thus both strikingly Aristotelian in its identification of time with motion and strikingly non-Aristotelian in its elevation of mathematical reasoning to a degree not found in any of his predecessors. In this respect, Bradwardine's isolation of the problems of time and continuity from other metaphysical considerations is similar to Ockham's; and, of course, on a theoretical level, both of them reach the same conclusions about the nature of permanent and successive continua. Bradwardine's implicit acknowledgment that geometrical figures do not represent real things indicates, for example, at least partial agreement with Ockham's criticism of Aristotelian physics. Both Bradwardine and Ockham realize that, by intermingling geometrical and physical continua, Aristotle failed to distinguish them adequately or to take into account the real usefulness of geometrical continua in the investigation of natural philosophy. In proposition 151, in fact, Bradwardine actually claims that "there are no surfaces, lines or points at

all".[86] Of course, Bradwardine's denial of a separate reality for these entities does not amount to an affirmation of Ockham's thesis that these concepts have no reality apart from a real physical object. In the *De continuo* Bradwardine simply wants to point out the practical difficulties of describing physical continua geometrically so he consciously avoids broader metaphysical considerations. Nevertheless, proposition 151 clearly indicates Bradwardine's conviction that the proper goal of geometry is to study real solids,[87] a position with which Ockham would have sympathized.

Furthermore, Bradwardine did not follow Ockham in defining motion as an inherent part of a moving object. Although he did not develop the point in the *De continuo*, Bradwardine maintained the orthodox Aristotelian approach of describing motion and time as categories of being and consequently failed to identify exactly how the continuity of space and time influences the continuity of motion.[88] Although Ockham's approach to the fundamental problem of motion was more promising, neither Ockham nor his immediate followers solved the problems presented by physical continua in a way that is more convincing than Bradwardine's. Still, Bradwardine and Ockham succeeded not only in providing new ways of investigating an ancient problem but also in reworking the Aristotelian definitions of time and motion found in Averroes and Thomas Aquinas for a more skeptical fourteenth-century audience.

CHAPTER SIX
TIME AND CONTINGENCY

Closely related to continuity is the problem of contingency, which often concerns the predictability of continuous events. Unlike continuity, contingency does not lend itself easily to mathematical analysis. Discussions of contingency in Aristotle and throughout the medieval period, therefore, are primarily linguistic or logical in character. Bradwardine's devotion to Aristotle, who had originally posed the problem in Book IX of his *De interpretatione*, and the importance of this topic in late medieval scholarly debate stimulated Bradwardine's interest in contingency in spite of its fundamentally non-mathematical nature. Although geometry certainly influenced his view of contingency, Bradwardine was forced to employ other methods when he approached this problem.

In the *De incipit et destinit* and the *De futuris contingentibus*, Bradwardine examined some of the logical and psychological aspects of time which a purely mathematical approach could not consider properly. These texts complement his scientific writing about time because they present an alternative, more philosophical view of time based not on its relationship to motion but on its enigmatic capacity to link the past to the future. Bradwardine's early work on contingency reveals not only the complexity of his view of time but also the origins of the mature opinions concerning predestination and divine foreknowledge which dominate the *De causa Dei*. It is in the *De incipit et destinit* and the *De futuris contingentibus*, moreover, that we find the clearest evidence of Bradwardine's early interaction with the most influential logicians of his day, particularly William Ockham.

The wide variety of medieval discussions about contingency makes it necessary to restrict this analysis to aspects of the problem which specifically concern time as a successive continuum. The previous review of Bradwardine's concept of time in the *De proportionibus* and the *De continuo* has shown that he largely accepted Aristotle's definition of time as the number or measure of motion according to before and after. Time, like motion, is successive and infinitely divisible. Time and motion cannot be conceived, therefore, as separate entities. These Aristotelian principles define a rational natural order which can be investigated through observation and mathematical analysis. Bradwardine found this notion of rationality very appealing.

Unfortunately, even Aristotle recognized that his definitions were not entirely compatible with human perception of time. The ambivalence about time in Aristotle's natural philosophy influenced discussions of contingency throughout the Middle Ages. In this chapter I shall examine the two aspects of contingency which have the greatest bearing on Bradwardine's view of time: prediction in the context of beginning and ceasing, and the question of whether a future event can be both contingent and foreknown. Because Bradwardine's position on contingency was based on classical as well as contemporary thought, I shall refer extensively to Aristotle, Boethius, Peter of Spain and William Ockham, all of whom directly influenced Bradwardine's view of contingency, both positively and negatively.

The problem of prediction which features so prominently in Bradwardine's view of contingency originated in Aristotle's physical theory. Bradwardine's approach to contingency was also influenced by the attempts of some medieval logicians to use the principles of Aristotelian physics to make predictions. Although the subject of prediction has received relatively little attention from modern scholars, those who have studied it agree that medieval thinkers often saw the problem of prediction as a physical one and approached it by analyzing the concepts

of beginning and ceasing. This approach, first suggested by Aristotle, involved the determination of the temporal limits of a process of change by measuring them against a continuum.[1] Having established that time is an infinitely divisible continuum, like the motion it measures, Aristotle then had to explain how a change could begin or end in a moment or now of time when a now is both divisible and singular. Two things cannot occur in the same now, so neither can the process of moving from a state of rest to a state of motion be described as occurring within a single now. Aristotle identified the difficulty of assigning a first moment of motion in Book V of the *Physics*:

> And not only must that which is changing have changed, but that which has changed must also previously have been changing, since everything that has changed from something to something has changed in a period of time. For suppose that a thing has changed from A to B in a now. Now the now in which it has changed cannot be the same as that in which it is at A (since in that case it would be A and B at once); for we have shown above that that which has changed, when it has changed, is not in that from which it has changed. If, on the other hand, it is a different now, there will be a period of time intermediate between the two; for, as we saw, nows are not consecutive. Since, then, it has changed in a period of time, and all time is divisible, in half the time it will have completed another change, in a quarter another, and so on always; consequently it must have previously been changing.[2]

On the basis of this argument, Aristotle went on to show that these ambiguities surrounding beginning and ceasing resulted directly from his definition of continuity:

> So it is evident also that that which has become must previously have been becoming, and that which is becoming must previously have become, everything (that is) that is divisible and continuous. . . . So, too, in the case of what is perishing and that which has perished; for that which becomes and that which perishes must contain an element of infiniteness since they are continuous things. . . . It is evident, then, that what has become must previously have been becoming, and that which is becoming must previously have become; for all magnitudes and all periods are always divisible.[3]

In a negative sense, this sort of analysis might thoroughly discourage the observer of an event from trying to determine its precise duration. On the other hand, Aristotle's approach to continuity suggested that one could reconstruct the past and predict the future (in a limited way, of course) simply by examining a particular successive continuum in its present state. Although Aristotle's theory posed serious difficulties for medieval natural philosophers, who wished to measure events clearly and accurately, it promised tantalizing possibilities to logicians, who welcomed any method which might help to verify the truth of logical propositions. Much of the excitement over beginning and ceasing among medieval thinkers grew out of the philosophical implications of Aristotle's theory. Because Bradwardine was more interested in natural philosophy than in pure logic, however, he seemed to find the logical implications of beginning and ceasing somewhat confusing and bewildering.

Aristotle himself was too good an observer of nature to ignore the impracticality of his theory. He knew from his own experience that the mind can discern the beginning and the ceasing of motions: to argue otherwise would be to support, implicitly or explicitly, Zeno's half-distance paradox. Aristotle thus needed to find a way of assigning the precise instant of initial motion without undermining his theory of continuity. His solution to the problem, as he outlined it in Book VIII of the *Physics*, involved the admission that logical considerations must precede physical ones in this case since it is impossible physically to isolate the first instant of beginning or ceasing:

> It is also plain that unless we hold that the point of time that divides earlier from later always belongs only to the later so far as the thing is concerned, we shall be involved in the consequence that the same thing at the same moment is and is not, and that a thing is not at the moment when it has become. It is true that the point is common to both times, the earlier as well as the later, and that, while numerically one and the same, it is not so in definition, being the end of the one and the beginning of the other; but so far as the thing is concerned, it always belongs to the later affection.[4]

If, then, one can logically attribute only one state of being to a given now, Aristotle insisted that the emphasis should be placed on the first instant of being rather than on the last instant of non-being. Similarly, when the motion ceases, emphasis should be placed on the last instant of being instead of the first instant of non-being.[5]

This passage from Aristotle generated a large body of commentary on beginning and ceasing throughout the Middle Ages, although evidence suggests that the medieval philosophers usually failed to grasp Aristotle's exact position on the subject.[6] Whether their approach to the problem of beginning and ceasing resulted from their familiarity with the *Physics* or was the consequence of their reading of some of Aristotle's grammatical texts,[7] it is certain nevertheless that medieval thinkers approached the problem of beginning and ceasing in classical terms and regarded the verbs *incipere* and *destinere* as logically complex. By the twelfth century, logicians had begun to include *incipere* and *destinere* in lists of syncategorematic words because, like other syncategorematic words (prepositions, adverbs, conjunctions and quantifiers), they complicate logical propositions. After syncategorematic analysis, the sentence "Socrates begins to be" becomes "Socrates is now and was not before," just as "Only man is capable of smiling" becomes "Man is capable of smiling and nothing that is not man is capable of smiling."[8] Although this approach to the problem of beginning and ceasing is primarily grammatical and logical, it still exposes the underlying concept of before and after which Aristotle stressed in all of his writings about time and continuity.

In the introduction to his edition of Bradwardine's *De incipit et destinit*, Lauge Olaf Nielsen reviews both the grammatical and the physical approaches which thirteenth- and early fourteenth-century philosophers applied to the problem of beginning and ceasing. According to Nielsen, medieval logicians, having misunderstood what Aristotle had said about this issue, went in the opposite direction from Aristotle when they tried to assign temporal limits. Whereas

Aristotle had always affirmed the first and last instants of being in permanent things, many medieval thinkers affirmed the first and last instants of non-being. While Aristotle would have expounded the sentence "Socrates begins to be" as "Socrates is now and was not before," the medieval logician usually expounded it as "Socrates is not now and will be immediately after this." The medieval logicians, therefore, "negated the present and affirmed the future."[9] By Bradwardine's day all discussions of beginning and ceasing stressed this grammatical aspect of the problem, although several scholars, including Bradwardine, also investigated some of its physical aspects.

Nielsen compares Bradwardine's position on beginning and ceasing to the views of his slightly older contemporaries, William Sherwood, Peter of Spain and Walter Burley, to show that a late medieval philosopher's view of time could influence his analysis of the problem as much as his assumptions about grammar.[10] According to Nielsen, Sherwood and Burley rejected both Aristotle's view of time and his solution to the problem of beginning and ceasing. In his *Treatise on Syncategorimatic Words*, for example, Sherwood tried to refute a variety of current proposals for establishing limits for permanent and successive continua and for describing the transition from a permanent to a successive continuum. His most significant contribution to the general debate was his logical analysis of different kinds of transition. His thesis concerning beginning and ceasing depended, however, on the presupposition that a point dividing a line cannot be common to two adjacent segments. Sherwood therefore compromised Aristotle's view of time.[11]

Burley came to the same conclusion as Sherwood in his *De primo et ultimo instanti*, in which he examined the problem of determining beginning- and end-points in various types of continuous entities. Following Sherwood, Burley relied on a logical argument to prove that a point dividing time into two segments cannot be

common to both segments. In Nielsen's view, this un-Aristotelian assumption allowed "the logical necessity of attributing a dividing point to only one segment [to] become an attribute of time itself."[12] Thus Sherwood's and Burley's preference for logic forced them to conceive of time as composed of indivisibles. Because these discussions were primarily logical, and so did not even address the physical aspects of time which feature so prominently in Aristotle's treatment of beginning and ceasing, it is not entirely clear whether Sherwood and Burley were aware of the implications of their solutions for natural philosophy as a whole. Nevertheless, insights into beginning and ceasing substantially enriched the purely logical approaches which characterized most early medieval studies of time. Even if they did not have Book VIII of the *Physics* in mind when they formulated their arguments, their general knowledge of Aristotelian physics served to make their criticism of previous theories more sophisticated because it allowed them to supplement logical arguments with appropriate concepts from Aristotelian natural philosophy.[13] Though they did not perceive beginning and ceasing as a physical problem, their implicit attitudes about time as a complex problem for both logicians and natural philosophers represent a significant advance in the medieval approach to the subject.

The tendency to consider beginning and ceasing as at least partially a physical question was more pronounced in the writing of Peter of Spain. In his *Tractatus syncategorimatum*, Peter supplemented his assessment of the logical functions of the words *incipere* and *destinere* with an analysis of permanent and successive continua. He considered the problem of before and after both grammatically as a matter of tense and physically in terms of the nature of time.[14] Unlike Sherwood and Burley, Peter proposed a solution that concurred with Aristotle's view of time and provided a model for Bradwardine to follow in his own early attempts to understand beginning and ceasing. The characteristic feature of

Peter's analysis is his emphasis on the infinite divisibility of permanent and successive continua. After briefly explaining why he classifies *incipere* and *destinere* as syncategorematic words, he devotes a major portion of his discussion to the physical properties of different kinds of continua. In distinguishing permanent from successive continua he points out that

> the being of permanent things is a whole at one and the same time while the being of successive things is not a whole at one and the same time but only in a succession of parts. . . . It is impossible that more than one time occur at one and the same time, . . . [P]ermanent things are naturally prior and successive things naturally posterior, since permanent things are the cause of successive things. . . . [Moreover,] permanent things are intrinsically limited while successive things are not limited intrinsically but are limited by permanent things - for example, a change is limited by a quantity or quality.[15]

In other words, Peter employs an Aristotelian argument to prove that continua are limited in different ways depending on how they exist in time.

These considerations, Peter goes on to say, play an important role in the assignment of actual limits:

> Thus as regards permanent things the being of which is obtained in an indivisible [instant], one can give the first instant of their being and of their non being afterwards, but one cannot give the last instant of their not being beforehand nor of their being. . . . But as regards successive things - being of which is not obtained in an instant, one gives neither the first not the last instant of their being but gives the last instant of their not being beforehand and their first instant of their not being afterwards. For while they have their being in a certain time. they have not being at the limit of that time; and just as there is no interval between time and its limit, so there is none between their being and their not being.[16]

Although permanent continua necessarily exist in time, their temporal limits are relatively unambiguous: one merely follows the Aristotelian principle of affirming the first and last instants of being. Because successive continua run parallel with time, however, one cannot so easily assess first and last instants: if time is a

continuous entity, divided into segments by nows, the first and last instants of a time segment cannot properly be considered part of the successive entity. This perspective comes directly from Aristotle's description of continuity in the *Physics*.

Although he recognized the logical dilemmas that could arise from accepting Aristotle's definitions, Peter was not overly disturbed by them. In the tradition of Aristotle himself, in fact, Peter devised a linguistic solution to the problem of beginning and ceasing which accounted for both Aristotelian physics and contemporary logical studies. The vocabulary which Peter used to express his solution became widely known and had a particularly strong influence on Bradwardine. His solution takes the form of five rules concerning the meaning and usage of *incipere*:

> Rule One. When the verb 'begins' occurs with permanent things the being of which is obtained at an indivisible [instant], it indicates an assertion of the present and the negation of the past. . . .
>
> Rule Two. When the verb 'begins' occurs with successive things or with permanent things the being of which is not obtained in an instant, it indicates a negation of the present and an assertion of the future, because successive things do not have being at their outset. . . .
>
> Rule Three. When being is added to the verb 'ceases' it indicates a negation of the present and an assertion of the past, no matter what sort of thing it occurs together with. The reason for this is that one cannot give the last instant of a thing's being whether the thing is permanent or successive. . . .
>
> [Rule Four]. Similarly, when the not being of things that are simply permanent is added to the verb 'ceases,' it indicates a negation of the present and an assertion of the past. . . .
>
> [Rule Five]. But when the not being of successive things is added to 'ceases,' it indicates an assertion of the present and a negation of the future, since one does not give the last instant of not being to successive things.[17]

Peter's analysis of beginning and ceasing had direct bearing on Bradwardine's view of time for several reasons. Most obvious, Bradwardine adopted Peter's method for assigning limits in almost every respect in his own treatise on beginning and ceasing, to the point of incorporating large portions of Peter's treatise in his own work.

Peter's study encouraged Bradwardine to think about continuity along the Aristotelian lines which already appealed to him and provided a ready-made vocabulary for expressing his own views about continuity. Moreover, though it is not itself a mathematical work, the *Tractatus syncategorimatum* stands in the late medieval tradition of applying Aristotelian physics to apparently non-physical problems and so possibly contributed to the flourishing of mathematical studies among the Mertonians.[18] Most important, Peter's contentions about ceasing in Rule Five reemphasized Aristotle's suggestion that syncategorematic terms might be used to predict the future. Peter did not develop this idea, but later thinkers, including Bradwardine, paid this suggestion considerable attention.

Bradwardine's *De incipit et destinit* and his *Geometria speculativa* were both written in the early 1320s and so represent his first academic efforts. Because of their geometrical nature, topics involving beginning and ceasing, continuity and infinity attracted his attention at an early stage of his advanced studies; judging from the content of subsequent work, moreover, these topics continued to fascinate him even after he began to concentrate on theology. Nielsen has established that Bradwardine wrote the *De incipit et destinit* in 1323, while he was in the middle of his arts course. The form and content of the text indicate that Bradwardine wrote it shortly after completing the part of the curriculum devoted to logic. In fact, according to Nielsen, the word *igitur* in the first sentence of the text suggests that the discussion of beginning and ceasing might have been part of a larger work listing the functions of several syncategorematic words.[19]

One need not look far to find a reason for the survival of this particular section if Nielsen's conjecture about its relation to Ockham's *Summa Logicae* is correct. Nielsen argues that Bradwardine presented his position on beginning and ceasing in response to Ockham's treatment of the same subject in the first book of the *Summa Logicae*, which Ockham had completed by 1323. In Book II of the

Summa Logicae, finished after 1323, Ockham presented a revised view on the same topic. Nielsen's analysis of these passages suggests that Ockham not only considerably modified his position on beginning and ceasing after 1323 but did so directly in accordance with Bradwardine's criticisms of his original position.[20] If the young student of arts was able to persuade Ockham to change his mind on this issue, it might be wise to reconsider the precise nature of their relationship. Most comparisons of Ockham and Bradwardine emphasize Ockham's influence on Bradwardine's theology, especially in the negative sense that Ockham's views prompted a fierce response on Bradwardine's part. Nielsen's research indicates, however, that the connection between the two thinkers was probably much more complex, positive and mutually beneficial than the conventional interpretation of their interaction has recognized.

Another indication of the date of the *De incipit et destinit* is its strong reliance on Aristotelian physics. In this treatise Bradwardine tried to resolve the problem of assigning limits to permanent and successive things within the context of Aristotle's teaching on the continuum. Since the text represents Bradwardine's earliest reflections on the subject, it is not surprising that his approach was conservative. Not only did he borrow heavily from Aristotle and Peter of Spain, but he also confined his discussion specifically to logical questions which did not have a theological dimension. The main theme of the work is the mind's inability to acquire determinate knowledge about future events. Thus the future, from the human perspective, is entirely contingent.[21] Although this position seems contrary to the more deterministic approach which he later took in the *De futuris contingentibus* and in the *De causa Dei*, his conscious decision to consider contingency without reference to God gave him the freedom to side-step aspects of the problem which involve divine causation or prescience. Subsequent discussions of beginning and ceasing in the *De continuo* confirm Bradwardine's tendency in

earlier works to treat logical and physical problems separately from theological ones.[22]

More compelling evidence for the early date of the *De incipit et destinit* is Bradwardine's use of Aristotle and Peter of Spain. His uncritical acceptance of Aristotle's view of time and continuity indicates a basic knowledge of the *Physics* but his arguments do not convey the originality which he later demonstrated in reevaluating Aristotle in the *De proportionibus* and the *De continuo*. Even this early effort, however, the text is structured as a series of geometric proofs, in spite of its essentially non-geometrical subject. This Euclidean approach to a logical problem reflects Bradwardine's growing interest in mathematics, a feature of his thought which left its mark on all of his writings, including those devoted to theology. It is revealing to note in this context that, even though both his topic and his method were logical, he tried as often as possible in the *De incipit et destinit* to explain his theories in terms of physical concepts such as motion and time and even stated explicitly in the text that he wished to speak as a natural philosopher not a logician.[23]

Like Peter of Spain, Bradwardine focuses in this text on the notion that the infinite divisibility of continua seriously complicates the task of assigning limits. Bradwardine's first two propositions essentially restate Peter's distinctions between permanent and successive continua and he concludes along with Peter that, in the case of permanent continua, one should affirm the first and last instants of being. In the third proposition Bradwardine tries to work out in a series of detailed corollaries how the problem of beginning and ceasing affects the analysis of successive things such as motion in which a single instant cannot truly constitute being. He therefore asserts, following Aristotle, that it is impossible to determine logically or physically when a motion begins to be, since one would have to isolate the instant at which the motion did not yet exist but would exist immediately afterward.[24] Working out the

implications of this proposition for the study of motion is the chief burden of the *De incipit et destinit*. To shed light on this dilemma, Bradwardine devotes the corollaries of the third proposition to a comparison between successive continua and permanent continua which are not so seriously affected by the problem of beginning and ceasing.

Having analyzed at length the problem of assessing beginning- and end-points for permanent and successive things respectively, Bradwardine turned very briefly in proposition four to the subject of things which possess being in only one instant, a notion which Burley had first introduced to the discussion of beginning and ceasing in the 1310s. Not entirely convinced that instantaneous things could really exist, however, Bradwardine addressed the issue only perfunctorily.[25] In the final proposition Bradwardine summarized his conclusions with a series of rules, based on Peter of Spain's method for analyzing propositions containing the verbs *incipere* and *destinere*. Bradwardine's entire conception of time in this treatise, in fact, parallels that of Peter of Spain: time is both the medium in which permanent things exist and also a successive continuum in its own right which measures and limits other successive things. In the case of a permanent thing, the infinitely divisible nature of time makes it impossible to determine the exact moment the thing comes into being or ceases to be: one must choose to affirm either the first and last instants of being or the last and first instants of non-being. Following Peter, Bradwardine claims that one should always affirm the first and last instants of being in cases of permanent things. Moreover, one cannot predict the future of a permanent thing merely by affirming its beginning in the present. He rejects the logic which expounds the sentence "Socrates begins to be" as "Socrates is now, therefore Socrates will be" on the grounds that such an exposition uses the same instant to affirm both Socrates' present and future state. On this basis, he questions the general assumption that propositions in the future tense can reveal the truth

about a permanent object.[26] Relying heavily on Aristotelian physical theory, therefore, Bradwardine concedes that the future state of permanent things can be predicted but only in a limited and artificial way. Logical analysis can predict that something which is will continue until it ceases to be, but this revelation offers no concrete information about the actual future state of that thing.

In the case of successive things, Bradwardine contends, again along Aristotelian lines, that it is impossible to make any true statements about them except retrospectively.[27] His first argument against predicting the future of a successive entity relates to Aristotle's initial problem of designating first and last instants of being. To predict the future state of a successive thing, such as motion, one would have to know the next adjacent instant, something which the infinite divisibility of time makes extremely difficult. If one cannot even designate a beginning-point for a motion, says Bradwardine, one can hardly be expected to determine what will follow after it.[28] A more significant obstacle to knowing the future of a successive thing is that successive things unfold themselves in time. One cannot fully know something which has not yet happened and therefore does not exist. Bradwardine again goes back to Aristotle in distinguishing between our perception of what might happen in the future and the sensible reality of the present. Even our sensible perception of present motion is suspect, however, since neither the senses nor the mind can tell us exactly when a motion in the present has begun. Under these circumstances it is clearly impossible to make predictions about a future motion which is completely beyond our experience.[29] Bradwardine is not denying here the common experience of motion or even the human capacity to measure it. He simply rejects the notion that one can know in the present the future state of a successive thing because knowledge of any physical being requires sensory experience, which is impossible to obtain for a future event.

The final argument against the possibility of certain knowledge about the future state of successive things contains the treatise's most explicit statement about the nature of time. The basis of Bradwardine's argument is Aristotle's insistence that the successive nature of time makes it impossible to designate an instant in the future before it actually occurs. Such a designation would require the measurement a motion from outside of time, which violates the definitions of both motion and time.[30] In the subsequent analysis of this problem, Bradwardine develops at length the thesis that the future of successive things lies beyond certain human knowledge because time, space and motion are all interrelated. As parallel successive continua, all three are subject to the ambiguities which result from their infinite divisibility.[31] In other words, Bradwardine implies that one cannot use syncategorematic terms to draw conclusions about the future, for the transition from present to future is a physical not a logical process. As far as Bradwardine is concerned, then, *incipere* and *destinere* are only really useful in affirming the present state of permanent things; their utility in affirming the present state of successive things is limited; and they cannot function at all as true indicators of future states in logical propositions.

When Bradwardine returned to the problem of beginning and ceasing in the *De continuo*, he treated it geometrically, without significant reference to syncategorematic words. He paid little attention, moreover, to the question of contingency, presumably because it did not lend itself to mathematical analysis and he had already dealt with that aspect of the subject in the *De futuris contingentibus*. Although it makes no reference to contingency, however, the *De continuo* reconfirmed, and indeed expanded upon, the underlying theory about time which informed Bradwardine's views on beginning and ceasing. In his initial definitions, for example, Bradwardine restated with mathematical precision the Aristotelian position on continuity which governs all statements involving before and after. His

seventeenth definition states that "for something to be, to have been, or to be about to be *after* another thing, is the same as to be, to have been, or to be about to be *with a mean* between those things." Definition eighteen says that "for something to be, to have been, or to be about to be *immediately after* another thing, is the same as to be, to have been, or to be about to be *without a mean* [between those things]."[32] The purpose of definition eighteen was to affirm Aristotle's assertion that beginning and ceasing occur in the same instant, or as Bradwardine later expressed the idea in proposition twenty-seven, "every beginning or ending is not measured in time, but in an instant."[33]

Bradwardine then went on to distinguish between the beginnings of permanent things, which have first and last instants of being and successive things which have first and last instants of non-being. In other words, permanent things are intrinsically bounded while successive things are extrinsically bounded. To say otherwise, one would have to assume that a thing must have both a last instant of non-being and a first instant of being and, consequently, that continua are composed of immediate indivisibles.[34] According to Murdoch, Bradwardine's views about beginning and ceasing had an important function in his overall strategy against the atomists. Bradwardine's success in this enterprise rested on his ability to perceive the inconsistencies of the atomist position and to tailor Aristotelian physical theory to suit the particulars of the debate.[35] By popularizing Bradwardine's criticisms of the atomists the *De continuo* contributed to the achievement of fourteenth-century philosophers who greatly clarified the nature of continuity through their investigations of successive continua.[36]

In the *De incipit et destinit* and the *De continuo* Bradwardine presented a physical rather than a psychological view of time. Even on those occasions when he admitted the role of human perception in defining time, he discussed this perception in Aristotelian terms. By consciously avoiding the issue of divine knowledge he was

able to describe time and motion as successive continua whose natures and directions are determined by natural law. Such a secular view of time was extremely useful in his mathematical studies, encouraged his respect for Aristotle and satisfied his desire to find order in the natural world. Nevertheless, Bradwardine could not escape from the influence of contemporary speculation at Oxford about contingency, which called into question the validity of a human-centered approach to time. Aristotle himself had addressed the problem of contingency, much in the same way as he had tried to solve the problem of beginning and ceasing, and so made an important contribution to an extremely complex debate. In the *De incipit et destinit* Bradwardine consciously avoided, as Aristotle had done, any consideration of broader philosophical or theological implications of contingency. By the fourteenth century, however, it was impossible to do full justice to the topic of contingency without taking into account the work of the Christian thinkers who had transformed contingency from a merely logical problem into a potent theological one. Their continuing efforts to establish a relationship between God's certain knowledge about the future and human uncertainty led to subsidiary discussions about a wide variety of difficult theological topics including predestination, free will and divine causation. Medieval theologians, in fact, made significant progress in bridging the gap between contingency as a logical problem and the temporal aspects of God's relationship with his creation.

The *De futuris contingentibus*, composed shortly after the *De incipit et destinit* while Bradwardine was still a master of arts, represents one of Bradwardine's first attempts to sort out the philosophical implications of contingency and to consider whether and to what extent the future has been predetermined. He had already shown in the *De incipit et destinit* that the future seems to be contingent from the human perspective because we cannot attain certain knowledge of the future through logical analysis of propositions or observation of nature. This does not

mean, however, that the future is also contingent to God. In the *De futuris contingentibus* Bradwardine explored, perhaps for the first time in his career, certain aspects of the transition from past to future which he later refined in the *De causa Dei*. His initial attempt to resolve the problem of contingency can be seen as a perceptive but youthful response to a complex body of authority ranging from Aristotle's metaphysical works to Ockham's studies of divine causation.

Aristotle's main contribution to the medieval debate about contingency comes from his discussion of truth in Book IX of the *De interpretatione*. The passage which Aristotle devoted to future contingents is, unfortunately, so confusing that neither medieval nor modern scholars have been able to agree on precisely what he was trying to prove about the truth of future events.[37] In his analysis of the passage, Jaakko Hintikka suggests that the source of Aristotle's difficulty with contingency, like his problem with beginning and ceasing, was his inability to offer on the basis of his physical system simple, unambiguous answers to questions about the truth of temporally indefinite sentences.[38] Aristotle approached the problem of contingency by distinguishing generally between things that are necessarily true for a given time and those which are only possible. He offered no firm criteria, however, for determining the relative truth of various kinds of statements about the future. Although he admitted that some events might be eternally necessary, he believed that most truths tend to be contingent, claiming that

> not everything is or happens of necessity: some things happen as chance has it, and of the affirmation and negation neither is true rather than the other; with other things it is one rather than the other and as a rule, but still it is possible for the other to happen instead. . . . Clearly, then, it is not necessary that of every affirmation and opposite negation one should be true and the other false. For what holds of things that are does not hold for things that are not but may possibly be or not be.[39]

This rather vague doctrine suggests that the contingency of an event or thing is based on whether it is necessary both now and in the future. While it is logically

necessary that a certain future thing will either be or not be, one cannot prove its future existence or non-existence in the present. From the human point of view, then, future things are almost entirely contingent. Whereas all true statements about the past are necessary, most future statements must wait for retrospective verification.[40] From the perspective of contingency, then, past and future are fundamentally different states of time.

Because of its large scope and obvious theological implications, the problem of contingency received much greater attention throughout the Middle Ages than the more specialized problem of beginning and ceasing. Although he had not yet begun his theological studies when he wrote the *De futuris contingentibus*, Bradwardine's philosophical training had advanced enough so that he was prepared to consider more than just the physical and logical aspects of contingency.[41] In developing his own philosophical approach to contingency, Bradwardine was guided by the work of Augustine and Boethius, who came to be, along with Aristotle, Bradwardine's favored authorities.

Augustine's approach to contingency appealed to Bradwardine chiefly because it considered contingency as much a physical problem as a theological one. Augustine supplemented Aristotle's view of contingency by paying greater attention to its moral implications and offered an alternative method for defining the problem. Whereas Aristotle concerned himself mostly with the issue of truth in temporally indefinite statements, Augustine considered the human perspective on contingency in future events. In Book V, Chapter 9, of the *City of God*, Augustine presents his own view of contingency through his criticism of Cicero's cosmology. According to Augustine, Cicero's major error was his unreasonable denial of any kind of foreknowledge or fate, which was due to his fear of rigid predestination. For Cicero, said Augustine, it would be far better to deny fate or God altogether than to live believing that there is no opportunity for independent will or action. In making

this claim, Cicero assumed that human acknowledgement of divine prescience amounts to the surrender of individual freedom.[42]

Augustine rejected Cicero's assessment of the relationship between the human and the divine will and thus dismissed Cicero's insistence on viewing contingency from the divine perspective. In Augustine's opinion, God's foreknowledge does not interfere with the exercise of human will; on the contrary, God's foreknowledge actually enhances and protects human freedom. As the first efficient cause of every event, God gives to his creatures a world in which they can exercise their wills freely according to their abilities: "their future strength is completely determined and their future achievements utterly assured."[43] Augustine's conception of the will not only preserved both God's prescience and human freedom but also placed the question of contingency in a human context. God's knowledge of the future does not make human knowledge of a particular future event any more certain, except in instances of prophesies, and even here we do know exactly how or when God will fulfill them. Augustine's position on contingency was entirely consistent, therefore, with his view of time, which also stressed human perception. God made time so that his creatures would have a sensible reference for ordering their existence and to give them a place in history. Thus time and contingency must always be related to eternal being.[44] In this sense, Augustine's approach to contingency had a metaphysical significance which Aristotle's lacked. Nevertheless, both Aristotle and Augustine emphasized, in different ways, the necessity of separating absolute truth from human perception of truth.

In the *Consolation of Philosophy* Boethius offers an interpretation of contingency which lies somewhere between Aristotle's and Augustine's. Like Aristotle, Boethius wanted to establish degrees of necessity and was, in fact, much more successful than Aristotle had been in Book IX of the *De interpretatione*. In

Boethius' view, the order of the natural world depends on the absolute necessity of certain events such as the rising and setting of the sun. As for contingent things, Boethius makes the further distinction between cases in which the possibility of one outcome is equal to another and cases in which a certain outcome is extremely unlikely but still possible. Boethius also maintains Aristotle's position that a true prediction concerning a future event cannot be considered necessary solely on the grounds that the prediction turns out to be correct: only individual events in time which are always true should be considered necessary.[45]

Through his consideration of the theological aspects of contingency, however, Boethius arrived at a position on the function of will in determining future events which closely resembles Augustine's. In the first place, God is not subject to the same kind of observation of past, present and future that his creatures experience because he is outside of time. God's foreknowledge does not involve the kind of control which Cicero and others have attributed to him. In fact, his influence is of an entirely different order:

> since God abides for ever in an eternal present, His knowledge, also transcending all movement of time, dwells in the simplicity of its own changeless present, and, embracing the whole infinite sweep of the past and future, contemplates all that falls within its simple cognition as if it were now taking place. And therefore, if thou wilt carefully consider that immediate presentment whereby it discriminates all things, thou wilt more rightly deem it not foreknowledge as of something future, but knowledge of a moment that never passes. For this cause the name chosen to describe it is not prevision, but providence, because, since utterly removed in nature from things mean and trivial, its outlook embraces all things as from some lofty height. Why then dost thou insist that the things which are surveyed by the Divine eye are involved in necessity, whereas clearly men impose no necessity on the things which they see?[46]

Boethius again echoes Augustine on the question of the human response to contingency. He contends that, while many unexpected events seem to be chance, they really occur as the result of "causes [arising] from that inevitable chain of order,

which, flowing from the fountainhead of Providence, disposes all things in their due time and place."[47] Moreover, in establishing that order, God has provided for the human will to exercise freedom in choosing future actions. The freedom of a human soul is relative to its capacity to use freedom wisely.[48] So while emphasizing the Aristotelian distinctions between necessity and possibility, Boethius also places contingency in a broader cosmological context which links human freedom with the obligation to recognize moral and natural order.

Medieval discussions of contingency bear the influence of Aristotle, Augustine and Boethius in varying degrees.[49] Anselm, for example, used Boethius' distinction between different levels of possibility to draw his own distinctions about necessity. Thus he differentiated between "antecedent" necessity, which is absolute, and "subsequent" necessity, in which God's foreknowledge does not interfere with free choice. In Anselm's view, only the rigid "antecedent" necessity could impair the free exercise of choice.[50] Similarly, Peter Abelard concluded from his reflections on Aristotle's discussion of future contingent sentences that God knows and can reveal contingent truths without enforcing determinism or yielding divine infallibility.[51] Peter Lombard later introduced a more sophisticated approach to contingency which involved the question of whether God can know what he does not know, thus making an initial distinction between that which is necessary and that which is immutable.[52] Robert Grosseteste went on to distinguish further between simple necessity (those things, like mathematical principles, which would be the same regardless of the course of history) and immutable truths, which can not change once they have been established. Grosseteste's theories about the relationship between past and future necessity stimulated a heated debate about the modal aspects of contingency which continued well into the fourteenth century.[53] Aquinas, in keeping with Boethius, went back to the familiar notions that God's being in the eternal present allows him to know the future without determining it

and that God's knowledge that a person will make a particular choice does not detract from the freedom of that choice.[54] In response to Aquinas Duns Scotus argued that there is an objective difference between past and future which God experiences as much as humans do. For Duns, contingency depends on God's power to will the opposite of anything that he wills.[55] This outpouring of theories about contingency in the thirteenth century provides the context for Bradwardine's dialogue with Ockham on contingency in the fourteenth century.

The philosophers who influenced Bradwardine most immediately in the *De futuris contingentibus* were Peter Aureoli and William Ockham. It was Aureoli who suggested the principles about contingency which Ockham later developed into a sophisticated logical theory of necessity. Bradwardine first challenged this theory in the *De futuris contingentibus*, then expanded his criticism of it much more skillfully in the *De causa Dei*. Aureoli's argument was based on the assumption that a thing which is immutable in a particular state must therefore be necessary in that state. From this premise he tried to prove that a true statement about the future is both immutable and necessary. Aureoli was fully aware of the central dilemma of this thesis: a statement which is true both in the present and at the time of its fulfillment leaves no room for contingency or choice. He therefore softened his original position by expanding the role of contingent statements about the future, which, he claimed, need not be either true or false in the present.[56] In this way he saved the logician from the necessity of verifying future truths in the present, but he put his whole theory in doubt by failing to explain how something could be true about the future but not true in the present. Aureoli left it to others, such as Ockham and Gregory of Rimini, to address the logical difficulties which arose from this new proposal. His use of arguments from Aristotle, Grosseteste and Lombard ensured, however, that his ideas would be widely publicized, if not precisely followed, throughout the fourteenth and fifteenth centuries.[57]

Ockham's speculations about contingency appear in many of his philosophical writings. In addition to discussions in the *Summa Logicae* and the *Quodlibeta*, the *Tractatus de praedestinatione et de praescientia Dei et de futuris contingentibus* provides an extended treatment of Ockham's view of contingency. In the *Tractatus de praedestinatione* Ockham is particularly interested in addressing the question of how the necessity of a statement varies according to whether it refers to a past, present or future time. He also makes a distinction here between the necessity of statements about things which God has predetermined and that of purely logical statements which do not reveal whether God's predestination is involved in them. According to Philotheus Boehner, who has edited the *Tractatus de praedestinatione* and several other of Ockham's works, Ockham conceives of contingency as a fundamentally logical and linguistic problem, although he admits that contingency also has some significant theological ramifications.[58]

The thrust of Ockham's analysis in the *Tractatus de praedestinatione*, reminiscent of treatises on syncategorematic words, is to decide whether verbs such as *praedestinare* and *reprobare* refer primarily to the present or to the future. Since statements about the future cannot be verified as true or false, he argued, one cannot determine whether they are absolutely necessary as one can when the statement is about the past. Even a statement containing the word *praedestinare* or *reprobare* in the past tense, however, still refers to the future until the event in question takes place and can be verified. On the other hand, God knows the truth of every proposition whether it applies to the past or present, in which it is possible for us to share in his knowledge, or to the future, in which it is not. Therefore, there cannot be any proposition which is neither true nor false. Moreover, if a statement about the future is true, it is necessarily true only after the instant in time at which God fulfills the prophecy. Until this instant, the statement could be true but would not be necessarily true, since an action can only be necessary after it has been

completed.[59] Ockham's logic is based on the observation that human and divine perceptions of the future are entirely different in character and scope.

Ockham then must explain how it is that God can know the future without depriving humanity of its free will. In contrast to many of his predecessors, who placed God outside of time, Ockham credits God with an immediate experience of time which resembles a human one. In the sixth assumption of the *Tractatus de praedestinatione* Ockham maintains that God's capacity to know the future is a logical, not a cosmological reality:

> It must be held beyond question that God knows with certainty all future contingents - i. e., He knows with certainty which part of the contradiction is true and which false. . . . It is difficult, however, to see how He knows this [with certainty], since one part [of the contradiction] is no more determined to truth than the other. . . . For that reason, I maintain that it is impossible to express clearly the way God knows future contingents. Nevertheless it must be held that He does so, but contingently. . . . Despite [the impossibility of expressing it clearly], the following way [of knowing future contingents] can be ascribed [to God]. Just as the [human] intellect on the basis of one and the same [intuitive] cognition of certain non-complexes can have evident cognition of contradictory contingent propositions such as 'A exists,' 'A does not exist,' in the same way it can be granted that the divine essence is intuitive cognition that is so perfect, so clear, that it is evident cognition of all things past and future, so that it knows which part of a contradiction [involving such things] is true and which part false.[60]

Though more perfect than human knowledge in every respect, God's knowledge of the future is still contingent. By drawing an analogy between human and divine knowledge of contingent events, Ockham suggests that God's experience of the future is comparable to ours: like us, he is waiting for the future to come into being so that his knowledge of the future can be necessitated.

Ockham's discussion of whether God's knowledge of the future can change further emphasizes God's temporality. In Ockham's view, one of God's supreme powers is his capacity to know the truth of changing propositions without changing himself. Moreover, Ockham argues that in certain cases God does not know future

events, but his lack of knowledge in no way impairs his perfect understanding of the future:

> [Some contingents] that are future as regards their wording suggest (*implicant*) that present or past things are future. Suppose, for example, that the proposition 'Socrates will sit down at t_1' is asserted after t_1. This suggests that past things are future - viz. that t_1 is future and that sitting down is future. Such a proposition about the future can change from truth to falsity, since before t_1 it was true and after t_1 it is false. And God can *not* know such a future contingent after He *did* know it, as a result of change of things and the passage of time, without any change on His part.[61]

This argument not only firmly places God inside time but also preserves, albeit in a limited way, the contingency of future events at the expense of God's absolute knowledge.

Ockham admitted that he could not easily prove his theories about contingency with human reason alone. He considered faith, rooted in Scripture and the saints, to be the best form of verification.[62] This admission did not spare him, however, from the criticism that his conception of divine foreknowledge directly contradicted patristic views. His acknowledged inability to explain his logical theories in terms of the orthodox position on God's relationship to time made Ockham's views on contingency the subject of considerable debate. While he was relatively successful philosophically in placing his theories about contingency in a context of a changing physical universe, he had more trouble in convincing his colleagues of the religious merit of his logic. At the heart of his difficulty lay his view of time, which seemed to contend that God experiences time in the same Aristotelian way of motion and change as his creatures experience it.[63]

Bradwardine's chief objective in the *De futuris contingentibus* was to refute the human-centered view of divine time expressed by Ockham and some of his contemporaries. Bradwardine agreed with Ockham that Aristotelian physics provides a good explanation of time as a natural phenomenon but he refused to

believe that God shared in any way the human experience of time. Because the *De futuris contingentibus* posited such a rigid separation of God from time and advocated such a firm commitment to the notion of God's absolute prescience, it could give the impression that Bradwardine saw practically no role at all for human free will. Later, in the *De causa Dei*, he would treat the subject of contingency with much greater subtlety and balance. In his first attempt, however, his inexperience in dealing with complex philosophical and theological questions led him to uncompromising positions and exposed his lack of expertise in philosophical inquiry. On the subsidiary issue of whether God causes sin by virtue of his prior knowledge of it, for example, Bradwardine had little to offer beyond an apology for not yet having mastered the problem.[64] Nevertheless the *De futuris contingentibus* demonstrated Bradwardine's general familiarity with the contemporary state of the debate over contingency and offered a criticism of Ockham's position which was clear and relatively well developed in spite of its failure to present a satisfactory alternative.

Bradwardine set out in the *De futuris contingentibus* to prove that God has complete foreknowledge of all future contingents by virtue of his eternal nature. In the sixth opinion, Bradwardine defined the temporal basis for his view of contingency, which echoed Boethius' and Anselm's assertion that everything is eternally present to God and therefore God has complete knowledge of every future event.[65] Bradwardine thus stressed the difference between the creature, whose knowledge of the future is necessarily contingent because of his position in time, and God, who knows everything there is to know simultaneously. Bradwardine reinforced his contention that God knows all things in an eternal present by stressing God's immutability. In contrast to Ockham's conception of God, Bradwardine's view did not admit that God experiences change and time. There is no reason to consider the question of whether God can change his mind about the

truth of a future statement because God knows eternally the truth of every proposition. Not even God's willingness to respond to his creation undermines his immutability.[66] Bradwardine then demonstrated in the same way that his view of God is thoroughly consistent with revelations about God's nature in Scripture. God's knowledge of future events ensures that his revelations were, are and will be true, whether they come to us through prophecy or through another means, such as created knowledge.[67]

When it came to explaining how human free will could be accommodated in his theory of God's unchanging omniscience, however, Bradwardine had nothing very original to offer. He derived his main argument about free will from Augustine's criticism of the Stoics in Book V of the *City of God*, in which Augustine had claimed that God allows the human will to participate freely in his eternal plan.[68] This and several other similar references to Augustine and Boethius indicate that Bradwardine adopted, essentially uncritically, their conception of the relationship between God's future knowledge and the human will.[69] Bradwardine's definition of divinity, based as it was on the classical and patristic principles of omniscience, immutability, eternity and omnipotence, gave him little choice but to acknowledge God's capacity for complete knowledge of future contingent events.

Bradwardine's youth and relative inexperience with theological matters apparently led him to a rigid and uncompromising position in the *De futuris contingentibus*. The conclusion of the treatise left no room for doubt that he was comforted much more by arguments which demonstrated God's absolute prescience than by those which emphasized free will. Bradwardine was content simply to acknowledge that some kind of free will must be possible since both Scripture and Christian writers have affirmed it. Nor did he show any inclination to define free will so that it was compatible with his deterministic view of necessity. Bradwardine's final word on contingency in the *De futuris contingentibus* was that, while the

capacity to know the truth of a future contingent statement is beyond the capacity of man, God, with his absolute power, is not constrained by human weakness.[70] Significantly, Bradwardine was not opposed to Aristotle's position on contingency as such; his concern was only to define contingency so that it did not minimize God's non-temporal knowledge of future contingent events.

Bradwardine's early position on contingency, as it was expressed in the *De incipit et destinit* and the *De futuris contingentibus*, was based on the tension which he perceived between two equally compelling temporal theories. As a mathematician and natural philosopher, Bradwardine found Aristotle's definition of time both reasonable and useful; as a Christian philosopher, he was attracted to Augustine's and Boethius' more psychological conception of time, which seemed to offer a better explanation of time's relationship to eternity. In both treatises on contingency Bradwardine exhibited a tendency towards rigid, almost dogmatic, logic, as if he was trying to express his philosophical opinions as mathematically precise truths. Thus his commitment to the thesis that the continuous nature of time prohibits logical predictions about the future was just as strong as his pronouncement that God's perfect foreknowledge repudiates real contingency. At the heart of this apparent contradiction lies Bradwardine's even more fundamental belief that Aristotle's description of time and other features of the natural world accurately reflects God's creation. Although he realized that one could never hope to determine God's temporal relationship to his creation using natural philosophy alone, Bradwardine thought that Aristotelian physics allowed the natural philosopher to study the world from the human perspective and in human terms.

These writings on contingency also say much about Bradwardine's academic personality in 1320s. He was at once receptive to the ideas of his thirteenth-century predecessors and defiant in support of the positions which attracted his interest. If Nielsen's assessment of Bradwardine's interaction with Ockham in the *De incipit et*

destinit is correct, the *De futuris contingentibus* also clearly indicates Bradwardine's ability as a young scholar to debate and even instruct his more established peers. Although it would be too much to expect complete consistency in his early treatises, Bradwardine's work on contingency, along with his mathematical studies of proportionality and continuity, provide a good indication of his intellectual outlook. While he did not confine his studies to problems which could be solved easily with mathematics, he applied mathematical methods to his subjects whenever possible. Underlying all of his main positions was the assumption that there is an order in nature which can be understood mathematically, not in the purely symbolic sense of Platonic mathematics but in the active observation and description of natural phenomena according to Aristotelian physics.

As a concept which has both cosmological and physical significance, time emerged again and again in Bradwardine's early writings, though he did not, so far as we know, devote a separate treatise to the problem of time. In his early treatises the problem of time always arose in the context of proportional velocity, continuity or contingency. While his studies of motion in the *De proportionibus*, the *De continuo* and the *De incipit et destinit* all depend on his Aristotelian understanding of time as a physical concept, however, the *De futuris contingentibus* attempted to confront the much more difficult problem of explaining how human beings can experience contingency in their temporal existence without denying certain knowledge to God. It was the logical dilemma of contingency in a temporal world created by a timeless God which troubled Bradwardine in the *De futuris contingentibus*. Although he tried to resolve the dilemma through recourse to Aristotelian natural philosophy he eventually realized that a purely creature-oriented view of time only partially explains the cosmological significance of the distinction between time and eternity.

In the *De futuris contingentibus* Bradwardine posed challenging questions about time and contingency but found himself unable to answer them. By the time that he wrote the *De causa Dei*, however, he was able to describe precisely the distinction between time and eternity, to assess the place of time in his own cosmological system and to reconcile Aristotelian physics with Augustinian theology. Bradwardine's mature view of time undoubtedly grew out of his interaction with colleagues in the 1330s and was influenced by his conversion experience. Nevertheless, his early speculations about time as a physical and logical concept informed his approach to God's use of time, which lies at the center of his attack on the modern Pelagians. Without an understanding of Bradwardine's mathematical way of thinking and his devotion to an Aristotelian perspective on nature, it is easy to underestimate his ability to balance different cosmologies and conciliate opposing schools of thought in the *De causa Dei*, a work that is generally portrayed as highly polemical. The foregoing discussion of Bradwardine's early attitudes towards time offers the necessary background, therefore, for exploring the cosmology he presented in the *De causa Dei*.

CHAPTER SEVEN

TIME IN THE DE CAUSA DEI

The *De causa Dei*, Bradwardine's longest and most influential work, represents the only surviving example of his theological method. Although it is as long as or longer than most contemporary sentence commentaries, the *De causa Dei* is a polemical work focused on a single issue: the defense of God's role as first cause in every created act against the false claims of the modern Pelagians, as Bradwardine referred to his opponents. In spite of its theological orientation, however, the *De causa Dei* follows the same style as Bradwardine's works of natural philosophy. The text consists of a series of axioms and corollaries arranged and tested with Bradwardine's characteristic mathematical precision.

His central thesis that God is the first cause of every created act was not remarkable in itself, since Thomas Aquinas had already developed it at length as both a philosophical and a theological problem in the *Summa theologica.* Bradwardine's capacity for precise mathematical reasoning, however, combined with his passionate disdain for the contemporary suggestion that grace need not precede a meritorious act, gave his analysis of the first cause a special sharpness and urgency. Bradwardine fully appreciated the implications of his view of the first cause for other theological questions, such as contingency, free will, grace, and predestination. Indeed, the burden of the three books of the *De causa Dei* was to illustrate both philosophically and theologically how the human will can be guided at all times by God's will and yet remain free.

The deterministic nature of Bradwardine's arguments made the *De causa Dei* a controversial work when it was published in 1344 and it remains so today. Bradwardine's activities in the 1340s helped, in fact, to ensure that the *De causa Dei* would reach a wide and varied audience. By the late 1330s, he had attracted powerful ecclesiastical patronage and was enjoying the prominence of his position as chancellor of St. Paul's and chaplain to Edward III. In spite of his new responsibilities, Bradwardine had been able to maintain close ties with his former colleagues at Merton: he dedicated the *De causa Dei* to the Mertonians, who had urged him to put his complaints against the "modern Pelagians" into writing. Bradwardine's reputation as a learned and saintly man and his strident claims about topics of contemporary interest assured a large audience for the *De causa Dei.* Any analysis of this work must consider, therefore, both the context of the academic debate which shaped its contents and the influential position of its author.

Modern readers of the *De causa Dei*, like their medieval counterparts, respond to the polemical tone of the work and sense in it some of the confusion of mid-fourteenth century theological discourse which Bradwardine tried to overcome. Although they all concede the importance of the work, historians disagree strongly about why it was significant. In spite of their different interpretations of Bradwardine's purpose, for example, both Leff and Oberman contend that the *De causa Dei* is almost wholly theological in character. According to Leff, "Bradwardine eschewed philosophy and metaphysics. He was not primarily concerned with the problems of being or its nature, nor with the scope of human knowledge."[1] After acknowledging the philosophical interest of the text, Oberman also argues that Bradwardine was "first and foremost a theologian, for whom philosophy served as a necessary means for the expression of theological thoughts."[2] Other historians contend, however, that it was Bradwardine's distinctive philosophical outlook which gives the *De causa Dei* its remarkable character. In his

assessment of Bradwardine's criticism of the "modern Pelagians," F. C. Copelston portrays Bradwardine as a metaphysician who based his doctrine of grace on the Aristotelian principle that whatever is moved is moved by something else; and, as a Christian, Bradwardine merely specified that the first cause of any movement ultimately is God.[3] Unlike Augustine and Boethius, who used a psychological argument to explain how God causes the human will to act predictably and freely, Bradwardine relied firmly on Aristotelian cosmology in his analysis of the problem.[4]

Bradwardine's views of time provide a good means for assessing the extent to which his theology was shaped by Aristotelian metaphysics. Time, the continuum which distinguishes limited created being from the eternal perfection of God, has both physical and theological significance in Bradwardine's cosmology. The variety of contexts in which the problem of time arises throughout the *De causa Dei* reveals the importance of time in Bradwardine's attempt to reconcile his Aristotelian natural philosophy with the doctrine of grace and justification which he derived from Augustine. In this chapter, I shall trace Bradwardine's treatment of time under three broad headings - the role of time in creation, the philosophical enigma of time, and the function of time in theological discussions of sin and grace - in order to examine Bradwardine's method of synthesizing Aristotelian natural philosophy with Augustinian theology. This analysis of Bradwardine's view of time in the *De causa Dei* will demonstrate that the problem of time held a central place in Bradwardine's metaphysical system as well as in his conception of God's absolute power because it is the distinction between time and eternity which reveals how God can create an orderly universe and participate in every created motion or act without being constrained by the rules which he has established for his creation.

Since one of the central purposes of the *De causa Dei* was to explain God's activity in the world, the subject of creation arose in it continually. As a devoted follower of Aristotle and a gifted natural philosopher in his own right, Bradwardine

remained committed even in his theology to the validity of Aristotelian natural philosophy. In the tradition of Thomas Aquinas, Bradwardine had advocated in his earlier works the exploration of natural phenomena through human reason. By the time of the writing of the *De causa Dei*, however, he had become more interested in the long-standing problem of reconciling reason with faith. Bradwardine's first attempt to integrate his Augustinian-Boethian view of eternity with his Aristotelian view of time in the *De futuris contingentibus*, in which he seemed to rule out the possibility that the human and divine minds could share a common experience of time, was not entirely successful. Some nineteenth- and early twentieth-century historians, such as Lechler, Workman and Laun saw the *De causa Dei* as a further attempt to separate humanity from God. In more recent times this view has been defended and enlarged upon by Leff and Robson, who, like their predecessors, see both Bradwardine and Wyclif as advocates of an extreme predestinarianism.[5] Because he held that God in his absolute power can do anything and insisted that God participates directly in every human act, Bradwardine has been accused both of determinism and of drastically diminishing the human capacity for creativity or independence.

If one keeps in mind Bradwardine's Aristotelian outlook on the world, however, another interpretation of the *De causa Dei* becomes possible. Bradwardine the scientist wished to find order and rationality in the created universe; and, like all theologians of his age, he looked to God to find the source of that order. In an intellectual environment of intense speculation about what God could or could not do, Bradwardine's approach to God can be seen as optimistic and a positive inducement to all kinds of human endeavor rather than a grim, paralyzing sort of determinism. For Bradwardine, the notion of presdestination was in fact a consolation to those who were anxious about the state of their relationship with God: he intended not to frighten people but to reassure them, in the face of

disquieting remarks by some theologians that God might intervene in the world without observing his own natural laws or that his knowledge of the future might be altered by acts of human will.[6] In Bradwardine's opinion, God has created the world in such a way that its orderly development in time in no way restricts his power, in his eternal present, to participate in his creation. On the contrary, God's constant involvement with his creation ensures order and goodness without fear of divine capriciousness.

The main theses of the three books of the *De causa Dei* give an indication of how Bradwardine envisioned God's activity in the world.[7] In Book I Bradwardine argues that God is the source of every good act: "Grace, which is a habit freely given by God, together with the human will is the proper efficient cause of whatever good and meritorious act man performs."[8] Moreover, although the human will must cooperate in the process of causing a good act, the gift of grace is "naturally prior" to the human will.[9] Book II develops the idea that God has created the human will in such a way that it can freely choose one course of action or another. In this sense, the human will is undetermined and its future is contingent. At the same time, any act of the created will requires God, who in his infinite and perfect knowledge knows what choice will be made, to be its coeffector.[10] In Book III Bradwardine explores the implications of this principle of "antecedent necessity" for the temporal order of creation. Here Bradwardine tries to explain how God's function as first cause influences the past, present and future of every aspect of his creation.[11] All three theses stress the creature's experience of God rather than God's experience of creation: God intervenes in the world and directs its entire development without being changed himself.

Bradwardine's conception of God's relationship to creation rests on the premise that the physical world exists in time and operates according to natural laws established by God. In his view of matter, for example, Bradwardine restates the

Aristotelian definition of matter as a formless, potential substance which only becomes a real being when a form is added to it. Along with Aquinas, Bradwardine contends that God has created both matter itself and the forms which shape matter into real things.[12] All things, therefore, come into being in accordance with the divine plan. God's love ensures that everything which he creates is good, so that nature itself is fundamentally good.[13] Because God not only gives matter its form but also determines the laws which govern all motion and change, God must be seen as the prime mover in every act.[14]

Bradwardine bases this thesis firmly on the philosophical and logical studies of Aristotle, who had argued that every effect must be caused by something. Therefore, every individual act, and indeed creation as a whole, proceeds from God as the first cause.[15] Bradwardine obviously did not see a contradiction between his belief in God as a direct and primary participant in the world and Aristotelian explanations for how the world actually operates. In fact, Aristotle's initial observation that all effects in the physical world have causes stands as the underlying principle both of Bradwardine's natural philosophy and of his theology.

Although he accepted Aristotle's definition of matter and his theory of causation, Bradwardine could not agree with his conviction that the world is eternal. We have already seen how closely Bradwardine followed Aristotle's conception of time in his works of natural philosophy. There is no reason to suppose that in the *De causa Dei* Bradwardine rejected the Aristotelian principles concerning time's continuity, its infinite divisibility or its relationship to motion after having proven their validity so successfully in his works of natural philosophy. Nevertheless, Bradwardine made it clear in several passages in the *De causa Dei* that the idea of a created world of infinite duration cannot be sustained.[16] Bradwardine contended that none of the classical philosophers, including Plato and Aristotle, had been able to prove that the universe has existed from eternity. Aristotle's theory of causation

in fact suggested the contrary, he said, since the motion of the universe must have been caused initially by something. In keeping with the medieval interpretation of Aristotle, Bradwardine attributed to God this initial motion, which began the process of creation.[17]

Bradwardine therefore tried in the *De causa Dei* to illustrate precisely how all created acts proceed initially from God. The idea of couching the story of creation in myth, as Plato had done in the *Timaeus*, held no appeal for Bradwardine. The truth, Bradwardine contended, should be clear both to natural philosophers and to theologians: since it consists of real being, the universe must have been created; and logic, observation of the natural world and revelation all point to creation by God. Bradwardine did not think speculation on how God created the universe or how he could exercise his absolute power over it was particularly useful, for the human mind cannot grasp the full meaning of creation. This notion lies at the heart of Bradwardine's criticism of his opponents' alternative approaches to God's absolute power. Bradwardine was much more intrigued by the question of how God, despite existing in an eternal present, nonetheless continues to participate actively in the historical development of his creation.

In Book I, chapter 1, of the *De causa Dei* Bradwardine defends the theses that God is the greatest and most perfect goodness and that every created thing has a definite beginning, concluding along Thomist lines that all things proceed from a first cause which is God.[18] Later, two long corollaries explore the metaphysical and logical reasons for affirming the creation of the world and God's power to direct it.[19] As we might expect from a specialist in natural philosophy, Bradwardine's arguments for creation are particularly effective when he illustrates the difference between God's eternal present and the temporal limits of created being with concrete references to natural phenomena. In corollary 40, for example, Bradwardine embarks on an extensive attack on the physical theory of those

philosophers, including Aristotle, Plato, Anaxagoras and Averroes, who persist in claiming that the universe is eternal in spite of irrefutable cosmological evidence to the contrary.[20]

In addition to logical arguments against the eternity of the world, Bradwardine adds the ingenious reasoning that the principles of Euclidean geometry preclude the possibility of a universe limitless in space and time. Bradwardine's understanding of continuity and the problem of beginning and ceasing are crucial in this context; for, as he points out, the majority of classical philosophers, including Democritus, Aristotle and Epicurus, agreed that permanent continua have external limits.[21] It is the existence of external limits which allows objects, whether physical or purely mathematical, to be compared.[22] Bradwardine therefore adopted a mathematical argument concerning the external limits of permanent continua to verify the theological truth that God creates and provides spacial and temporal limits for every existing thing.

The question of temporal limits for created things has additional significance for Bradwardine's theology because time distinguishes created being from eternal being. Whether a thing is permanent or successive, it exists in time and therefore has limits. All successive continua such as motion or temperature share the characteristics of finity and infinity: while they are potentially infinite in respect of their divisibility, they do not have limitless duration.[23] By placing his creation within time, God ensures that it remains distinct from himself and has limits. Indeed, Bradwardine goes so far as to say that God cannot create something which is necessary and limitless in itself, for only God can have these qualities.[24] In spite of its negative wording, this assertion is not meant to restrict God's power in any way. Rather, it serves to emphasize Bradwardine's larger contention that the created world is not only distinct from God but also receives its goodness directly from God. Bradwardine's use of a mathematical argument to disprove the

possibility of an eternal universe indicates the extent to which his natural philosophy informed his theological views. It is evident from Corollary 40 that he had no difficulty in reconciling his opinions about continuity, infinity, time and motion with his belief in the supreme power of God. Bradwardine maintained, in fact, that Aristotle and other classical philosophers contributed directly to his proof of the finity of the created world despite their conviction that the world is infinite. In contrast to Bradwardine's former efforts to explain and redefine Aristotelian principles, his discussion of time and eternity in the *De causa Dei* amounts to a self-conscious rejection of certain Aristotelian principles and a thoughtful revision of others.

Bradwardine's profound belief in God the creator led him to adopt a cosmology which emphasized the Augustinian and Boethian distinction between divine eternity and the imperfect changeability of the created world. Echoing certain themes from the *Timaeus*, Bradwardine conceived of creation as neither corrupt nor fundamentally evil simply because it changes and exists in time: the very fact that God has made the world and loves it makes it good.[25] Nor did he think that human reason is inadequate to the task of investigating the natural order which God has made.[26] Nevertheless, Bradwardine had to come to terms with the dilemma posed by the central theses of the *De causa Dei*: God is both an active participant in every aspect of creation and yet distinct from it because he is infinite and immutable. In resolving this dilemma Bradwardine returned to the conception of time which he had first developed in the *De futuris contingentibus*.

Bradwardine considered it a matter of primary importance to prove that God is not affected by time but has a kind of being which transcends the temporal order of his creation. One of the first objections Bradwardine made in the *De causa Dei* was directed against those who try to make God more accessible to human experience by likening him to created things. In an impressively thorough

repudiation of the polytheism of the ancient world, Bradwardine warned against the error of reducing the manifest greatness of God's creation to pantheism by worshipping as gods things such as trees, the sun or the moon.[27] Since nature-worship was not a wide-spread heresy in mid-fourteenth-century England, one might wonder why he should have focused so much attention on it. Part of the explanation lies, of course, in his effort to provide encyclopaedic coverage of all challenges to God's cause. Although Bradwardine could not have worried seriously about Babylonian, Egyptian or Roman religious practices, he was extremely distressed by the assumption which underlay them all that the world had formed itself out of primordial chaos rather than being created from nothing by God. Bradwardine therefore used the subject of polytheism to make the larger point that God cannot be conceived as "temporal, created or corruptible."[28] It is in this context that Bradwardine laments the human failure, both in ancient times and in his own, to recognize God's transcendence over his creation.[29]

Bradwardine further emphasizes God's distinctiveness by asserting that God remains infinite and eternal despite his capacity to enter into the created world. Bradwardine develops this point most thoroughly in the second chapter of Book I, which demonstrates why God necessarily is the first cause in every human act. In this passage Bradwardine explicitly states his thesis, which he derived from Aristotle, Avicenna and Algazali, that God is the first cause from which all effects proceed. God is not, however, simply a craftsman who, having created the world, leaves it to operate according to its own mechanisms and by its own energy. Instead, God, as the first cause of every created act, is always directly involved in his creation. Leff observes that Bradwardine uses here the terms of Aristotelian metaphysics to portray God as the "triple cause, formal, efficient and final," of every created act: formal, because he establishes the conditions in which the act will take place;

efficient, because he actively participates in every phase of the act; and final, because his participation makes a potential act real and actual.[30]

From a cosmological point of view, God's most mysterious power is his ability to participate so fully in creation and to encompass all creation within himself without being changed, limited or corrupted.[31] Bradwardine draws on a long tradition of metaphysical speculation when he accords to God a perfect, uncreated being. Following Augustine, he attributes great significance to God's response to Moses in the Book of Exodus. In replying "I am who I am," God has offered humanity an insight into his true nature as simple, perfect and universal being.[32] By his very nature, God cannot be other than distinct from created things, which are changeable, have limits, pass in and out of existence and lack the perfection of the creator. Bradwardine's Platonic interpretation of the passage from Exodus exposes his dependence on Augustine for his view of God. Like Augustine, Bradwardine is able to accept both Platonic statements about God's perfection and completeness and revelation through Scripture, in spite of his preference for Aristotelian natural philosophy. Bradwardine's conception of God as distinct and changeless plays a key role in his solution to the philosophical and theological problem of God's intervention in a changeable but largely rational world.

Bradwardine's statements about time in the *De causa Dei*, therefore, need to be examined primarily in the context of his conception of God's distinctiveness from creation. Bradwardine considers it a mistake to think that time is not in itself a creation and, unlike other creations, had no beginning and will have no end. For Bradwardine, time provides a frame of reference for creation. No created thing exists which does not exist in time; indeed, time is such a fundamental concept in creation that God alone can exist outside time. If one accepts the premise that God is perfect being and the first cause of every created act, says Bradwardine, one must also admit that God created the world from nothing and placed his creation within

the limits of time. To say otherwise would be to claim the existence of other kinds of pre-temporal being which share in God's eternity and infinity. Even Aristotle, who thought that the world is eternal, proved through his natural philosophy that the world could not have been made from pre-existing material.[33] God alone, then, is free from the constraints of time; and time, as the medium of creation, assures us of God's eternal, infinite and perfect being. God is able to exist outside time yet still participate in the lives of his creatures because he sees all of his creation from an eternal present. God knows all things simultaneously and eternally, and there is nothing to obscure his vision at any instant of creation: he does not need to wait for his knowledge to be completed or his prophecies fulfilled in time.[34] Bradwardine thus supplements his metaphysical argument about God's relationship to the world through time with an epistemological one.

In Book I, chapter 6, Bradwardine contends that God has complete knowledge of every created thing. Relying on a powerful range of authorities, including Plato, Aristotle, Seneca, Boethius, Augustine and Averroes, Bradwardine develops a complex logical argument in favor of God's eternal knowledge. God's knowledge is necessary for the existence of every created thing, says Bradwardine, because it is God's eternal knowledge of a thing which makes it real. Bradwardine quotes, for example, from Avicenna's commentary on Aristotle's *De anima* that "all things of the earth which are past, present or future have being in the mind of the creator."[35] He goes on to suggest that God's knowledge not only is complete but also exists in God's mind in a perfect and universal form. God's knowledge thus transcends time and the limitations of created being.[36] Having built up an extensive list of authorities in his favor, Bradwardine considers it a simple matter to prove in a brief corollary that God, "both omnipotent and omniscient," has complete knowledge of every created thing, whether it is possible or impossible, whether it can be verified by human reason or only imagined.[37]

Bradwardine's strongest statements about the problem of time and eternity come in chapter 51 of Book III, which is devoted entirely to the topic of eternity. Once again drawing on authorities from Plato to Averroes, he contrasts the mutability and limitation of created being with the immutability and infinity of God. Because he is eternal, neither God nor any of his acts can be measured in time. In God there is no divisibility; no past, present or future; no succession. God's existence is simple, unified, perfect and simultaneous. The patterns of flux and change which human beings observe in time are part of a created order which is separate from God and does not change him. God sees everything in a single instant.[38] Throughout this passage Bradwardine reveals his continuing interest in the physics of motion and succession by using images of nature to define negatively God's eternal serenity. Bradwardine suggests, in fact, that knowledge of the manifestations of God in nature deeply enriches the understanding of the eternal God. He acknowledges with Plato that it is motion, especially the motion of the heavenly bodies, the constant pattern of night and day, which distinguishes our world of time and change from God's timeless existence.[39] In Bradwardine's view, then, time as a created being has a central place in the natural order which God has made for his creatures.

Like Aristotle and Averroes, Bradwardine associates time with motion and implies that time and motion can be used to measure each other. In the context of eternity, however, the concept of time has a much more significant cosmological function, for it is the flux of time itself which gives created things their special character and makes them different from God. To illustrate this point, Bradwardine appropriately chooses a geometrical metaphor to describe God's temporal relationship to his creation: God is a single point on a line; he is a single instant in time. In his eternal present God does not experience any of the effects of time as his creatures do, either physically, as in successive continuity, or psychologically, as

in memory.[40] The importance of time in Bradwardine's cosmology, then, is that it establishes the proper scope for the study of nature, while its counterpart, eternity, frees God to participate in his creation without being changed or restricted by it. In Oberman's words, "by his theocentric thinking Bradwardine sees the idea of time as the limiting factor for the creature, characterising the relation between man and God as an infinite distance, whereas this distance does not exist for God."[41]

We can conclude, therefore, that although Bradwardine did not present a systematic analysis of time in the *De causa Dei*, his view of time had significant bearing on his understanding of creation. In his other works Bradwardine demonstrated a thorough mastery of Aristotelian natural philosophy and Euclidean geometry. The *De causa Dei* allowed him to display commensurate skill in analyzing other kinds of sources. Plato's *Timaeus*, Augustine's theological works and Boethius' *Consolation of Philosophy* all contributed to Bradwardine's conception of eternity and the relationship of eternity to time in creation. As we shall see, Bradwardine's reading of Anselm, Aquinas and Duns Scotus enhanced his conception of time as a philosophical and theological problem. Throughout the *De causa Dei* Bradwardine suggested that an Aristotelian approach to natural philosophy in no way contradicted the notion of an eternal and limitless creator, so long as one did not try to argue that the world itself is eternal. Bradwardine's remarks about time in the *De causa Dei* indicate that he continued to see time in Aristotelian terms, as the measure of motion or, more generally, as the successive continuum which embraces all movement and change in created being. Because time is created and therefore has a beginning and an end, its regular, successive nature serves as a frame for all other motions and changes which can be observed in nature. Like Boethius, however, Bradwardine felt compelled to state that God exists outside the temporal order; otherwise God would be subject to the same

forces as created beings and would lose his essential characteristics of infinity, eternity, immutability and omniscience.

By the time he wrote the *De causa Dei*, however, Bradwardine had completed his degree in theology and was thoroughly familiar with the contemporary debates concerning the nature of God's involvement in the world. Consequently, he fully realized how difficult it is to reconcile logically a conception of God as changeless and eternal with a belief that God participates directly in every aspect of creation. It is almost impossible for the human mind to grasp how God can be simultaneously inside and outside time, how God can prophesy and respond to the petitions of his creatures without himself changing in any way; and yet the educated fourteenth-century Christian was expected to affirm this complex and apparently self-contradictory definition of God. Both Scripture and patristic authority demanded it.

As we have already seen, theologians such as Duns Scotus and Ockham tried to solve the problem by proposing alternative cosmologies. They argued in various ways that God, by virtue of his absolute power, has the capacity to change along with his creation in time without losing his qualities of immutability or omniscience.[42] In this way the contingency of at least some acts of the human will could be preserved. Ockham was particularly aware of the dilemma of maintaining God's omniscience while safeguarding human freedom: he ultimately concluded that reason cannot resolve this dilemma and that certain truths about God's essential nature have to be accepted by faith alone.[43]

Because Bradwardine refused to admit the possibility of change in God, even to preserve the freedom of the human will, he had to consider an alternative approach to contingency in the *De causa Dei*. His conception of God as distinct from the created world, coupled with his conviction that God participates directly in every human act, made it necessary for him to work out a theory of contingency which respected both positions. Although his treatment of contingency was much

more sophisticated in the *De causa Dei* than it had been in the *De futuris contingentibus*, Bradwardine maintained the same thesis in the later work and continued to regard contingency primarily as a philosophical problem. His greater success in the *De causa Dei* results from his superior knowledge of the early fourteenth-century debates about contingency as well as his readiness, where appropriate, to consider some of the theological implications of his theory of contingency. In fact, Bradwardine took the same step as Ockham in contending that some mysteries of God's power have to be taken on faith. Nevertheless, in his characteristically optimistic portrayal of the power of human reason, Bradwardine tried to show that faith can serve the pursuit of knowledge: to a certain extent at least, he thought, one can use the same methods to learn about God as one might use to investigate the natural world.[44]

In all of his discussions of contingency Bradwardine attempted to prove that God in his absolute power knows all future contingents but is still able to ensure the freedom of the human will: God "causes the human will to act predictably but freely."[45] Bradwardine shared with Ockham the idea that God in his absolute power can change anything in the universe at will, although they interpreted the significance of this power in different ways. Ockham took what might be called a psychological view of contingency, claiming that because the finite mind cannot reconcile divine foreknowledge with human contingency we must accept contingency as a feature of consciousness and divine foreknowledge as a matter of faith.[45] Consequently, we must admit that God can act in unpredictable ways. As a metaphysician and natural philosopher, Bradwardine assumed that, although God could act in apparently confusing or unpredictable ways, his constant participation in the activities of creation assures a kind of order which the human mind can observe and comprehend. In any event, God's knowledge that an individual will make a particular choice does not make the choice any less free from the human point of

view. By emphasizing free will from the human perspective, both Ockham and Bradwardine echo Augustine. They differed primarily in their approach to the role of divine foreknowledge as a factor in human decision-making.

In his discussion of late medieval approaches to contingency, Calvin Normore argues that views of time and modality usually influenced opinions about contingency. In the case of Duns Scotus, who helped to focus Bradwardine's attention on God as first cause, contingency relates to the necessity of the past, present and future. Duns thought that, while the past is necessary because it has already happened, neither the present nor the future are necessary. According to Normore, Duns contended that "God's knowledge is a single act which never 'passes into the past' and so is as contingent as any present act. God knows what will happen, but he can know otherwise than he knows."[47] Ockham, on the other hand, was convinced that both the past and present are necessary since, once they have happened, they can no longer be changed. Ockham rejected a claim made originally by Grosseteste that for God to know something he must be in a particular state. Using a linguistic argument, Ockham tried to show that Grosseteste's claim is true only for the human mind because knowing or not knowing a particular thing is the same for God.[48] Being linguistic in nature, Ockham's argument did not pay so much attention as Duns' to the problem of transition from past to future. Even so, both theologians implicitly acknowledged that God's fundamentally different perception of time is at the heart of human contingency.[49]

In contrast to Duns and Ockham, Bradwardine approached contingency in the *De causa Dei* in a way that is explicitly temporal. Bradwardine made use of arguments from Grosseteste's *De libero arbitrio*, as well as Anselm's *Cur Deus homo*, to support his theory that God's immutability makes contingency impossible from the divine perspective.[50] Because past, present and future all depend on God's knowledge, which is eternal and absolute, it is inconceivable that he could be subject

to any kind of contingency.[51] Indeed, in Bradwardine's opinion, there is no objective difference at all between past and future. God's will simultaneously directs all things which we see modally as past, present and future. Therefore, God is not bound by our perception that a future event finally occurs in time, passes into the past, and can no longer be changed. Because God is free from the temporal limits of succession, he does not have to regard past and future as different. The truth of a past event, like the truth of a future event, is confirmed by God's will alone, which is constant, eternal and unchanging. Though we see the future as contingent and the past as unchangeable, and therefore necessary, God assures the truth and reality of both in his eternal present.[52]

This thesis is more or less the same as the one which Bradwardine presented in the *De futuris contingentibus* although, as Normore observes, it is developed with much greater skill in the *De causa Dei*. Instead of portraying God's knowledge of everything at once as a static and rigid kind of knowledge, Bradwardine again makes use of a geometrical image to explain how God sees the transition from past to future without changing himself: God is like a point at the center of a circle, and the points moving along its circumference are instants of time. Thus God can see a particular point first as future, then as present, and finally as past in a single observation.[53] This image both illustrates God's ability to view apparently contingent things without changing and also reinforces Bradwardine's larger contention that God is both distinct from and involved in creation.

Having described in compelling terms God's capacity to observe the transition from future to past in his eternal present, Bradwardine is left with the difficulty of defining the scope of the human will: how can one argue that God has perfect knowledge of every future act without facing the charge of determinism? Bradwardine was not prepared to deny free will since both Scripture and human reason point to the fact that individuals constantly make choices, sometimes with

terrible consequences, without conscious awareness of restraint. Bradwardine, of course, agreed with Boethius that God's eternal knowledge of a future event does not force an individual, living in time, to make predetermined choices. From the human perspective, God's foreknowledge does not presuppose determinism. Whereas in the *De futuris contingentibus*, Bradwardine had been content merely to make this contention and support it with references from relevant authorities, he tried in the *De causa Dei* to define contingency and free will in terms of axioms about God's absolute power over his creation.

Bradwardine based his mature theory of contingency on the principle that God's knowledge is complete and therefore necessary for the reality of his creation. Even free will is "necessary" in the sense that God has created the universe in such a way that human beings are able to exercise their wills freely within it. If God is the first cause of every act, however, he naturally participates in every act of free will; indeed, God is the source of free will. This circumstance is, of course, very difficult to explain. Most of Book III of the *De causa Dei* is devoted to defining the complex relationship between the divine and human wills. Throughout his discussion of free will Bradwardine assumed that, although God permits individuals to use their wills freely, he does not allow them unlimited choices.[54] All of Bradwardine's assertions about contingency and free will are based, moreover, on the assumption that human perceptions of creation are different from God's.[55] While the individual can be guided by God to choose to act in a particular way, he cannot conceive of the choice as being predetermined. Human beings must live in and make choices in a world governed by time: they cannot know with any certainty what will happen in the future, and, at any rate, the conviction that God knows the future does not allow them to abrogate their responsibility for their own moral conduct in the present.[56]

It is for this reason that Bradwardine, returning to an idea which he had developed at length the *De incipit et destinit*, strongly denied any possibility of

prediction in the *De causa Dei*. In the later work, however, Bradwardine went beyond the relatively simple issue of logical prediction to condemn the use of astrology and the unfounded beliefs in fortune or fate. Bradwardine devoted three chapters to exploring the classical origins of belief in fate and the occult practices of prediction.[57] He then systematically refuted these beliefs, not only by appealing to Scripture and other established theological authorities but also through reference to his own cosmological system. Bradwardine considered it wrong to think that the future will occur in some arbitrary way; but, because the future must unfold according to plan in the mind of God, it is even worse for the human mind pretentiously to try to predict the future. Moreover, since the future is not arbitrary, there is no fate, except in the sense the divine mind knows what will happen and allows this providence to be fulfilled in time.[58] Bradwardine concluded his arguments against fate with the proposition that all things are governed by laws which are established by divine providence.[59]

This pervasive emphasis on providence in the *De causa Dei* has led twentieth-century historians to focus on, and often exaggerate, Bradwardine's cautious approach to contingency. In fact, Bradwardine's treatment of the relationship between contingency and will is the central issue in Leff's and Oberman's highly influential studies of the *De causa Dei*. Although neither of them examines in detail the philosophical assumptions about time and eternity which support Bradwardine's view of contingency, their approaches to contingency in the *De causa Dei* provide an extremely useful framework for evaluating the connection between Bradwardine's theology and his ideas about time as a physical principle. The following comparison of Leff's and Oberman's interpretations of Bradwardine's view of contingency will serve, therefore, not only to review some of the historiographical issues which have influenced studies of Bradwardine's theology for the last three decades but also to

suggest opportunities for reevaluating the role of Bradwardine's approach to time in the development of his thesis that God is the first cause of every human act.

Although they differ greatly on many aspects of Bradwardine's theology, both Leff and Oberman agree that, in the case of future contingents Bradwardine sees no conflict between the necessity of an act based on God's foreknowledge and the freedom of an individual to choose that act. Unlike Oberman, however, Leff uses Bradwardine's view of contingency to emphasize Bradwardine's determinism. In Leff's analysis of the problem of contingency, "Bradwardine regards liberty and contingency for God's creatures as relative; as the product of secondary causes they are equally dependent upon God's will as their first cause."[60] For this reason, the divine will is the source of contingency, for God is not only the first cause behind the chosen act, but creator of the world in which the consequences of the act will manifest themselves. Indeed, Bradwardine openly acknowledges that God, having full and absolute knowledge of past, present and future, is able to build the concept of free will into his creation.[61] However, Leff also attributes to Bradwardine the conviction that the future, like God, is immutable:

> Firstly, every act of divine will, past, present and future, must have existed eternally. Secondly, in the same way, all that is about to be, and all that will be, must, of necessity come to be. Thirdly, that everything, therefore, whether past, present or future, is subject to the same act of creation, and its temporal order bears no relation to the certainty and eternity of its existence in God. The use to which Bradwardine puts these conclusions shows clearly where he departs from tradition: he transforms the eternal instant in God to deny the future any independent existence. Where St. Thomas was content to allow that God saw everything through His own essence which in no way necessitated what He foresaw, Bradwardine changes this neutral intelligence into active approbation: with him, what God sees, He forewills. As a result, the future is as determined as the past and the present: it cannot not come about.[62]

This passage reveals Leff's tendency to interpret Bradwardine's view of the future in theological terms and as a restriction of human freedom without accounting for

Bradwardine's Boethian emphasis on God's experience of creation in one eternal present.

Leff then places Bradwardine's determinism in the context of the intellectual radicalism of the late medieval universities. According to Leff, Bradwardine was driven to such an extreme view on future contingents because of his opposition to three contemporary schools of thought. Bradwardine's most obvious opponents were those Stoic and Islamic philosophers who promoted a kind of determinism in which God need not be directly involved in the world. In Leff's view, Bradwardine, whose own conception of God was heavily dependent on Greco-Arabic definitions, was not worried about determinism as such; his chief complaint was that the Stoic and Islamic philosophers made God too impersonal, too far removed from his own creation. Bradwardine also attacked a less unified group of philosophers who went too far in the opposite direction. These thinkers undermined God's omniscience and omnipotence by emphasizing the large scope for free will in human choice. Bradwardine thoroughly rejected any claim that God does not fully know the future, either because he has not yet willed the future or because he can only foresee good and not evil. Even more distressing to Bradwardine was the Pelagian notion that God waits until an act has been completed to assess its merit. Such a position "would remove any order between merit, free actions and reward, denying God's will to be their cause and making the past, present and future all completely contingent and free from necessity."[63]

The third group of opponents angered Bradwardine with their suggestion that since the future, unlike the past and present, does not yet actually exist, it might or might not take place at all. This view not only violated Bradwardine's assumption that the future already exists in the divine mind but also implied that God can change his mind about the future and is therefore mutable. Bradwardine's fierce rebuttal of this point of view suggests to Leff the collapse in the fourteenth century

of Aquinas' moderate balance between contingency and free will. While Aquinas' metaphysical system allowed God to be the ultimate cause of any human action, it also posited enough of a connection between created being and God to permit a more flexible approach to contingency. Leff argues that fourteenth-century approaches to contingency, on the part of both Bradwardine and of his opponents, so separated created and uncreated being that philosophers had to favor either free will or necessity. Bradwardine's originality, in Leff's opinion, lies in his ardent and almost solitary defense of the principle of divine necessity.[64]

At the heart of Bradwardine's argument about future contingents, says Leff, is his notion that God's will defines what will happen by making choices which stand for all eternity. Although God could logically have made different choices from the ones which he has made, his ultimate decisions are eternal: creation is the process of these decisions coming to fulfillment in time. For God subsequently to make a different decision he would have to change.[65] To change, God would have to make himself a creature of time. Therefore, to say that God cannot change something that he has willed is not to doubt God's absolute freedom but to give God's free choices the respect due them as eternal truths. According to Leff, Bradwardine locates his opponents' main error "in confusing this eternity in God with temporal measurements, thereby trying to judge the infinite by finite standards. . . . As a result, rather than acknowledge the problem of the future, he denies it."[66]

The main problem with Leff's approach to Bradwardine's view of contingency is that it underestimates the importance of Bradwardine's understanding of eternity as both physical and theological concept. As the examination of Bradwardine's analysis of the role of time in creation has demonstrated, it is misleading to say that Bradwardine did not acknowledge the problem of the future. As we have seen, he paid the problem of the future considerable attention in the *De causa Dei* and in other works, though not so much

in a theological context as in a cosmological one. The image of God as a point in the center of a circle elegantly conveys Bradwardine's conception of God's relationship with his temporal creation: God's awareness of past, present and future in an eternal present ensures the future of the human will without compelling it to act in a particular way. If we keep this image in mind when reading the *De causa Dei*, we discover that Bradwardine's purpose is not to reduce, either explicitly or implicitly the scope of human action but to demonstrate how God accommodates free will eternally into his creation. Bradwardine's temporal theory therefore transforms the problem of the future from a logical one into a cosmological one in which the distinction between time and eternity, not that between past and future, becomes crucial in determining the contingency of a particular event.

One of the chief advantages of Oberman's interpretation of Bradwardine's view of contingency over Leff's is that it takes more into account Bradwardine's ideas about creation, although here again the emphasis is on a theological not a philosophical understanding of contingency. Like Leff, Oberman sees Bradwardine's approach to contingency as a reflection of his conception of eternal and created being. Oberman, however, stresses more than does Leff Bradwardine's attachment to Christian authority in his treatments of necessity and divine prescience. Oberman reminds us that Bradwardine always works from the assumption that God is not restricted by time, which only exists for the benefit of his creation. He points out from the start of his analysis of the *De causa Dei* that Bradwardine feels justified in ignoring certain aspects of the problem of future contingency which arise only because of "the imperfect human conceptive faculty."[67] In the words of D. J. B. Hawkins:

> The imaginative difficulty which we have to overcome is the erroneous supposition that He (God) knows actual events as we know them in a temporal series. He knows them as a temporal series, but he does not know them in a temporal series of acts of awareness.[68]

Nevertheless, Bradwardine still has to explain how God can know the outcome of all future events and still give his creatures the freedom of will which Scripture promises and human experience seems to require. In Oberman's view, Bradwardine's major task in his discussion of contingency is to explain the relationship between the omniscient divine will and the temporally limited human will.

According to Oberman, Bradwardine, following Bernard of Clairvaux, defines the human will at least partially in terms of the divine will: every rational creature shares with God the capacity to choose freely. The human will is nevertheless limited in the sense that it cannot choose from an infinite number of possibilities: it can only choose to accept or refuse a definite possibility that has been presented to it. Bradwardine concurs with Hugh of St. Victor and Peter Lombard that the human will is free not on account of its power to will everything (which belongs only to God) but because it can act spontaneously according to its own powers of judgment. Though the human will is more limited than the divine will, neither will is capricious or arbitrary.[69]

To acknowledge the will's capacity to choose, however, does not necessarily demand acceptance of contingency, since God might predetermine what the choices will be and know in advance the will's decision. Oberman agrees with Leff that Bradwardine's real difficulty with contingency arises from his unwillingness to diminish in any way God's knowledge of the future or his role as the first cause in every human act. Bradwardine thus comes to insist that the will cannot function without grace. He stands in opposition to Ockham and others, who doubted whether grace, as a theological doctrine, and will, as a philosophical principle, could be considered together in any treatment of contingency. In Bradwardine's cosmology, however, grace and will come from the same source and must be examined together. Therefore, according to Oberman, Bradwardine always tries to

interpret will in terms of grace. In Oberman's view, Bradwardine's insistence on combining a theological starting-point with a theocentric approach to contingency has led many to the assumption that he was a rigid determinist.[70]

Oberman notes, however, that Bradwardine's method of synthesizing the views of important authorities with his own profound insights into nature actually contributed to a flexible view of human will. Bradwardine maintained throughout the *De causa Dei* his reliance on Christian authority, especially the views of Augustine, Anselm and Thomas Aquinas. All of these theologians had emphasized the importance of grace in guiding the human will and attributed full omniscience to God. Bradwardine was particularly devoted to Anselm, who in his own struggle with the problem of necessity concluded along Boethian lines that God does not really have prescience, but has simple knowledge in his eternal present. By eliminating tense from the analysis of God's knowledge, Anselm argued, it is possible to see how the will can remain free in spite of God's knowledge of the future.[71]

Bradwardine also seemed to follow Aquinas almost exactly on two aspects of the question of necessity. In the first place, both agreed that the human will lacks the capacity for self-conscious conformity to the divine plan because it cannot envision the final aim. Furthermore, even if God were to reveal the final aim to someone, he would not compel that person to conform to it.[72] According to Oberman, Bradwardine's view of God's role in this process of directing the human will is one in which God "moves man according to his own nature, and freely, and when this is thwarted by sin, He transforms man by His grace."[73] In accepting these positions of Anselm and Aquinas, Bradwardine absorbed the entire Augustinian tradition of defining free will in terms of grace. The combination of Augustine's psychological view of time and his convictions about grace deeply moved Bradwardine, as it had other theologians in the Augustinian tradition.

Nevertheless, Bradwardine had a gift for original thought, and he could not be expected merely to repeat the work of his predecessors. In Oberman's view, the uniqueness of his position on contingency lies in the degree to which he elevated the role of grace in the exercise of human will. In this context, Oberman lists four factors which give Bradwardine's approach to contingency its deterministic quality. First, as we have already observed in the discussion of the *De futuris contingentibus*, Bradwardine stressed the vast difference between the divine and human experience of time. He was not very patient with efforts to develop purely psychological or logical explanations for contingency because he saw human lack of knowledge about the future as the inevitable condition of the imperfect human mind. Second, Bradwardine was not satisfied by the conclusions of Anselm and Aquinas, which suggested that God's prescience guarantees that what was, is and will be cannot at the same time be what was not, is not and will not be. Bradwardine rejected the notion that God merely protects his creation from internal contradiction in favor of a view which places God in the more active role of directing the events which his creatures perceive in the past, present or future. Third, Bradwardine reinterpreted the Aristotelian theory that potency precedes every act. Bradwardine's predecessors had used this theory to argue that God creates potencies and then allows the will to participate in the process of transition from potency to act. In Bradwardine's view, however, God's use of the process of potency does not mean that he does not know whether or how the act will take place. Finally, Bradwardine stressed the Augustinian argument that the human will does not give up any freedom by following God; indeed, the human will is in its freest state of all when it acts without resistance to the divine will.[74]

Oberman concludes his assessment of Bradwardine's view of necessity by noting that, although Bradwardine expressed his ideas in a rigorous and sometimes extreme form, he did not intend his position on necessity to negate the possibility of

free will. In Bradwardine's philosophical and theological system contingency, not liberty, is the opposite of necessity.[75] Oberman recommends that we approach Bradwardine's theory of necessity from the perspective of Augustine's distinction between "necessitas invita" and "voluntaria":

> The former is the Stoical necessity of fate, the latter the Christian necessity in which God's world dominion is confessed. The statement 'all things that happen, happen of necessity' can accordingly be meant in two ways: as an excuse for guilt with reference to destiny, and as a confession that God performs everything according to his will.[76]

Bradwardine routinely took the latter view and argued throughout the *De causa Dei* that God's will constantly guides the course of creation. Bradwardine's conviction that God's will is necessarily fulfilled reflects his fundamental optimism concerning the natural order, while his emphasis on grace indicates his belief that the human will has a crucial role to play in following God freely and participating in the work of creation. Thus Oberman, like Leff associates almost all aspects of Bradwardine's view of time and contingency with such theological issues as grace, will and prescience.

The pervasiveness of Leff's and Oberman's theological approach to the *De causa Dei* is confirmed by another major study of Bradwardine's view of contingency. Donald J. McCarthy argues along the lines of Oberman that Bradwardine's approach to the problem of contingency was bound up with his definitions of the nature of God.[77] Like Oberman, McCarthy tries to avoid Leff's verdict of severe determinism by evaluating Bradwardine's conception of the relationship between the divine and human will within the context of grace. Whereas Leff sees Bradwardine's position as a philosophical one dominated by a particular theological outlook, Oberman and McCarthy portray Bradwardine primarily as a theologian with considerable skill in philosophy. McCarthy goes

beyond both Leff and Oberman, however, in stressing the metaphysical and cosmological factors which shaped Bradwardine's view of contingency.

McCarthy contends that readers of the *De causa Dei* must take into account not only Bradwardine's sources and conclusions but also the place of the problem of contingency in his theology as a whole. Unlike many of his contemporaries, who were more interested in contingency as a philosophical, grammatical or psychological problem, Bradwardine saw it as a subordinate issue to the more important one of God's participation in the creation through grace. Because he wished more than anything else to prove that God is the first cause of every act, Bradwardine was prepared to minimize the role of free will as a major factor in determining the outcome of an event. Bradwardine did not want to eliminate free choice, but he did want to place it firmly under the direction of divine causality. His main task, therefore, was not to examine contingency and free will as distinct doctrines but to devise a theological and philosophical system which allowed "the greatest possible human liberty consistent with the nature of divine willing."[78]

Paying careful attention to Bradwardine's conviction that God's knowledge is perfect and quite different from human knowledge, McCarthy examines Bradwardine's concept of the future. McCarthy cites Bradwardine's remark that God's knowledge of the future is more complete than an astronomer's prediction of an eclipse to illustrate Bradwardine's thinking about the reality of the future: since we have not yet experienced it, the future is not real to us, but this does not mean that it is not real for God, who already knows and wills it.[79] Moreover, not only does God will the future to exist but his will places future events in the future. God provides whatever being the future has, and without God neither past nor future would exist.[80]

McCarthy presents these ideas as a product of Bradwardine's acceptance of Augustinian teaching on eternity and grace and of the work of Anselm and Duns

Scotus on divine causality. Bradwardine proved the existence of God by positing that creation is a series of causes, with the primary cause existing in God. Having added all of the other attributes of God which Augustine had included in his vision of God as first cause, Bradwardine was able to explain the function of human will as analogous to God's: in the present a person is free either to do or not do any act of which he is capable. As long as he is in full possession of his reason and is able to make a real decision, the consequence is a free act.[81] God, too, can perform or not perform any act, but his omniscience, omnipotence and eternal presentness remove any limitation on his ability to choose. McCarthy therefore concurs with Oberman that Bradwardine's approach to free will is only deterministic from the perspective of God, who, because he has ordained free will as a fundamental feature of rational being, cannot be seen as an unrelenting or unsympathetic controller of human activity.

Although all of these discussions of Bradwardine's view of contingency recognize implicitly and occasionally even explicitly the crucial role of Bradwardine's conception of eternity and time, none of them approach the *De causa Dei* primarily from the perspective of Bradwardine's natural philosophy. The analysis of various aspects of Bradwardine's view of time in this dissertation suggests, however, that Bradwardine's approach to time and eternity resulted from his consideration of both philosophical and theological concepts. Indeed, this examination of Bradwardine's mathematical and philosophical treatises has demonstrated that he had an extremely well-developed conception of natural philosophy which could not have failed to influence his theological outlook in the *De causa Dei*. He was in fact so convinced of the correctness of his views of time and other natural phenomena that he did not ever attempt to prove them: he considered a relevant citation from Augustine or Boethius sufficient to verify the truth of his ideas. Even though the *De causa Dei* is not primarily a work of natural

philosophy, Bradwardine drew both on Aristotle's doctrine of causality and on his approaches to natural philosophy to show that created being has an entirely different character from God's eternal being. Support from Plato, Augustine and Boethius further enhanced Bradwardine's own portrayal of the distinction between the ever-changing world contained within temporal limits and the immutable, infinite existence of God. Bradwardine's desire to find order in the natural world, aided by his special ability to see through the complexities of physical, psychological and philosophical problems, contributed to his success in examining even purely theological problems from the perspective of his Aristotelian-Augustinian cosmology.

The influence of Bradwardine's cosmology on purely theological matters is nowhere more evident than in his discussion of the two main theological problems in the *De causa Dei*, sin and predestination. In his analysis of sin, Bradwardine has to explain why God, who is not only supremely good but also the first cause of every human act, permits and indeed seems to cooperate in sin. The problem of predestination involves defining the scope of human responsibility in meritorious acts and the relationship of human merit to eternal salvation. Bradwardine's arguments on both subjects are based on his assumption that God sees his creation in a much simpler and more complete way than his creatures do. God is both inside creation and distinct from it, like a point in the center of a circle, while his creatures are restricted both by their temporal existence and their incomplete knowledge. Although Bradwardine's discussions of sin and predestination add little to our understanding of his view of time as such, they are worth considering briefly because they point to some of the limitations of applying an Aristotelian-Augustinian cosmology to theological problems.

Bradwardine's doctrine of sin depended heavily on a definition of evil, derived from Neoplatonic philosophers and Augustine, which holds that evil has no

being in itself. Therefore evil, and consequently sin, represent not positive forces but only the absence of God's goodness. Augustine had, of course, stressed the non-being of evil in his attack on the Manicheans, who supposed evil to be a powerful creative force which actively opposed goodness in the world. By Bradwardine's day, although the Manichean heresy was no longer considered a serious threat, Augustine's approach had become the basis of the orthodox position on evil and sin. The extensive philosophical and theological debate about evil in the thirteenth and early fourteenth centuries, however, indicates widespread dissatisfaction with conventional explanations for the presence of evil in a divinely created world.82

In the face of these debates Bradwardine warmly embraced the Augustinian position for two reasons. First, Augustine's denial of the reality of evil supported Bradwardine's contention that God acts eternally and positively for the good of his creation. Second, Augustine's emphasis on the positive goodness of God strengthened Bradwardine's assumptions about the natural order of creation. Bradwardine was certainly not so naive as to deny the presence or effects of sin, but he relied on Augustine to show that evil and sin had no power to disturb the orderly processes of the created world. Bradwardine maintained throughout the *De causa Dei* that, since God is the first cause and creator of every existing thing, all things must be good in themselves.[83] No action, therefore, is sinful *per se*, only *per accidens*: the same qualities which make homicide and adultery sins are also present in the good acts of natural death and marriage.[84] Sin results from the deliberate choice to act in a way which removes one from God or which causes one to deviate from the course of positive obedience to God's will.

Bradwardine did not agree with Augustine in every respect, however. In Bradwardine's view, the intention behind the act and the degree to which such an act obeys or disobeys God's will mainly determine whether or not it is a sin.[85] Thus, for example, the acts of a child or a mentally disturbed person cannot be judged in

the same way as those of rational adults. By stressing the role of intention in sin, Bradwardine in fact minimizes Augustine's assertion that all sins, whether intentional or unintentional, are reflections of original sin, which plagues the entire human race. Bradwardine's recognition of the role of the will in sin indicates the influence of thirteenth- and fourteenth-century reflections, particularly those of Duns Scotus, on Augustine's doctrine of sin.[86]

Bradwardine's answer to the question of why God permits sin in the first place is rooted both in his metaphysical system and in his understanding of the relationship of the human to the divine will. Because he is the cause of all that exists and does not exist, God must be seen as the cause of sin as well. It follows that God must permit sin as a sort of agent of good, and not as an end in itself.[87] The contrast of good and evil makes good more obvious. Simple observation of the natural world reveals that the universe operates on the principle of balancing opposites, as for example in music, humidity, temperature, weight and shape.[88] The integrity of the entire universe depends on the interaction of natural forces in a state of flux. This quality of balance of opposites, which distinguishes ever-changing creation from immutable God, is both good and necessary. So too, then, is the balance of sin and merit good. Although God does not wish us to sin, he allows us to exercise our wills even if we end up making wrong decisions.[89] Because it is the consequence of free will, sin is part of the fabric of the universe. We utterly mistake God's intentions, and run the risk of attributing to him human goals and understanding, if we equate the existence of sin with the notion that God creates evil for its own sake.

In acknowledging God's active role in creating sin, Bradwardine allows his cosmological view of God as the first cause of every created act to overshadow his Augustinian conviction that sin represents a turning away from the reality of God's goodness. Bradwardine's positive view of sin put him at odds with tradition and left

him open, potentially, for attacks on his orthodoxy.[90] That he was never seriously challenged on this point indicates that his opponents understood that his doctrine of sin could not be separated from his conception of God's relationship with creation: to refute Bradwardine's view of sin would require dismantling his entire cosmology. Bradwardine's compelling approach to creation and his fundamentally optimistic view of sin ensured that his ideas would be comforting to his supporters and carefully considered by those who disagreed with him.

Bradwardine's doctrine of predestination, too, is essentially optimistic and based on faith in a God who is both utterly transcendent and immediately personal. Bradwardine's conception of the way in which God decides whom to save is the central feature of his entire argument against the Pelagians, and it is based firmly on the definition of God as eternal and immutable. According to Bradwardine, our temporal experience can give us the incorrect impression that God waits to observe our actions before he decides whether or not we deserve salvation. Justification is actually a completely atemporal phenomenon. Bradwardine therefore questions the accuracy of the metaphor in Psalms that an individual can be erased from the book of life:

> God knows in advance, before the foundation of the world He has predestined all who will reign with His Son in eternal life. Those whom He has enrolled are contained in the book of life. How can they be erased from a book where they were never written? This quotation expresses their hope, that is, they thought themselves to have been entered into the book of life. What does this mean, 'Let them be erased from the book of life'? It is obvious that they were never there to begin with. Thus, therefore, those who had hoped, by reason of their righteousness, that they were written in the book of God, when confronted by their damnation, are made aware that they are 'erased from the book of life,' and they realize that they were never there. The second part of the statement ['Let them not be enrolled with the righteous'] explains the first part. As I have said, 'Let them be erased' is to be understood to refer to their vain hopes. And this can be correctly summarized by saying 'Let them not be enrolled.'[91]

This passage brings into sharp focus Bradwardine's contention that we can only deceive ourselves by assuming that God, like us, is temporal and changeable. Although we must wait until the time of our judgment to know whether we have been saved, God always possesses this knowledge in his eternal present.

Bradwardine makes use of the Aristotelian concept of potency to explain how the will, acting within the temporal limits of creation, fulfills the eternal expectation of God by responding to his grace:

> Aristotle shows that power, or capability, is of two kinds, active and passive. Now that which is meant by the quotation, 'He gave them power to become sons of God,' is also asserted in Romans, 'whoever are led by the Spirit of God are sons of God.' God gives men power, that is to say, a rational soul and free will with which man can freely and voluntarily receive grace in the present and glory in the future so that, in both the present and the future, they might become sons of God. Thus in the present, as they are being made sons of God by faith and prevenient grace, which makes them into adopted sons of God, they freely accomplish the pleasing work of sons and so freely persevere in this to such an extent that no one could take away their sonship unless they would permit it.[92]

We must recognize, then, that God is unconstrained in matters of time or power in justifying certain individuals. His decision to save them and his gift of grace amount to the same act, although the human will experiences grace and justification as sequential. Here, as in the case of sin, Bradwardine subordinates the independent function of the human will to the demands of his cosmological system but does not completely undermine it.

Bradwardine relates his doctrines of sin and predestination to his definition of God as first cause of all creation by repeating St. Paul's image of God as a potter:

> Why do [the Pelagians] not accuse God because He punishes innocent beasts and baptized infants with no small physical pain? Indeed He gave up his own most innocent Son, our Lord Jesus Christ, to a most painful, cruel, and tormenting punishment. But since God is omnipotent, completely free Lord of his whole creation, whose will alone is the most righteous law for all creation - if He should eternally punish

> the innocent, particularly since he does it for the perfection of the universe, for the profit of others, and for the honor of God Himself, who would presume to dispute with Him, to contradict Him, or ask 'Why do you do this?' I firmly believe, no one! 'Has the potter no right over the clay to make of the same lump one vessel for honor and another for menial use?'[93]

Not only does God have the right to punish certain creatures for the overall good of creation, he can also determine whether a punishment should be merely temporal, eternal or both: "If a man may undergo temporal punishment for the temporal benefit of others, why should he not be punished temporally and eternally for the temporal and eternal benefit of the elect, in order that they might all the more flee from evil and choose the good of the present, that in the future they might have greater joy, deeper love, and higher praise of God?"[94] Thus Bradwardine returns to the basic concept of God's absolute goodness and transcendence to justify divine punishment. In Bradwardine's confident and optimistic view, God's omnipotence and eternal knowledge ensure that creation will proceed in a way which is ultimately good. The human will is obliged to respond to God's love and to refrain as much as possible from willful disobedience; but, if one has faith in God's creation, one need not worry about the philosophical dilemmas surrounding sin and grace.

Even in matters of purely theological interest, therefore, it is difficult to evaluate Bradwardine's thought in isolation from his views about creation, time and eternity. Bradwardine regarded these fundamental concepts as necessary for describing both God's essence and his creative activity. Because Bradwardine not only made metaphysics and logic serve a theological purpose but also used theological principles to support a cosmological system that depends equally on God's will and human perception of creation, the *De causa Dei* cannot be seen exclusively as either a philosophical or a theological work.

Although Bradwardine's main purpose in the *De causa Dei*, to prove that God is the first cause, was, of course, unquestionably theological, his interest, as we

have seen, was not confined to this issue alone. As a natural philosopher, Bradwardine also wanted to explore the human response to God's creation and the significance of the natural world to man's relationship to God. The *De causa Dei* gives every indication of Bradwardine's confidence in the power of human reason to comprehend the natural world, within the confines of our temporal existence, so long as thinkers do not limit God by applying the same standards to him as they would to physical phenomena. For created beings, he argued, temporal and spacial limits are good because they allow us to make comparisons, to measure, to study nature in general. Furthermore, the human mind can even hope to achieve some success in understanding God once it grasps the fact that God is creator of the laws which govern creation but is not himself subject to them. While he did not underestimate the difficulty of obtaining certain knowledge about God, Bradwardine exposed the error of trying to describe God's nature or powers in human terms: hence his impatience with contemporary speculation about God's experience of time, which inevitably tried to temporalize God. In constantly emphasizing the distinction between time and eternity, therefore, Bradwardine presented a view of God which was thoroughly consistent with the whole body of his scientific, metaphysical and religious beliefs.

The preceding examination of Bradwardine's view of time demonstrates that this distinction between time and eternity represents a unifying theme for his most important scientific, philosophical and theological work. For this reason, an understanding of his conception of time can help to answer some of the unresolved questions regarding his thought as a whole. The issue of Bradwardine's determinism, for example, can only be evaluated properly in the context of his particular analysis of the relationship between time and grace. There is no doubt that by the theological standards of his day Bradwardine truly was a determinist: he affirmed that both past and future are equally dependent on God's eternal and

unchanging will, and he readily subordinated the scope of the human will to the cause of God's absolute freedom.

Nevertheless, his brand of determinism had a strikingly optimistic, even humanistic tone. Both his objection to logical prediction in his early treatise on beginning and ceasing and his rejection of fate in the *De causa Dei* indicate his belief that the future should be faced confidently and without fear of divine repression. To the human mind, the future provides endless opportunities for choice, for willing cooperation with or conscious disobedience to God's plan for creation. God's participation in our acts, his eternal knowledge of how we will respond and his ability to take all of these responses into account confirm his power to create an orderly universe without restricting human freedom. Moreover, from the human perspective, the future is completely open: so much so, in fact, that we cannot accurately predict the future, except perhaps in the experimental sense of astronomical observation. Bradwardine considered this juxtaposition of determinism and free will one of the chief mysteries of faith, analogous to the profound cosmological mystery of the juxtaposition of time and eternity.

Those who are inclined to consider Bradwardine a rigid determinist often accuse him, in one way or another, of refusing to recognize contingency as a valid philosophical problem and so reflect their misunderstanding of Bradwardine's cosmological and metaphysical outlook. To be sure, Bradwardine made no attempt to reconcile his view of contingency with contemporary ones which required explanations for how God can be immutable and eternal and yet enjoy a temporal existence. Instead, Bradwardine's most important contribution to the fourteenth-century debate over contingency was to offer an alternative approach, based on a synthesis of Aristotelian, Augustinian, Boethian and Thomist cosmological principles, to the attempts of such theologians as Peter Aureoli, Duns Scotus and Ockham to resolve the problem of contingency logically or grammatically. That

Bradwardine approached contingency in a cosmological way, one which combined a precise definition of time's relationship to eternity with an Augustinian conception of grace, does not mean, however, that he dismissed everything his contemporaries had to say about the logical problem of time. Bradwardine in his theology simply subordinated purely logical considerations to such metaphysical issues as the difference between created and uncreated being and the principle of God as first cause. Therefore, although it cannot be denied that Bradwardine was a determinist, it is equally clear that he used the distinction between time and eternity to ameliorate the consequences of divine determination of human acts.

Bradwardine's method for constructing his alternative approach to the problem of contingency brings us to the related question of the orthodoxy of his synthesis of Aristotelian and Augustinian principles. Oberman portrays Bradwardine as an orthodox conservative who tried to defend his Augustinian views from the radical attacks of young, skeptical theologians like Robert Holcot, Thomas Buckingham and Adam Wodeham. Leff goes even further, claiming that Bradwardine followed his conservative principles with such unyielding rigor that he went well beyond the limits of conventional orthodoxy. Both historians point out that Bradwardine's views about sin and necessity deviated, sometimes markedly, from the dominant perspectives. As in Bradwardine's scientific works, the *De causa Dei* clearly shows that he was not afraid to reevaluate or challenge the opinions of other thinkers, whether they were his own peers, as in the case of Ockham, or revered authorities like Aristotle or Augustine. All of his works which have been examined here reflect, in fact, Bradwardine's ability to redefine and clarify problems by balancing the wisdom of recognized authorities with his own mathematical insight. He freely took what were to him the most convincing aspects of well-established arguments and arranged them axiomatically to produce his own assessments of disputed questions.

Especially in the case of time, Bradwardine showed allegiance to many authorities but subservience to none. His view of time combined Aristotelian definitions of time with the Augustinian-Boethian explanation of its cosmological significance. When he began to explore the theological implications of his cosmology, Bradwardine gathered support from every possible source. Although some conclusions in the *De causa Dei* may appear extreme because of his axiomatic organization of ideas or his uncompromising manner of expression, he based every argument on principles of such wide acceptance that no contemporary seriously challenged either his orthodoxy or his reputation as a gifted thinker. Like other fourteenth-century theologians at Oxford and Paris, Bradwardine took a keen interest in certain ancient philosophical and theological problems which, on account of the contributions of Aquinas and Duns Scotus in the thirteenth century, had become even more complex by the early fourteenth century. Bradwardine shared with Ockham in particular the desire to push the debates about these problems in new directions without sacrificing the commitment to Christian authority. On the issue of time, as we have seen, their main difference was that Bradwardine developed an approach which permitted him to avoid certain aspects of contingency which openly contradicted his cosmology, whereas these very aspects fascinated Ockham and deeply influenced his philosophical system. To the extent that they each achieved major innovations in investigating complicated philosophical and theological problems while remaining faithful to the same body of Christian doctrine, however, both must be seen as conservative theologians.

In the introduction to Bradwardine's *Sermo Epinicius*, which commemorates the English victory at Crécy, Weisheipl makes the important observation that it is Bradwardine's unique analytical style, not the unconventionality of his opinions, which makes his writing so compelling. Weisheipl contends that the theology of the *De causa Dei* is perfectly in line with Thomist teaching about God as the first cause.

The impact of the work has been so strong, no less today than in the fourteenth century, because Bradwardine far surpassed his contemporaries in grasping the implications of traditional metaphysics and in conveying his insights to a large audience.[95] His influence and popularity as a thinker are proven by his remarkable success within and outside of academic circles. His brilliant public career enabled him, in turn, to popularize his essentially traditional views of nature and God among both learned and lay communities. Weisheipl's observation holds as well for Bradwardine's other works. His ideas about geometry, proportionality and continuity also attracted large audiences because they displayed his skill in presenting Euclidean geometry and Aristotelian natural philosophy rationally and in a highly original form. Even his early and relatively immature opinions about beginning and ceasing forced more advanced scholars to reconsider their views. In spite of its awkwardness, moreover, the *De futuris contingentibus* demonstrates that Bradwardine was prepared by the late 1320s to apply his exceptional analytical talents to a new range of difficult theological questions.

The *De causa Dei* was the product of Bradwardine's attempt to place his well-developed assumptions about the natural world in a broader context and to explain how God uses the physical and spiritual forces which are observed in nature and revealed in Scripture to create a unified, balanced and orderly universe. This study of the *De causa Dei* has shown that the distinction between time and eternity, which lies at the heart of both Bradwardine's natural philosophy and his theology, became the major link between them in his mature thought and has suggested that no attempt to understand the development of Bradwardine's views or to assess his role as preserver and transformer of traditional positions can be complete without some reference to his conception of time.

CONCLUSION

In this dissertation the physical, philosophical and theological elements of Bradwardine's view of time and eternity have been examined in the context of ancient and medieval approaches to the problem of time. Chapters Two and Three trace the development of the large body of speculative literature on this subject from the classical period to the end of the thirteenth century. These chapters reveal not only the general importance of the problem of time in the Western philosophical tradition, but also the complexity and subtlety of the various solutions to the problem of time. The main conclusion to be drawn from this review is that medieval thinkers inherited an approach to time which tried to balance the poetical cosmology of Plato's *Timaeus* with Aristotle's more concrete natural philosophy. Christian philosophers from Augustine to Aquinas reinterpreted Plato's and Aristotle's views of time in light of Scripture, but they based their arguments about time almost entirely on classical formulations.

Chapters Four through Seven of this dissertation explore the influence of both classical and Christian approaches of time on the views of one of the fourteenth century's most prominent natural philosophers and theologians. Chapter Four indicates how Bradwardine's axiomatic method of combining Euclidean mathematics and Aristotelian physics allowed him to remain firmly committed to Aristotle without losing the analytical benefits of a more Platonic approach to mathematics. Bradwardine's use of time in his analysis of ratios suggests that he fully accepted the physical validity of Aristotle's definition of time as the number or measure of motion.

Chapter Five, which focuses on Bradwardine's influential work on continuity, develops further the theme of his preference for Aristotelian natural philosophy. In the *De continuo*, Bradwardine explicitly defined time as the successive continuum which contains and measures all other continua, whether successive or permanent. This treatise not only reaffirms Bradwardine's commitment to Aristotelian natural philosophy but also presents unambiguously his notion that infinity in the created world is a matter of infinite divisibility, not of infinite duration or dimension. Although he made no attempt in the *De continuo* to compare the continuity of created matter with the infinity or eternity of God, he developed a theory of continuity which is consistent with the cosmology which he later described in the *De causa Dei*.

Chapter Six contrasts Bradwardine's early views on beginning and ceasing with his first speculations on contingency. This analysis emphasizes Bradwardine's growing awareness of the difference between the human perception of time and change on the one hand and the divine experience of eternity and immutability on the other. In the *De incipit et destinit*, which consciously excludes the issue of divine foreknowledge, Bradwardine fearlessly proves through Aristotelian principles that the future is undetermined and completely unpredictable. The *De futuris contingentibus* explores much more cautiously the true relationship between God's knowledge and human perception of the future. By rigidly interpreting the Augustinian-Boethian view of eternity, Bradwardine seems to deny any possibility of contingency at all, suggesting an almost complete reversal of his opinion in the *De incipit et destinit*.

Chapter Seven attempts to resolve this apparent dilemma by examining Bradwardine's mature thought about time and eternity as he expressed it in the *De causa Dei*. In this work Bradwardine presents a cosmology which admits no human capacity to attain certain knowledge of the future through logical prediction[1] and

which recognizes man's perception of the future as contingent and yet ultimately dependent on the eternal, immutable will of God. By subordinating every created act to God as first cause, Bradwardine placed God at the center of both the physical and temporal order. Although it was not primarily a work of natural philosophy, the *De causa Dei* was based on a view of time and eternity which enlarged Augustinian notions of eternity and grace with the principles of Aristotelian physics.

This study of Bradwardine's conception of time in scientific, philosophical and theological contexts demonstrates several important points about Bradwardine's thought and fourteenth-century intellectual life as a whole. First, although Bradwardine was perfectly capable of distinguishing among the logical, physical, metaphysical and spiritual aspects of time and eternity, he considered it neither necessary nor desirable to approach time in one way exclusively. All of his works show his awareness of the classical and medieval debates about specific topics such as time, continuity and proportionality, as well as the larger contemporary debate about the validity of Aristotelian natural philosophy. Nowhere does Bradwardine show more clearly his affinity for the philosophy of Thomas Aquinas than in his multi-faceted treatment of time for, to reconcile Augustine and Aristotle, both theologians had to confront the conflicting approaches to time and eternity which these two authorities present.

Second, Bradwardine's view of time and eternity, in spite of its clear basis in Aristotelian physics and Euclidean mathematics, helped him to define the cosmological principles which supported his theological positions on grace, free will, justification and sin. In fact, his axiomatic approach to metaphysical problems allowed him to retain and balance what he considered to be the most convincing aspects of the Aristotelian and Augustinian-Boethian temporal theories. Bradwardine's method allowed him to affirm the accuracy of human observation of change and motion while acknowledging God's different perspective on creation.

Bradwardine's technical understanding of infinity, continuity, proportionality and limits lent authority to his conception of God as eternal, immutable, omnipotent and the first cause of every created act.

Third, Bradwardine's treatment of time illustrates one of the most characteristic features of his analytical method: his ability to refute his opponents, not by debating every aspect of a problem under discussion, but by systematically eroding the validity of one or two crucial underlying assumptions. Thus, one of Bradwardine's most effective challenges to contemporary speculation about contingency, logical prediction and free will arose directly out of his definition of time as a created entity, dependent on God for its existence and with no power to encompass or restrict him. Bradwardine's view of time illustrates, therefore, how misleading it is to study his natural philosophy and theology as unrelated features of his thought.

Another theme which has been stressed in this dissertation is that, despite the remarkable originality of his methods and the unusual clarity of his style, Bradwardine was a member an academic community. His achievements, therefore, cannot be seen in isolation from those of his colleagues. Except perhaps for the *Geometria speculativa*, all of Bradwardine's major works addressed disputes of great contemporary interest. Whether the topic was physical, philosophical or theological, Bradwardine and his fellow scholars referred to the same body of authority, made use of the same analytical methods and constantly emphasized the orthodoxy of their arguments. For this reason, the dilemma of time's relationship to eternity, unresolved since the classical period, is a recurrent, if implicit, theme in mid-fourteenth-century thought.

Although Ockham and Bradwardine were two of the few thinkers explicitly to examine time as both a physical and theological problem, the issue of time emerged implicitly in a much wider range of discussions concerning free will,

contingency and God's absolute power. Ockham contributed to this discussion by introducing new techniques for evaluating the truth of logical propositions. Bradwardine, as a natural philosopher, helped to focus attention on the cosmological assumptions which theologians must make whenever they try to define the relationship between God and man. Bradwardine's most positive role in these debates, however, was to suggest that no explanation of the operation of human or divine will in the created world is valid if it fails to acknowledge the distinction between God's atemporal existence and the human experience of constant change.

It would be wrong to suggest that these debates did not sometimes lead to serious disagreement and personal antagonism, but it is equally inaccurate to exaggerate the differences among the participants, who were, after all, trained for critical disputation in the search for truth. The current trend in historical analysis of late medieval thought, therefore, is to step back from the earlier interpretation of fourteenth-century intellectual life as a clear-cut debate between advocates of a radical skepticism and conservative Augustinianism. The main impetus behind this shift has been a reevaluation of Ockham's role as an intellectual leader in the early decades of the fourteenth century. While the originality of Ockham's thought has never been doubted, he is being portrayed increasingly as a rather conservative Franciscan, who influenced, but certainly did not dominate, those younger scholars whose views were eventually condemned in Paris in 1347.[2] Recent research on such men as Thomas Buckingham, Robert Holcot, Adam Wodeham, John of Mirecourt and Gregory of Rimini underlines the complexity of their thought and provides a better framework for understanding their debates with each other and with so-called conservative opponents like Bradwardine and Richard FitzRalph.

Because he was a major contributor to the fourteenth-century academic debates, Bradwardine's relationship with his contemporaries also deserves to be reconsidered. Unfortunately, most of the standard interpretive studies of

Bradwardine either have concentrated almost entirely on his contributions to natural philosophy or have placed his theological views, embodied in the *De causa Dei*, in the context of a fierce religious dispute. Because very few treatments of Bradwardine's thought have tried to explain how his views about natural philosophy influenced his theology and because most studies have contrasted his positions with those of a specific group of opponents, Bradwardine's position in the fourteenth-century debates has been somewhat misconstrued: he has been labeled a conservative on account of his opposition to "Ockhamist" assertions about God's absolute power, in spite of his own equally emphatic advocacy of that principle; he has been called an "inhumane genius" in spite of his constant acknowledgement of human reason and his unfailing optimism about the goodness of man's relationship with God.[3] Moreover, the literature on Bradwardine consistently gives the impression that, although he was an active natural philosopher, his scientific views generated little controversy whereas his theological opinions involved him in a hostile struggle with the nominalists which ended for him only at his death - a view which fails to account for key features of Bradwardine's argumentative style. As we have seen, even his scientific works were polemical and were directed against ideas rather than individual thinkers.[4] The same observation needs to be made about Bradwardine's theological views.

These features of the traditional approach to fourteenth-century intellectual life are particularly evident in the studies of Leff and Oberman. Despite their vastly different opinions about the basic direction of Bradwardine's theology, both Leff and Oberman portray Bradwardine as a self-conscious opponent of Ockham and his followers. Because each is chiefly concerned with philosophical and theological questions, however, neither Leff nor Oberman considers other aspects of academic debate in the mid-fourteenth century. Their decision to stress theology over natural philosophy leads occasionally to misinterpretations not only of Bradwardine but of

Ockham. As recent studies of Ockham have shown, even his most innovative and controversial views about faith and reason depend on his acceptance both of Aristotelian physics and of Franciscan theology. This combination of influences from natural philosophy and theology applies to Bradwardine's work as well.

The tendency among historians to separate the scientific theories of medieval authors from their theological views is, of course, mostly a matter of convenience: individual scholars often lack expertise in some of the fields which have bearing on their multi-disciplinary approaches to cosmological problems. The reason for focusing attention on Ockham as the leader of a new, skeptical intellectual movement in the early fourteenth century, however, is primarily historiographical. The thesis that Ockham initiated a direct challenge to orthodoxy, one which was checked only temporarily by the Paris condemnations of 1347 and the Black Death, originated at the end of the nineteenth century and was pursued with vigor for many decades. Its elegance and internal consistency caused it to persist even in the absence of direct evidence either to prove or to disprove it.[5]

One of the most eloquent and influential proponents of the traditional view of the fourteenth-century intellectual climate has been Étienne Gilson, who argued that Ockham almost single-handedly changed the tone of late medieval philosophy. By divorcing faith and reason, says Gilson, Ockham jeopardized the delicate balance between theology and philosophy which his thirteenth-century predecessors had crafted and so brought about the disintegration of scholastic unity:

> The practical effect of [Ockham's] theology was to nullify, in many minds, the effort of what might be called the classical scholasticism of the thirteenth century, including Henry of Ghent and Duns Scotus. Of the rational understanding of faith attempted by Bonaventure, Albert the Great, Thomas Aquinas and their contemporaries, very little, if anything, was left after Ockham. This is the reason why we described Ockhamism as marking the end of the golden age of scholasticism. Faith was intact, but to follow Ockham was to give up any hope of achieving, in this life, a positive philosophical understanding of its intelligible meaning. . . . In this sense, it can be said that the

> doctrine of Ockham marked a turning point in the history of philosophy as well as of theology. In theology his doctrine was paving the way to the 'positive theology' of the moderns. In philosophy, it was paving the way to modern empiricism. In both cases it really was a *via moderna*: a modern way.[6]

In Gilson's view, then, Ockham transformed the late medieval intellectual community by rejecting completely the philosophical and theological principles which supported the views of his predecessors.

Gilson subsequently described the effect of Ockham's thought on his contemporaries. According to Gilson, Ockham quickly acquired a loyal group of followers who intensified the attack on traditional beliefs. These men came to be known as the "nominalists":

> The expressions 'nominalists' and 'realists' (*nominales, reales*) had been in use as early as the twelfth century. In the thirteenth century, Albert the Great had spoken of the 'nominalists' as of men who placed community in the intellect only. . . . But there have been few nominalists in the thirteenth century. After Ockham, this ancient appellation was used to designate his disciples. Hence a new doctrinal alignment. Despite their constant controversies, Thomists and Scotists were lumped together and made up the class of the 'realists,' or partisans of the 'ancient way' in philosophy and theology (*via antiqua*); the nominalists or terminists (*nominales, terministae*) were also called the moderns (*moderni*), not because they intended to abandon Aristotle, but because they were following a new way (*via moderna*) in interpreting it. . . . On December 29, 1340, some nominalistic theses were prohibited by the [Parisian Faculty of Arts], but these measures no more stopped the spread of Ockhamism than the thirteenth-century interdictions to teach Aristotle had prevented Aristotelianism from invading the mediaeval schools.[7]

This interpretation of Ockham's role in fourteenth-century intellectual life encouraged the notion that there was a single debate between clearly defined parties and suggested that Ockham led his adherents in a blatant attack on traditional views.

In his analysis of nominalism, Gilson equated Ockham's apparent reluctance to accept the possibility of certain knowledge, either of nature or of God, with the

principle of skepticism. Gilson portrayed Ockham as at odds generally with all thirteenth-century attempts to reconcile Christian faith with Aristotelian natural philosophy and specifically with Duns Scotus' philosophical refinement of this synthesis:

> The God in whom Ockham believes is Yahweh, who obeys nothing, not even Ideas. Duns Scotus had submitted to the free will of God the choice of essences to be created; instead of letting God be free to choose between essences, Ockham suppresses them. Abélard had made Ideas the privilege of the divine mind; Ockham suppresses universals even in God. It is because there are no universal Ideas in God that there is no universality in things. The so-called Ideas are nothing but the very things producible by God. God needs no Ideas in order to know; by the very fact that God is God, he knows all.[8]

Thus, although protecting himself with the orthodox claim that God, in his absolute power, could do anything, Ockham completely dismantled the rational underpinnings for reconciling faith and reason. In doing so, he negated the work of thirteenth-century theologians whose outstanding achievement had been to demonstrate that such a reconciliation was possible.

According to Gilson, Ockham's rejection of Aristotelian metaphysics further eroded the attempt to reconcile faith and reason. Ockham's approach to knowledge made it impossible for him or his followers to establish either a philosophical basis for faith or even a rational certainty about natural phenomena. In spite of their closeness to modern views of certainty, Ockham's views posed serious and disruptive theological questions in the fourteenth century:

> Like Thomas Aquinas and Duns Scotus, Ockham was first and last a theologian using certain philosophical doctrines in order to elaborate his own understanding of Christian faith. The dissolving influence exercised by his doctrine in the history of mediaeval scholasticism is due to the fact that, professing as he did a radical empiricism in philosophy, he had to reduce the understanding of faith to a bare minimum. An Ockhamist intellect is as badly equipped as possible for metaphysical cognition, and since where there is no metaphysical knowledge theology can expect little help from philosophy, the

> consequence of Ockhamism was to substitute for the positive collaboration of faith and reason which obtained in the golden age of scholasticism, a new and much looser regime in which the absolute and self-sufficient attitude of faith was only backed by mere philosophical probabilities.[9]

By presenting "Ockhamism" as an anti-Averroist theological reaction, moreover, Gilson stressed Ockham's position as the leader of a group with a well-defined agenda of opposition to thirteenth-century approaches to Aristotle.[10] Although it had more lasting effects than the initial criticisms of Aristotle in the twelfth and thirteenth centuries and displayed a more sophisticated understanding of Aristotelian natural philosophy, Ockham's nominalist school arose, in Gilson's view, from a similar distrust of classical approaches to knowledge.

Gilson's interpretation of Ockham and his followers, though it is an extreme one, provided a model for almost all subsequent discussions of Bradwardine's cosmology. Bradwardine's criticism of the modern Pelagians, who seemed to lack confidence both in the natural order of the universe and in God's complete knowledge of it, points the reader of the *De causa Dei* to the group of people whom Gilson identified as the "Ockhamists." Not surprisingly, therefore, the standard treatments of Bradwardine's theology routinely have compared Bradwardine to Ockham and his nominalist followers, including Robert Holcot, Thomas Buckingham, Adam Wodeham, Gregory of Rimini and John Mirecourt. Comparisons have been made because these men have been considered "Ockhamists," sometimes despite the lack of any specific evidence suggesting that the "Ockhamist" label was legitimate. Of course, if these men really did try systematically to destroy the Aristotelian foundations of thirteenth-century theology, Bradwardine surely would have opposed them, if only on the grounds that their skepticism undermined the profession of a lively and confident faith. In fact, the attitudes of Bradwardine's contemporaries to Aristotle were varied and complex. Thus comparisons of their views can provide many useful insights into late medieval

thought, but only so long as we resist the temptation to separate these thinkers into distinct schools.

We have already seen, for example, that Ockham, in spite of his real differences from Bradwardine, was perhaps not quite so radical as Gilson and others have made him out to be. Ockham presented his contemporaries with epistemological and logical, not so much cosmological, speculations: he was concerned not with what exists but with how we can know about what exists. Nonetheless, his skepticism about the possibility of certain knowledge paralleled Bradwardine's own concerns on this issue and his method for expressing this uncertainty was analogous to Bradwardine's sharp division between the characteristics of created and divine being. Moreover, both theologians accepted the fundamental truth of Aristotelian natural philosophy and both based their theology on the conviction that God, in his absolute power, can do anything. Indeed, in certain respects, Bradwardine pushed this point farther than Ockham.

Similar observations could be made concerning Bradwardine's relationship with the "Ockhamists." Gilson, Leff and Oberman all maintained that Ockham had followers who together represented the radical challenge which Bradwardine tried to combat in the *De causa Dei.* Because they expressed some of the logical skepticism about knowledge which Ockham had introduced in his philosophical works, these scholars could easily be identified as the modern Pelagians whose notions so distressed Bradwardine. In order to evaluate the extent to which these men really opposed Bradwardine, historians have focused on their divergent opinions about the nature of God's absolute power. The usual assumption is that, in following Ockham's conception of God's absolute power, the "Ockhamists" developed a theological perspective that undermined the balance of faith and reason advocated by Augustine and Aquinas. Little attention has been paid to the greater likelihood that Bradwardine disagreed with the "Ockhamists" in direct

proportion to their acceptance of a cosmology which temporalized God and made the future contingent not only to man but to God.

According to Leff, for example, the "Ockhamist" insistence that God's absolute power allows him to do anything calls into question the necessity of an orderly, predictable universe. Although God, through his ordained powers, gives the impression of rationality, he is not compelled always to act according to these powers. God's absolute power is an attribute "outside all space and time and not directed to any specific universe, or to sustaining any fixed order."[11] This conception of God's absolute power is, in Leff's view, the source of skepticism throughout the whole nominalist movement because

> it combined [the] three features of mutability, possibility and indeterminacy, and applied them to God and revelation. Its central theme was that nothing was impossible for God in His absolute power; and in removing the bar of impossibility, it opened the way to neutrality and indeterminacy. Neutrality was expressed in the refusal to limit God so that any course was as likely as another in his infinite freedom; accordingly, the sceptics refused to limit themselves in what could be said about Him; it enabled them to join the blasphemous to the devotional, to make black part of white, to consider the impossible as possible, all in the name of His freedom. . . . As a result, God was as he willed; His attributes dissolved before the blaze of His omnipotence, making him unknowable not only in the wider and accepted sense, but in those traits which were virtually the precondition of belief. His goodness, perfection, mercy, justice and wisdom all faded from man's vision as beyond his ken. He could be known only by His ability ever to do differently than He had done. God, therefore, lost his certainty; He became identified with infinite possibility rather than with any fixed and ascertainable order. Hence anything could be posited of Him, for His *potentia absoluta* substituted speculation for understanding.[12]

The implications of Ockham's theory for explaining God's relation to the created world are so extreme, says Leff, that Bradwardine had no choice but to refute them.

The comparisons which have been made between Ockham and Bradwardine in this dissertation have indicated that the view of Ockham advanced by Gilson and Leff have somewhat exaggerated the extremity of Ockham's philosophical and

theological views. We have seen that Ockham never advocated so rigorous a skepticism that it rendered God and the natural order totally incomprehensible; he merely pointed out that the human tools of propositional logic and philosophical analysis can only partially explain how and why God exercises his absolute power as he does. This reevaluation of Ockham's thought obviously raises serious questions about the interpretation of the work of his followers. If Ockham cannot be accused of excessive or radical skepticism, how, then, do we evaluate the work of those thinkers whose ideas have been associated with his? In other words, to what extent did the "Ockhamists" deviate from Ockham's essentially moderate position, and to what extent did they advocate the view of God ascribed to them by Gilson and Leff? More important in the context of this dissertation, did the ideas of the "Ockhamists" influence Bradwardine's arguments concerning time, contingency, grace and free will? Although it would be inappropriate to attempt here a comprehensive analysis of the entire group of scholars commonly referred to as the "Ockhamists," I shall try to address some aspects of the question of Bradwardine's relationship to his contemporaries through two examples of academic interaction. Thomas Buckingham and Robert Holcot are the two "Ockhamists" most often associated with Bradwardine. Not only did all three move in the same circles, but there is good evidence of mutual influence in both philosophical and theological matters. By briefly comparing their opinions about God's absolute power, natural justice and grace, I hope both to show the complexity of academic interaction in the mid-fourteenth century and to emphasize the role of cosmological differences, particularly those involving time, in late medieval scholarly debate.

Bradwardine's interactions with Thomas Buckingham indicate that Buckingham moderated his somewhat extreme skepticism after considering Bradwardine's complaints against the modern Pelagians, although he remained convinced that Bradwardine's approach to contingency was too deterministic. A

slightly younger contemporary of Bradwardine's, Buckingham was born at the turn of the fourteenth century and was a fellow at Merton from 1324 to 1340. Gifted both as a natural philosopher and as a theologian, Buckingham would certainly have had direct contact with so prominent a Mertonian as Bradwardine. In his sentence commentary, completed in the mid 1330s, Buckingham took a great interest in contemporary speculation about the importance of grace in determining the merit of an act. Buckingham's opinion that God, in his absolute power, could create a sinless individual without having to provide him with justifying grace, led him into conflict with both Bradwardine and FitzRalph. Buckingham's assertions about grace corroborated the conventional teaching that unbaptized infants are unjustified even though they are too young to act meritoriously or without grace; nevertheless, the assumptions about God's absolute power, which he used to support this thesis, raised doubts about Buckingham's overall orthodoxy.[13] In probing the question of God's capacity to contravene the natural order established by his ordained powers, Buckingham took the potentially dangerous step of undermining the importance of grace.

According to Leff, in fact, Buckingham pushed the "Ockhamist" approach to God's absolute power so far that his theology was only barely orthodox. The doctrine of God's absolute power enabled him to challenge the orthodox position on contingency in two dangerous ways: first, by denying the necessity of grace for a meritorious act; and second, by describing God's knowledge of the future as fully contingent. Instead of stressing God's constant involvement in the world and participation in human acts, Buckingham contended that God has provided human beings with a kind of "natural justice" which allows them to perform good acts without grace. Since one could therefore do good without the constant intervention of God, one could postulate that salvation might be attained without the benefit of

created grace. Buckingham even went so far as to suggest that this natural justice empowers the human will to reject sin of its own accord.[14]

Buckingham claimed that he placed such a strong emphasis on human freedom only in order to ensure the absolute freedom of God. Leff has suggested, however, that Buckingham's real concern was to safeguard the freedom of the human will and to disguise the radical nature of his views by maintaining the widely accepted view that human freedom depends on and resembles divine freedom. It is perhaps more likely that Buckingham over-emphasized the analogy between human and divine freedom on account of his legitimate concern about the restrictions which God's ordained powers might have on his absolute power. Therefore, although Buckingham did not wish to deny the reality of God's ordained power, he struggled with the question of how God could be truly free if he must participate in the world according to his ordained powers. Nevertheless, in his early thought at least, Buckingham expressed views about grace and necessity which appeared to his contemporaries to stress too much the correspondence between human and divine freedom. Bradwardine, in particular, criticized Buckingham's underestimation of the importance of created grace, although his regard for God's absolute freedom equalled or even surpassed Buckingham's.

Buckingham's view of contingency suggests that his cosmology prevented him from accepting Bradwardine's solution to the problem of free will. Leff claims that Buckingham's radical view of contingency reflects better than any other issue Buckingham's extreme skepticism:

> In essence the problem is how to reconcile God's eternal knowledge of everything with man's freedom to act contingently; that is, if God knows all from eternity how can men act freely without either making His knowledge mutable or their actions determined? It is a problem which arises only when there is a break between God's will and His operations in the world; with no hierarchy between God and men, there can, in the circumstances, be only two alternatives, if freedom for the future is to be preserved: either God, while knowing the

> general shape of things to come, foregoes, in the interests of freedom, any foreknowledge of their details; or His knowledge of these particulars must be contingent, as subject to change as they themselves are. . . . Buckingham . . . chooses the second way and makes God's foreknowledge of the future as contingent as the contingents He knows.[15]

In following this line of argument, says Leff, Buckingham willingly sacrificed two attributes of God, omniscience and immutability, in order to preserve both God's absolute power and the freedom of the human will. Although Buckingham did not deny that God has complete knowledge of all future contingents, he stated much more openly than Ockham ever had the implication of this contingency for creation: God knows all of the possibilities of the future but he waits to see which possibilities will be realized. To ensure that the future remained contingent, therefore, Buckingham qualified God's foreknowledge, making it a knowledge of potentiality, not of actuality. By emphasizing these themes, Leff is able to portray Buckingham as a theologian for whom conventional explanations of God's powers and ways of acting in his creation are unnecessarily deterministic and so are inadequate.

Robson argues that Buckingham responded decisively to the unfavorable reaction that his sentence commentary received in the academic community. According to Robson, Bradwardine had an especially strong influence on Buckingham, not only because Bradwardine was a highly respected figure in Buckingham's own circle but because they were both interested in the same kinds of philosophical and theological problems.[16] Although Buckingham continued to maintain that the future is in an absolute sense more contingent than the past, because the future still holds the possibility of change, he tried in his later works to find a middle ground between determinism and skepticism. In his *Quaestiones*, for example, Buckingham reevaluated Bradwardine's criticism of his view of antecedent necessity:

> In a necessary consequence, if the antecedent is not in the free control of the person concerned, then neither is the consequence; and if the consequence is under his control so is the antecedent; and the rules brought with authorities and arguments against my second, third, ninth and tenth conclusions have (I hope) been fully refuted to the understanding of those who uttered them. But to what has been said here a certain doctor objects, by proving that whoever has free control over a consequence is also in control of whatever follows from it and whatever is necessarily antecedent. And he says that he understands this only of any antecedent which is not absolutely impossible: and it is his 13th conclusion.[17]

This passage indicates that Bradwardine and Buckingham had a fundamental disagreement about the temporal nature of created acts. Whereas Bradwardine continually affirmed both the past and the future as equally necessary because they exist simultaneously in God's mind, Buckingham insisted on temporal variations in necessity. Even for God, he argued, the past is more necessary than the future because it has lost its contingency.

Although Buckingham conceded that his earlier opinions about grace might have been too extreme, he was not prepared to give up his temporal approach to contingency.[18] Nevertheless, Robson points out, Buckingham denied in his *Quaestiones* that the past and future are so contingent that God would arbitrarily change or destroy conditions which are necessary for faith and so gently chastised Bradwardine for misrepresenting his position:

> Likewise the Reverend Doctor, arguing in opposition to this conclusion, says that unless we admit antecedent necessity, we must admit it possible for the whole of God's church to fall, collapse and perish, for the whole vessel of Peter to suffer shipwreck and drowning, for all Christ's faith before the Day of Judgement to be defective and shattered (and even that all the articles of faith concerning the future should be, and should always have been, false and erroneous); that Christ should have lied and all the Saints, Apostles, Martyrs and Confessors who formerly lived in this faith should have been deceived.[19]

Robson, calling this passage a "caricature of the alternative to rigid determinism,"[20] depicts Buckingham as a moderate theologian trying to find a compromise between restrictive determinism and arbitrary contingency. Buckingham affirmed his orthodoxy by refusing to go too far in either direction. To this extent, he followed Ockham in balancing the necessary truth of God's revelation with seemingly irrefutable sensory evidence that the future contains many possibilities while the past can no longer be changed. Buckingham and Bradwardine were in conflict over this issue because they had fundamentally different conceptions of time. Buckingham was unwilling to accord to God an eternity and simultaneity which completely remove him from the human experience of time; consequently, his view of necessity was ambiguous. Bradwardine, as we have already seen, sacrificed some of the full range of human freedom to avoid this very ambiguity.

Buckingham's and Bradwardine's disagreement concerning God's experience of time manifested itself in different interpretations of God's essential attributes. While they both gave the highest affirmation to God's absolute power, Buckingham stressed God's freedom to change his mind in a temporal way, whereas Bradwardine viewed God's freedom, unlike human freedom, as an entirely atemporal reality. Though wishing to remain orthodox Buckingham could not relinquish his conviction that divine and human freedom share certain characteristics:

> To the argument alleged by the Master and Reverend Doctor, that unless we admit antecedent necessity in all acts of the will, we must admit the possibility of the whole church being destroyed, and so forth: in reply, I wish to know whether God is free to change his ordinances; and if he is, whether he cannot by his free will effect and fulfil all those things here named. . . . For I think that the created will has liberty of contradiction, and no man has the power to destroy Holy Church. . . . And I know that, as logic demands, [I must affirm] the co-operation, grace, predestination, and prescience of God, which I shall not deny. Nor like the Fool shall I deny his existence, nor like Pelagius do I wish to exalt my will as master and God's as mere handmaid. But I wish to attribute to God, as first agent, every good we have and to declare that we are in many things his free instruments, not coerced, and also fit to be rewarded out

> of his abundant mercy for which, as I am bound, I return all the thanks I can.[21]

Nothing in this statement contradicted Bradwardine's positions about God as first cause or the freedom of the human will to respond to the infinitely divine will. In fact, Buckingham's language clearly indicates that he was responding directly to complaints which Bradwardine had levied against him in the *De causa Dei.* Buckingham openly acknowledged that God is the first cause of created acts. His differences from Bradwardine arose mostly from the question of how God "changes his mind": for Buckingham, the change could occur temporally, so that the future could be seen as at least somewhat contingent; for Bradwardine, any change in the divine plan would be atemporal and entirely independent of human perceptions of change in time.

Buckingham's disagreement with Bradwardine over the temporal basis of necessity should not be exaggerated, however. There is little doubt that Buckingham was sensitive to the charge of "Pelagianism" and adjusted his opinions accordingly, although he continued to distinguish between the necessity of the past and the contingency of the future. Leff would have us believe that Buckingham and Bradwardine stood so far apart on this issue that they both strayed perilously close to heresy: that Buckingham, in his extreme interpretation of "Ockhamist" principles, provoked Bradwardine into an equally extreme form of determinism. What Leff fails to take into account in his analysis of Buckingham is the positive influence of academic dialogue. While it is true that Buckingham's temporal approach to contingency resembled Ockham's, he neither slavishly followed Ockham nor altered his cosmology in favor of Bradwardine's when he was alerted to some of his errors.[22] Robson has shown that communication between Buckingham and Bradwardine led to reconsideration and refinement on Buckingham's part, just as, we may suppose, Buckingham's immature expression of his early opinions provided

a useful target for Bradwardine's analysis of the problem of contingency. The fact that they did not ultimately agree on every issue does not diminish the value of their attempts to work out their views in an environment of debate and criticism. Bradwardine's exchange with Buckingham, far from suggesting bitterness, radicalism and despair over the collapse of an old way of thinking, reflects the capacity of mid-fourteenth-century thinkers to collaborate on new solutions to difficult problems.[23]

Another contemporary of Bradwardine who has been regularly included in the list of "Ockhamists" was Robert Holcot. Holcot was a Dominican who combined study and lecturing at Oxford with an active career of public preaching. In addition, he wrote on a variety of topics of contemporary interest. Indeed, Oberman has called Holcot a "proto-humanist" on account of his intense interests in classics and moral theology.[24] Although he was a friar, Holcot's career paralleled Bradwardine's remarkably closely. Both arrived at Oxford in the 1320s, taught and wrote in the 1330s and early 1340s and spent the last years of their lives away from the universities, though Holcot entered a quiet retirement at the same time that Bradwardine was enjoying his most active period of public service. Both died in 1349. More important than these coincidental comparisons, both Bradwardine and Holcot belonged for a time to Richard de Bury's household, which ensures that they were at least reasonably well known to each other. Unlike the Mertonians in Bishop Bury's circle, Holcot did not specialize in natural philosophy. He shared with Bradwardine the distinction, however, of publishing several books which were immediately popular and widely read.[25] Given his Dominican training, Holcot showed an unusual enthusiasm for many of Ockham's ideas, particularly in the sphere of logic. Like Ockham, Holcot was fascinated by the problem of reconciling matters of faith with the philosophical constraints of Aristotelian logic.[26] Holcot was also involved in discussions about contingency and necessity. He has generally been considered an opponent of Bradwardine's determinism, although historians

have disagreed as to the nature and extent of his criticism. Gilson and Leff have portrayed Holcot primarily as an "Ockhamist" whereas Oberman has stressed the more original features of his attack on determinism.

Those historians who emphasize Holcot's ties to Ockham point to Holcot's nominalistic tendency to separate faith and reason. According to Gilson, for example, Holcot tried to prove in his sentence commentary that faith and natural philosophy require two separate logical systems, because Aristotelian logic is ineffective for examining a theological mystery such as the Trinity. Holcot's reliance on the concept of God's absolute power to prove that one cannot apply the same analytical methods both to natural philosophy and theology indicates to Gilson that Holcot was deeply influenced by Ockham's teaching about contingency, prediction, natural order and sin.[27] Leff goes even farther than Gilson in identifying Holcot as a follower of Ockham and an inevitable opponent of Bradwardine. Indeed, says Leff, Holcot made himself the main target of Bradwardine's attack on Pelagianism by fully exploring the implications of Ockham's extreme skepticism. For Leff, Holcot is the quintessential "Ockhamist":

> Robert Holcot well illustrates how fruitfully Ockham provided for his followers along the path of scepticism. He takes up many of the same positions that Ockham held; and he also extends them. Despite his fulsome qualification to everything, it is not hard to discern the same trait of doubt that moulded Ockham's views. With some room for everything, there is hardly room for God; possibility once again dissolves the stable order that Bradwardine proclaims; and men can do all that men can will. Thus, on the one hand, there is divine causality; on the other divine indeterminacy. Holcot's view represents the application to which the latter outlook can be put. As the almost exact contemporary of Bradwardine, he indicates the attitude against which Bradwardine had to contend, and the effect of Ockham's teaching on thinkers of his generation.[28]

Thus Leff sees Holcot as a leading participant in a well-defined and well-integrated school of thought against which Bradwardine desperately battled.

Like Gilson, moreover, Leff stresses Holcot's use of the principle of God's absolute power, the favored "Ockhamist" method for deferring the charge of heresy. As with Buckingham, Leff underlines Holcot's belief in the inherent goodness of natural human powers, which permits the will to recognize and sometimes even perform good acts without the necessity of created grace. All of these concepts, says Leff, come more or less directly from Ockham. Holcot deviates from Ockham only in the direction of even greater skepticism, as when he denies that the human will need do anything to attain merit, because merit depends on God's will alone.[29]

According to Leff, Holcot's approach to contingency also reflects his tendency towards further skepticism. Holcot accepts Ockham's logical explanation of contingency and his assumption that the future is mutable in order to prove that God cannot know future contingents. Since revelation must be true, God's knowledge of revealed truths must be necessary and complete. Therefore, since God cannot have both complete and incomplete knowledge, it must be the case that he knows revealed truth with certainty and has no certain knowledge of contingent truths. In Leff's view, Holcot uses revelation as "the sign that God cannot know future contingents: in his desire to prevent God's word from being fallible he has chosen the other alternative of limiting his knowledge. . . . As a result, revelation has been transformed: it is now no longer the eternal sign of God's foreknowledge, but of its limitations."[30]

Although Oberman also considers Holcot sympathetic to many of Ockham's positions, he portrays Holcot as a more complex figure. Oberman admits that Holcot and Bradwardine disagreed on certain fundamental theological issues, but he does not think "Ockhamist" doctrines were the only source of the conflict. In fact, Oberman maintains, Holcot supported several of Bradwardine's ideas and sometimes departed significantly from Ockham: he did not simply intensify "Ockhamist" views.[31] By comparing Holcot's and Bradwardine's positions on grace

and will, Oberman is able to demonstrate, as Robson demonstrated for Buckingham, both Holcot's independence from "Ockhamism" and his positive contributions to a process of fruitful academic discussion.

Oberman cites Holcot's popular *Commentary on the Wisdom of Solomon* to indicate precisely where Holcot deviated from Bradwardine on the issue of grace. Whereas Bradwardine risks the charges of determinism and unnecessary restriction of the innate human capacity for good in order to assure God's primacy, Holcot tries very hard to preserve the integrity of the human will in the process of justification. Holcot wishes to define merit in such a way that intrinsic human worth is not ignored. Thus he distinguishes between the natural value of an action and its contracted value:

> Now if we understand man's merit according to the first interpretation, the natural goodness of our works does not earn eternal life fully (*de condigno*) but only partially (*de congruo*), since it is appropriate (*congruens*) that if man has done all that he can with his finite resources God should reward him with His infinite resources. But according to the second understanding of merit we can say that our works are fully worthy of eternal life, not because of any merit inherent in the acts themselves but because of grace, since our Lord has established that he who does good works in a state of grace shall receive eternal life.[32]

At this level Holcot appears to be in agreement with Bradwardine. Both accept the necessity of grace for transforming a human act, which is neither good nor bad in itself, into a meritorious one. They agree, moreover, that it is the direct activity of God which ensures a meritorious act.

Their differences become more apparent, however, when Holcot begins to discuss the precise way in which grace is received. Not only does Holcot claim that "whoever prepares himself to accept grace necessarily receives it," but he implies that God's capacity to give grace can be limited by circumstances:

> it may be said that there is a distinction between compulsory necessity and unfailing necessity [that is, consistency]. With God compulsory necessity has no place, but an unfailing necessity is appropriate to God because of His promise, that is, His Covenant, or established law. This is not an absolute, but rather a conditional necessity. According to God's established law the pilgrim who does whatever he can to dispose himself for grace always receives grace. However, if He should choose to, God could deviate from His law for someone other than the pilgrim or the devil. Then, however much a person [with whom God has not made His Covenant] might dispose himself for grace, he would not receive it. Man's disposition does not require the giving of grace except by congruency, because grace surpasses every natural act; it is impossible for man to fully merit (*de condigno*) through any natural act.[33]

Bradwardine would agree with the final sentiments of this passage but would take exception to the limiting language Holcot use to define God's scope in giving grace. In Bradwardine's opinion grace and act are inseparable because God causes and sanctifies the act all at once; Holcot, who has a different view of God's experience of time, sees the process of act and grace as sequential and temporal.

Although Oberman focuses on grace, not the problem of time and eternity, he argues convincingly that the disagreement between Bradwardine and Holcot cannot be conceived simply along the traditional lines of "Ockhamism" versus Augustinian determinism. Holcot shared some of Ockham's views about the nature of God's absolute power and future contingency but he produced his own views about grace and justification. Oberman's account of the exchange between Holcot and Bradwardine emphasizes themes which were of common interest to a large number of scholars. Instead of searching for the "Ockhamist" source of all Holcot's opinions, Oberman acknowledges the originality of both theologians as well as their dependence on the work of predecessors and contemporaries from various philosophical and theological traditions.

More recent interpretations of Holcot bear out this notion of subtlety and complexity of scholarly interaction in the mid-fourteenth century. Historians observe, for example, that Holcot accepted Ockham's logical approach to

contingency and note Holcot's ability to adjust Ockham's views to support his own particular interests. Although they do not describe it in such terms, most historians recognize that the conflict between Holcot and Bradwardine had to do with a basic difference in their conception of God's activity in the world. While Bradwardine and Holcot arrived at similar conclusions about grace and God's absolute power, they disagreed about the essential characteristics of the God who dispenses that grace and wields that power.

Furthermore, as Ockham's views increasingly come to be regarded as conventional, it becomes more difficult to distinguish fourteenth-century theologians on the basis of their skepticism.[34] Since Ockham, Bradwardine, Buckingham and Holcot identified many of the same problems and applied to them the analytical methods of their common education, they perhaps had more in common than the standard interpretation of late medieval philosophical trends recognized.[35] Although Holcot's place in the scholarly debates of the mid-fourteenth century has not yet been fully worked out, it is safe to assume that he, like Buckingham and Ockham, possessed the ability to respond to the ideas of others and to incorporate many perspectives into new ones.

The examples of Thomas Buckingham and Robert Holcot indicate that it is no simple matter to explain the complexities of late fourteenth-century intellectual life in terms of a clear-cut division between either conservatives and radicals or Augustinians and Ockhamists. Much more work remains to be done on the less well-known participants in fourteenth-century academic discussions at Oxford and at Paris, who also contributed to the rich and varied intellectual life of this period. Although fourteenth-century thinkers considered the same problems and looked to the same authorities as their predecessors, their innovations in logic and natural philosophy helped to push theological speculation, the most revered subject for human reason, in new directions and into new controversies. The closeness of the

academic community in training, patronage and belief made lively intercourse inevitable, particularly at Oxford, where the absence of any serious complaints of heresy stimulated a relatively uninhibited exchange of ideas. The multi-disciplinary skills of many of scholars significantly enriched debates about both traditional and novel topics.

As a highly respected member of late medieval academic circles both as a natural philosopher and as a theologian, Bradwardine epitomizes the vibrancy and multi-disciplinary extent of scholarly debates in that period. His mastery of many types of learning and his productive interaction with colleagues and students reflect the eagerness with which fourteenth-century scholars approached long-standing philosophical and theological problems in new ways. If the thirteenth century was the age of synthesis of Aristotelian natural philosophy and Christian doctrine, the fourteenth century represents an age of exploration of the implications of that synthesis. Occasionally, studies culminated in expressions of uncertainty about the propriety of using traditional methods to solve complex cosmological and theological questions: hence the charge of skepticism. If we look beyond the obvious lines of debate, however, we can also discern their optimism and confidence about the relationship between God and his creation which characterized the speculation of this period. Bradwardine's treatments of time and eternity and his critical responses to his contemporaries clearly indicate that skepticism in the mid-fourteenth century was not the consequence of anxiety about God's sovereignty or the rationality of the created world; rather, its source was dissatisfaction with traditional analytical methods which were inadequate to the needs of increasingly sophisticated scientific and theological investigations.

This examination of Bradwardine's view of time concurs with other recent studies which suggest that fourteenth-century thought cannot be accurately portrayed by emphasizing individual personalities, well-organized intellectual

alliances, pervasive skepticism or the breakdown of thirteenth-century syntheses. Instead, the complex interaction of scholars is the most striking feature of the period. William Courtenay describes the fourteenth century as a time when "methods and topics were generally more important than individual thinkers."[36] Bradwardine's scholarly achievements, seen in this context of criticism and debate, reflect his skill in correcting others' methods, contributing original perceptions based on his special knowledge of mathematics and natural philosophy and redefining cosmological problems in a way which combined the traditional authority of Aristotle, Augustine and Boethius with fresh perspectives.

The problem of time is an ancient one which still has not been resolved. Bradwardine's elegant solution was so tied up with his cosmology that it could not be accepted by those who proposed alternative cosmologies. Because he ignored aspects of the problem which were paramount to others, he was unable to convince all of his contemporaries that his approach was the correct one. Nevertheless, the state of the debate about time in the mid-fourteenth century, with Bradwardine so skillfully defending a view accepted from Plato through Aquinas while others built on an equally long tradition of criticism of this view, provides a great insight into the interests and abilities, the prejudices and limitations of the entire age. The discussions about time were neither universally optimistic nor completely pessimistic, but they exhibited an intense desire to understand God and how he operates in the world. As a physical, metaphysical, logical and cosmological concept, time afforded many different avenues for investigation. Bradwardine's training in both natural philosophy and theology put him in the position to understand the various aspects of time as well as any of his contemporaries. Even today many aspects of the problem of time remain unsolved, but the work of Bradwardine and his colleagues show how much can be accomplished when such a

complex issue engages the interest of a varied and well-integrated academic community.

NOTES

INTRODUCTION

[1] For a good general discussion of late medieval attitudes to time see Jean Leclercq, "The Experience of Time in the Late Middle Ages," *Studies in Medieval Culture*, 8-9 (1976), pp. 137-50.

[2] Full references to this and all subsequent texts by Bradwardine discussed in this dissertation can be found under Thomas Bradwardine in the Bibliography. Citations to the most frequently used texts are included in the List of Abbreviations. Basic bibliographical works on Bradwardine are cited in this chapter. For a comprehensive list of Bradwardine's writings see J. A. Weisheipl, "Repertorium Mertonense," *Mediaeval Studies*, 31 (1969), pp. 174-224.

[3] Gordon Leff, *Bradwardine and the Pelagians*, Cambridge Studies in Medieval Life and Thought, Series 2, Number 5 (Cambridge: Cambridge University Press, 1957), pp. 18-19.

[4] Katherine Walsh, *A Fourteenth-Century Scholar and Primate: Richard FitzRalph in Oxford, Avignon and Armagh* (Oxford: Clarendon Press, 1981). Even for FitzRalph, whose career is remarkably well-documented, it is impossible to fix the details of his birth, early life and death (*ibid.*, pp. 1-15, 445-50).

[5] Leff, p. 2.

[6] Walsh, p. 28.

[7] James A. Weisheipl and Heiko A. Oberman, "The *Sermo Epinicius* Ascribed to Thomas Bradwardine (1346)," *AHDL*, 26 (1958), p. 295. For some

useful remarks on Bradwardine's contribution to fourteenth-century mathematics and logic see J. M. Thijssen, "Burdian on Mathematics," *Vivarium*, 23 (1985), pp. 55-78 and Paul Vincent Spade, "*Insolubilia* and Bradwardine's Theory of Signification," *Annuaire de l'école pratique des hautes études*, 85 (1977-78), pp. 391-93.

[8] Anneliese Maier, "Zwei Recensionen," in *Ausgehendes Mittelalter: Gesammelte Aufsätze zur Geistesgeschichte des 14. Jahrhunderts*, 2 vols. (Rome: Storia e letteratura, 1967), II: 458.

[9] William Abel Pantin, *The English Church in the Fourteenth Century* (Cambridge: Cambridge University Press, 1959), p. 159; Walsh, p. 28.

[10] Weisheipl and Oberman, p. 299.

[11] *Ibid.*, p. 300.

[12] Leff, p. 3.

[13] J. A. Robson, *Wyclif and the Oxford Schools* (Cambridge: Cambridge University Press, 1961), p. 39.

[14] Quoted in Gotthard Lechler, *John Wycliffe and his English Precursors*, trans. P. Lorimer (London: The Religious Tract Society, 1878), p. 66. See *De causa Dei*, Book I, Chapter 35, p. 308, C-E.

[15] *Ibid.*

[16] William J. Courtenay, "Recent Work on Fourteenth Century Oxford Thought," *History of Education Quarterly*, Spring-Summer, 1985, pp. 227-32.

[17] Sebastian Hahn, *Thomas Bradwardine und seine Lehre von der menschlichen Willensfreiheit* (Münster: Aschendorff, 1904); Herbert Workman, *John Wyclif: A Study of the English Medieval Church* (Oxford: Clarendon Press, 1926); Justin Ferdinand Laun, "Die Prädestination bei Wyclif und Bradwardin," in *Imago Dei*, ed. H. Bornkamm (Giessen: Alfred Töpelmann, 1923), pp. 63-84; and Justin Ferdinand Laun, "Thomas Bradwardin, der Schüler Augustins und Lehrer Wyclifs," *Zeitschrift für Kirchengeschichte*, 47 (New Series 10) (1928), pp. 333-56. See also

Laun, "Recherches sur Thomas Bradwardin, précurseur de Wyclif," *Revue d'histoire et de philosophie religieuse*, 9 (1929), pp. 217-33, which briefly summarizes the contents of the previous article and provides a useful appendix on texts.

[18] See also Oberman's "Thomas Bradwardine: un précurseur de Luther?" *Revue d'histoire et de philosophie religieuse*, 40 (1968), pp. 146-51 for a brief analysis of Bradwardine's place in the Reformation tradition. For a critical appraisal of Oberman's view see Alistair E. McGrath, "Forerunners of the Reformation," *Harvard Theological Report*, 7 (1982), pp. 219-42.

[19] The editions produced by Nielsen and Genest will be discussed extensively in later chapters of this dissertation. Hüner Gillmeister has edited a very short treatise by Bradwardine on mnemonic devices in "An Intriguing Fourteenth-Century Document: Thomas Bradwardine's *De arte memorativa*," *Archiv für das Studium des neueren Sprachen und Literaturen*, 220 (1983), pp. 111-14. See also Beryl Rowland, "Bishop Bradwardine on the Artificial Memory," *Journal of the Warburg and Courtauld Institutes*, 41 (1978), pp. 307-12. Niels Jorgen Green-Pedersen discusses an anonymous text which has been attributed to Bradwardine in "Bradwardine (?) on Ockham's Doctrine of Consequences: An Edition, "*Cahiers de l'Institute du moyen âge grec et latin*, 42 (1982), pp. 8-20. Since evidence for the identification of the text is inconclusive and the subject of the treatise is unrelated to the issue of time, this text will not be examined in this dissertation.

[20] For some examples of recent work connecting Bradwardine with his contemporaries on issues not directly related to the subject of this dissertation see Kaluza, "La prétendu discussion parisienne de Thomas de Bradwardine avec Thomas de Buckingham: témoinage de Thomas de Cracovie," *RTAM*, 43 (1976), pp. 209-36; Kaluza, "Le problème du 'Deum non esse' chez Étienne du Chaumont, Nicolas Aston et Thomas Bradwardine," *Mediaevalia Philosophia Polonorum*, 24 (1979), pp. 3-19; Kaluza, "L'oeuvre théologique de Nicolas Aston," *AHDL*, 45

(1978), pp. 4-82; Leonard Kennedy, "Oxford Philosophers and the Existence of God," *RTAM*, 2 (198), pp. 194-208; and M. L. Rouré, "La problématique des proportions insolubles au XIIIe siècle - William Shyreswood, Walter Burleigh et Thomas Bradwardine," *ADHL*, 37 (1970-71), pp. 205-36.

CHAPTER TWO

[1] P. E. Ariotti, "The Concept of Time in Western Antiquity," in *The Study of Time*, ed. J. T. Fraser and N. Lawrence (New York: Springer-Verlag, 1975), II: 69-70. Ariotti points out, however, that the earliest Greek writers also conceived of time as the accumulation of "multiple times," (e. g. astronomical and seasonal cycles), rather than as a single entity. The poet Hesiod, for example, referred to several of these cycles in *Works and Days*. Says Ariotti, (p. 69): "Natural events were used for timing important activities. The arrival of cranes in ancient Greece, Hesiod noted, marks the time for planting, the return of the swallows the end of preening. . . . Hesiod noted the setting of the Pleiades as marking the time for hauling the fragile ships of the Greeks up on dry land, and the summer solstice for safe seafaring."

[2] *Ibid.* Ariotti suggests that these artists (e. g. Pherecydes, Aeschylus, Sophocles, Solon) might have been influenced by Iranian sources. In *Studies in Iconology* (New York: Harper and Row, 1959), pp. 70-75, Erwin Panofsky discusses the mythological tradition of the god Chronos. Although there was no god of time in the earliest Greek pantheon, the similarity between the Greek word for time, *chronos*, and the name of the oldest Greek Titan, *Kronos*, (Saturn in Roman mythology), caused poets and philosophers to begin to associate the symbols of Kronos with concepts of time. Thus by the fourth century B. C. *Kronos'* name had been changed to *Chronos* and he was widely considered to be both a Titan and the god of time. Panofsky suggests, moreover, that the deification of time, though based on a linguistic coincidence, reflects a significant change in ancient Greek cosmology: "When religious worship gradually disintegrated and was finally supplanted by philosophical speculation, the fortuitous similarity between the words Chronos and Kronos was adduced as proof of the actual identity of the two concepts which really had some features in common (p. 73)." The association of Chronos with Kronos has

had considerable influence on artistic expressions of time in Western Art. Panofsky observes that Father Time is usually depicted as an old man with a scythe because Kronos, originally a god of agriculture, had those characteristics.

[3] D. Corish, "The Beginning of the Beginning in Western Thought," in *The Study of Time*, IV: 36. Nevertheless, classical philosophers could not escape the cosmological implications of their speculations about time. For a good brief introduction to the cosmological aspects of classical temporal theory see William Calvert Kneale, "Time and Eternity in Theology," *Proceedings of the Aristotelian Society*, 60 (1960-61), pp. 87-108.

[4] Ariotti, p. 72.

[5] J. Alexander Gunn, *The Problem of Time: An Historical and Critical Study* (London: Allen and Unwin, 1929), p. 18.

[6] Simplicus, *In Aristotelis Categorias Commentarii*, ed. Carolus Kalbfleish (Berlin: G. Reimeri, 1907), p. 350. Trans. Ariotti, p. 72. See note 53 below for additional information on the Neoplatonists.

[7] Zygmunt Zawirski, *L'Évolution de la notion du temps* (Cracow: Libraire Gebethner et Wolff, 1936), pp. 8-10.

[8] Ariotti, p. 72.

[9] Gunn, p. 18.

[10] Ariotti, p. 72.

[11] Zawirski, pp. 11-12.

[12] Gunn, p. 22.

[13] *Ibid.*, pp. 21-22.

[14] *Timaeus*, 388, trans. Alfred Edward Taylor in *Plato: Timaeus and his Critics* (London: Methuen, 1929), p. 34.

[15] John F. Callahan, *Four Views of Time in Ancient Philosophy* (Cambridge, Massachusetts: Harvard University Press, 1948), p. 6.

[16] *Ibid.*, pp. 6-7.

[17] *Ibid.*, p. 16.

[18] *Ibid.*, p. 17.

[19] Robert E. Cushman, "Greek and Christian Views of Time," *Journal of Religion*, 33 (1953), p. 256.

[20] *Ibid.*, p. 257.

[21] Callahan, p. 189.

[22] Corish, p. 37.

[23] *Ibid.*

[24] *Republic*, 528E-530C, trans. Francis MacDonald Cornford in *The Republic of Plato* (Oxford: Clarendon Press, 1961), p. 243.

[25] Cushman, p. 258.

[26] G. E. L. Owen, "Aristotle on Time," in *MTSM*, p. 3

[27] See for example, *Physics*, IV 11.221b3, in Barnes, pp. 374-75; or *Physics*, IV 14.223a33,in Barnes, p. 377.

[28] Cushman, pp. 258-59.

[29] *Physics*, IV 11.218b21, in Barnes, p. 371.

[30] Ariotti, p. 75.

[31] *Physics*, IV 11.219b3-5, in Barnes, p. 372.

[32] *Physics*, VIII 1.252b5, in Barnes, p. 421.

[33] Callahan, pp. 70-71.

[34] Cushman, p. 260.

[35] Callahan, pp. 72-73.

[36] Cushman, p. 260.

[37] Callahan, p. 22. "On Eternity and Time" is the seventh treatise of the third book of Plotinus' *Enneads*. For a standard edition and English translation of this text see *Plotinus*, Volume III, ed. and trans. Arthur Hilary Armstrong (London:

Heinemann, 1967), pp. 293-355. In the following discussion I quote from excerpts of this treatise which have been translated by Callahan in his chapter on Plotinus, pp. 88-148.

[38] Gordon H. Clark, "The Theory of Time in Plotinus," *Philosophical Review*, 53 (1944), p. 337.

[39] "On Eternity and Time," trans. Callahan, pp. 88-89.

[40] *Ibid.*, p. 89.

[41] *Ibid.*, pp. 90-91.

[42] *Ibid.*, p. 93.

[43] Callahan, p. 98.

[44] *Ibid.*, p. 101.

[45] *Ibid.*, p. 102. Whereas Aristotle based his rejection of this second theory on an argument from natural philosophy (time is the measure of heavenly bodies so it cannot be equated with them), Plotinus used a more metaphysical approach by placing time in a different coeval from the material sphere of heavenly bodies.

[46] *Ibid.*

[47] *Ibid.*, p. 107.

[48] *Ibid.*, p. 111.

[49] *Ibid.*, p. 122.

[50] *Ibid.*, p. 123.

[51] *Ibid.*, pp. 197-98.

[52] Samuel Sambursky and Shlomo Pines, *The Concept of Time in Late Neo-Platonism* (Jerusalem: The Israel Academy of Sciences and Humanities, 1971), pp. 12-13.

[53] Richard Sorabji thoroughly discusses the temporal theory of the late Neoplatonists in *Time, Creation and the Continuum: Theories in Antiquity and the Early Middle Ages* (London: Duckworth, 1983). For a good general introduction to

the late Neoplatonists see A. C. Lloyd, "The Later Neoplatonists," in *The Cambridge History of Later Greek and Early Christian Philosophy*, ed. Arthur Hilary Armstrong (Cambridge: Cambridge University Press, 1967), pp. 272-32; see also R. T. Wallis, *Neo-Platonism* (London: Duckworth, 1972); and Philip Merlan, *From Platonism to Neoplatonism* (The Hague: Martinus Nijhoff, 1975).

[54] *The Confessions of Augustine*, xi.2, ed. John Gill and William Montgomery (Cambridge: Cambridge University Press, 1927), pp. 333-34: ". . . et olim in ardesco meditari in lege tua et in ea tibi confiteri scientiam et inperitiam meam." Quoted in Callahan, p. 149.

[55] Clark, p. 358. See also Hugh M. Lacey, "Empiricism and Augustine's Problems about Time," in *Augustine: A Collection of Critical Essays*, ed. Robert Austin Markus (New York: Doubleday, 1972), pp. 280-308.

[56] Herman Hausheer, "St. Augustine's Conception of Time," *Philosophical Review*, 46 (1937), p. 512.

[57] *Ibid.*, p. 503.

[58] *Confessions*, ix.10, trans. Richard Sidney Pine-Coffin (Harmondsworth, Middlesex, England: Penguin, 1961), pp. 197-98. See Sorabji, p. 164.

[59] Sorabji, pp. 164-165.

[60] *Ibid.*, pp. 304-305.

[61] *Ibid.*, p. 304.

[62] *Confessions*, xi.17.9-10, ed. Gibb and Montgomery, p. 345: "[Q]uid est ergo tempus? si nemo ex me quaerat, scio; si quaerenti explicare uelim, nescio."

[63] In response to people who asked what God was doing before creation, Augustine said that God was creating Hell for those impertinent enough to ask such a question. See *Confessions*, xi.12.13-16: "Ecce respondeo dicenti: 'quid faciebat Deus antequam faceret caelum et terram?' respondeo non illud, quod quidam

respondisse perhibetur ioculariter eludens quaestionis uiolentiam: 'alta,' inquit, 'scrutantibus gehennas parabat.'" See also Sorabji, p. 233.

[64] Étienne Gilson, *The Christian Philosophy of Saint Augustine*, trans. L. E. M. Lynch (London: Victor Gallancz, 1961), pp. 190-91.

[65] J. de Blic, "Les arguments de saint Augustin contre l'éternité du monde," *Mélanges de science religieuse*, 2 (1945), pp. 43-44.

[66] Jules Chaix-Ruy, "Le problème du temps dans les 'Confessions' et dans 'La cité de Dieu,'" *Giorniale di Metafisica*, 9 (1954), pp. 468-69.

[67] Rudolph Berlinger, "Le temps et l'homme chez saint Augustin," *L'année théologique augustinienne*, 13 (1953), pp. 278-79.

[68] James McEvoy, "St. Augustine's Account of Time and Wittgenstein's Criticisms," *Review of Metaphysics*, 37 (1984), p. 555.

[69] *Confessions*, xi.15, from *S. Aurelii Augustini Confessionem Libri XIII*, ed. Martinus Skutella (Stuttgart: Teubner, 1969). Translated by McEvoy, pp. 555-56.

[70] *Confessions*, xi.20-26. Translated by McEvoy, p. 557.

[71] Jules Chaix-Ruy, *Saint Augustin: temps et histoire* (Paris: Études augustiniennes, 1956), p. 15.

[72] M. Moreau, "Mémoire et durée," *Revue des études augustiniennes*, 1 (1955), p. 244.

[73] *Confessions*, xi.28. Translated by McEvoy, p. 562.

[74] Joseph Maréchal, "Lettres sur le problème du temps chez saint Augustin et sur le problème de la philosophie catholique," *Mélanges Joseph Maréchal* 2 Vols. (Paris: Desclée, de Brouwer et Cie, 1950), I, 263.

[75] Robert Jordan, "Time and Contingency in St. Augustine," *Review of Metaphysics*, 8 (1955), p. 395.

[76] *Ibid.*, p. 394.

[77] *City of God*, V, 10, trans. Bettensen, p. 195. For a complete discussion of this topic see William L. Rowe, "Augustine on Foreknowledge and Free Will," and John M. Rist, "Augustine on Free Will and Predestination," in *Augustine: A Collection of Critical Essays*, ed. Robert Austin Markus (New York: Doubleday, 1972), pp. 209-217, 218-252.

[78] Étienne Gilson, *History of Christian Philosophy in the Middle Ages* (London: Sheed and Ward, 1955), p. 97. Additional information on Boethius is available in Henry Chadwick, *The Consolations of Music, Logic, Theology and Philosophy* (Oxford: Clarendon Press, 1981) and in a collection of scholarly articles entitled *Boethius: His Life, Thought and Influence*, ed. Margaret Gibson (Oxford: Basil Blackwell, 1981). There is no consensus among historians as to whether Boethius was a professed Christian. Because Bradwardine considered Boethius' philosophy to be Christian and relied so heavily on Boethius' view of eternity in his natural philosophy and theology, the language of this dissertation assumes that Boethius consciously sought a philosophical explanation of God which would not contradict Christian doctrines.

[79] Sorabji, p. 256. Unlike Augustine, who applied philosophical techniques to theology, Boethius was a trained, practicing philosopher. Moreover, his translations of Plato and Aristotle gave Boethius greater mastery of these materials than Augustine had.

[80] *Consolation of Philosophy*, 5:6, ed. Edward Kennard Rand, in Hugh Fraser Stewart, Edward Kennard Rand and S. J. Tester ed., *Boethius: The Theological Tractatus and the Consolation of Philosophy* (London: Heinemann, 1973). Translated by Eleonore Stump and Norman Kretzmann, in "Eternity," *Journal of Philosophy*, 78 (1981), p. 430.

[81] Stump and Kretzmann, p. 430.

[82] *De trinitate*, 20.64-22.77, ed. Rand. Translated by Stump and Kretzmann, pp. 430-431. For a standard edition of this work see *Philosophiae consolatio*, ed. Ludwig Beiler, in *Corpus Christianorum Series Latina*, XCIV (Turnholti: Typographie Brepols, 1957).

[83] Anthony Kenny, *The God of the Philosophers* (Oxford: Clarendon Press, 1979), p. 107.

[84] *Consolation of Philosophy*, 5:6. Translated by Sorabji, pp. 119-20.

[85] De Blic, p. 42.

[86] Sorabji, p. 256.

[87] *Consolation of Philosophy*, 5:6. Translated by Sorabji, p. 256. See below, Chapter 6.

[88] Gillian R. Evans, "Time and Eternity: Boethian and Augustinian Sources of Thought in the Late Eleventh and Early Twelfth Centuries," *Classical Folia*, 31 (1979), p. 105.

[89] *Ibid.*, pp. 107-8.

[90] *De Processione Spiritu Sancti*, 52.200.1-2, from *Sancti Anselmi Opera Omnia*, ed. Franciscus Salesius Schmitt (Rome: 1938), quoted and translated by Evans p. 108.

[91] Evans, pp. 109-10, cites and translates a passage from Garlandus Compotista's *Dialecta*, ed. Lambertus Maria De Rijk (Assen: Van Gorcum, 1959), pp. 25-27.

[92] Evans, p. 111.

[93] Evans, p. 112 cites and translates a passage from Abelard's *Dialectica* in *Peter Abaelards philosophische Schriften*, ed. Bernhard Geyer (Münster: Aschendorff, 1933), p. 184.34-6.

CHAPTER THREE

[1] Gilson, *History of Christian Philosophy*, pp. 235-36. For additional information about the introduction of Aristotelian philosophy into the medieval West see especially "The Entry of the 'New' Aristotle," Part IV of *A History of Twelfth-Century Western Philosophy*, ed. Peter Dronke (Cambridge: Cambridge University Press, 1988); and "Aristotle in the Middle Ages," Part II of *CHLMP*. For an account of and bibliography for the reception of Aristotelian and Muslim learning in the twelfth through fourteenth centuries see John Marenbon, *Later Medieval Philosophy (1150-1350): An Introduction* (New York: Routledge and Kegan Paul, 1987).

[2] Gilson, p. 238.

[3] Gilson, p. 217. For Averroes see also René Antonin Gauthier, "Notes sur les débuts (1225-1240) du premier 'averroisme,'" *Revue des sciences philosophiques et théologiques*, 66 (1982), pp. 321-74; Gauthier, *Ibn Rochd (Averroes)* (Paris: Presses Universitaires de France, 1948); Majid Fakhry, *A History of Islamic Philosophy* (New York: Columbia University Press, 1970), pp. 302-25; and Oliver Leaman, *An Introduction to Medieval Islamic Philosophy* (Cambridge: Cambridge University Press, 1985), pp. 42-57, 92-104.

[4] Gilson, p. 218. Faith debases theology because it allows a person to accept probable truth without rigorous analysis of necessary principles.

[5] "Aristotelis doctrina est summa veritas, quoniam eius intellectus fuit finis humani intellectus. Quare bene dicitur quod fuit creatus et datus nobis divina providentia, ut sciremus quidquid potest scire." Quoted and translated by Gilson, my translation adapted, p. 220. See also Gilson, p. 642, note 17, for additional references to Averroes' praise of Aristotle.

[6] Augustin Mansion, "La théorie aristotélicienne du temps chez les péripateticiens médiévaux: Avèrroes, Albert le Grand, Thomas d'Aquin," *Revue néo-scholastique, 32* (1934), p. 280.

[7] Averroes, Commentary 98 on Aristotle's *Physics*, quoted from Volume IV of *Aristotelis Opera cum Averrois Commentarius* (Venice: Juntas, 1562-74) by Mansion, p. 281: "Si tempus non sequitur aliquem motum existentem extra animam, . . . quomodo igitur dicit Aristoteles post, ipsum sequi motum corporis caelestis . . . ? Et etiam si sequitur motum corporis caelestis, continget ut caecus non percipiat tempus, quia numquam percepit motum caeli. Et etiam, si sequitur omnem motum, continget etiam ut tempus multipliciter per multiplicationem motuum. Aut sequetur unum motum, et sic qui non sentit illum motum non sentit tempus, quod est impossible."

[8] *Ibid.*, quoted by Mansion, p. 282: "Et manifestum est quod nos non sentimus nos esse in esse transmutatabili, nisi transmutatione caeli. Et, si esse possible ipsum quiescere, esset possible nos esse in esse non transmutabili. Sed hoc est impossible. Ergo necesse est ut sentiat hunc motum qui non sentit motum corporis caelestis, scilicet per visum."

[9] Mansion, pp. 282-83.

[10] Mansion, p. 284.

[11] Averroes, Commentary 98, quoted by Mansion, p. 284: " . . . quarum *una* est, quod nos non percipimus tempus, nisi quando fuerimus moti in anima nostra; et hoc existimavit Galenus, et est corrupta per se. *Secunda* autem est, quod nos non percipimus tempus, nisi cum perceperimus aliquem motum quicumque sit, et hoc est percipere per accidens. *Tertia* vero est, quod nos non percipimus motum neque tempus, nisi cum percipimus nos transmutari, quia sumus in esse transmutabili; et ista perceptio est perceptio quam sequitur tempus essentialiter, et non accidet ei aliqua quaestio. Et verba Aristotelis manifesta sunt secundum hanc intentionem . . .

et secundum hunc modum possumus ponere tempus sequi motum corporis caelestis, et quod sentiet tempus qui numquam sensit corpus caeleste. Et ideo omnes conveniunt in hoc quod tempus sequitur motum caeli."

[12] *Ibid.*, quoted by Mansion, p. 288: ". . . quia unaquaeque rerum numeratur per aliquod suae speciei, . . . necesse est ut tempus etiam numeretur per aliquod tempus notum et terminatum naturaliter. Et *dixit* (*scil.* Aristoteles) *in praecedenti* quod hic est motus translationis et circularis; quoniam, cum fuerit positum quod tempus est numerus cuiuslibet motus, et fuerit positum quod hic est prior motus caeteris motibus, sequitur ut tempus istius motus sit prius caeteris temporibus, et numerans illa."

[13] Gilson, *History of Christian Philosophy*, pp. 218-19.

[14] *Ibid.*, p. 229. See Moses Maimonides, *The Guide of the Perplexed*, trans. Shlomo Pines (Chicago: University of Chicago Press, 1963). Good secondary accounts of Maimonides include Georges Vajda, "Moïse ben Maïmon," in *Introduction à la pensée juive du moyen âge* (Paris: J. Vrin, 1974), pp. 129-51; *Essays on Maimonides: An Octocentennial Volume*, ed. Salo Wittmayer Baron (New York: Columbia University Press, 1941); and Abraham Joshua Heschel, *Maimonides: A Biography*, trans. Joachim Neugroschel (New York: Farrar, Strauss, Giroux, 1982).

[15] Gilson, pp. 230-31.

[16] Gilson, p. 230.

[17] From "Die Opuscula De summo bono sive de vita philosophi und De sompniis des Boetius von Dacien," ed. M. Grabmann, *AHDL*, 6 (1931), pp. 287-317; translated by Gilson, p. 401.

[18] Gilson, p. 401.

[19] Richard C Dales, "Maimonides and Boethius of Dacia on the Eternity of the World," *The New Scholasticism*, 56 (1982), p. 306.

[20] *Ibid.*, pp. 309-312.

[21] *Ibid.*, p. 315

[22] *Ibid.*, p. 319.

[23] Gilson, p. 278. For a full discussion of Albertus' broad scientific and philosophical interests see *Albertus Magnus and the Sciences: Commemorative Essays 1980*, ed. James A. Weisheipl (Toronto: Pontifical Institute of Mediaeval Studies, 1980).

[24] In his discussion of Albertus, Gilson, pp. 279-81, makes several references to Albertus' *Summa de creaturis* in Volume XXXIV of *Alberti Magni Opera Omnia*, ed. A. Borgnet (Paris: L. Vivès, 1890-99), pp. 319-84 (hereafter cited as Borgnet).

[25] Gilson, pp. 279-80, citing Borgnet, pp. 323-25.

[26] Gilson, p. 280, citing Borgnet, pp. 339-52.

[27] Gilson, p. 281, citing Borgnet, pp. 369-70.

[28] Gilson, p. 281, citing Borgnet, pp. 373-74.

[29] Gilson, p. 281, citing Borgnet, p. 384.

[30] Mansion, pp. 289-90.

[31] *Ibid.*, p. 296.

[32] From Albertus' commentary on Aristotle's *Physics* in Borgnet, Volume III, p. 341; quoted by Mansion, p. 295: "Cum autem dicimus suum (*scil.* circulationis primae) tempus esse mensuram aliorum temporum, non intelligimus plura esse tempora, sed unum diversimode referri ad multa. Refertur enim tempus ad primam mobile et ad motum ejus sicut ad subjectum et numeratum, ad alios autem motus sicut numerus extrinsecus ad numerata solum et in illis non est sicut in subjecto: et ideo non multiplicatur multiplicatione eorum."

[33] James A. Weisheipl, *Friar Thomas d'Aquino: His Life, Thought and Works* (Oxford: Basil Blackwell, 1975), pp. 46-47. For additional information about Aquinas' education and philosophical and theological interests see especially Marie Dominique Chenu, *St. Thomas d'Aquin et la théologie* (Bourges: L'imprimerie

Tardy, 1959) and Frederick Charles Copelston, *Aquinas* (Hammondsworth, Middlesex, England: Penguin, 1965).

[34] *Summa Theologica*, Ia.ix.1-2, quoted in *St. Thomas Aquinas: Philosophical Texts*, trans. Thomas Gilby (London: Oxford University Press, 1951), p. 82.

[35] *Summa Theologica*, Ia.x.4, trans. Gilby, p. 83.

[36] *Summa Theologica*, Ia.lxxix.9, trans. Gilby, p. 26.

[37] *Summa Theologica*, Ia.lixxix.6, trans. Gilby, pp. 250-51.

[38] Commentary, I *Perihermenias*, lect. 14, trans. Gilby, pp. 84-45.

[39] See Anthony Kenny, "Divine Foreknowledge and Human Freedom," in *Aquinas: A Collection of Critical Essays*, ed. Anthony Kenny (London: Macmillan, 1969), pp. 255-70.

[40] *Summa Theologica*, Ia.xiii.7, trans. Gilby, p. 95.

[41] Étienne Gilson, *The Christian Philosophy of Saint Thomas Aquinas*, trans. L. K. Shook (London: Victor Gallancz, 1961), pp. 149-50.

[42] John M. Quinn, *The Doctrine of Time in St. Thomas: Some Aspects and Applications. An Abstract of a Dissertation* (Washington, D. C.: The Catholic University of America Press, 1960), pp. 17-23.

[43] Commentary, *III Physics*, lect. 2, trans. Gilby, p. 51.

[44] Commentary, *XII Metaphysics*, lect. 5, trans. Gilby, p. 53.

[45] Disputations, *III de Potentia*, 17, trans. Gilby, p. 138.

[46] Disputations, *III de Potentia*, 17 ad 5, trans. Gilby, p. 138.

[47] For a discusison of Aquinas' opinions about the eternity of the world see James F. Anderson, "Time and Possibility of an Eternal World," *Thomist*, 15 1932), pp. 137-144.

[48] *Summa Theologica*, Ia.vii.3, trans. Gilby, p. 140.

[49] Vincent Edward Smith, *St. Thomas on the Object of Geometry* (Milwaukee, Wisconsin: Marquette University Press, 1954), pp. 54-55.

[50] "Ohne Dinge, ohne Qualität, ohne Kontinuum ist keine Zahl möglich." See Ewald Bodewig, "Zahl und Kontinuum in der Philosophie des hl. Thomas," *Divus Thomas*, 13 (1935), p. 63.

[51] Anderson, p. 144; Mansion, pp. 297-98.

[52] Copelston, *Aquinas*, p. 79.

[53] Daniel A. Callus, "Robert Grosseteste as Scholar," in *Robert Grosseteste, Scholar and Bishop*, ed. D. A. Callus (Oxford: Clarendon Press, 1955), pp. 6-9.

[54] *Ibid.*, pp. 12-13. For additional information on Grosseteste see Richard William Southern, *Robert Grosseteste: The Growth of an English Mind in Medieval Europe* (Oxford: Clarendon Press, 1986).

[55] Alistair Cameron Crombie, *Robert Grosseteste and the Origins of Experimental Science* (Oxford: Clarendon Press, 1953), pp. 52-53.

[56] Commentary on the *Posterior Analytics*, i.2, f. 2^{vb}, quoted in Crombie, pp. 58-59. For a standard edition of this work see *Commentarius in Posteriorum analyticorum libros*, ed. Pietro Rossi, Unione Accademica Nazionale Corpus Philosophorum Medii Aevi, Testi e Studi, II (Florence: L. S. Olschki, 1981)..

[57] "Robert Grosseteste on Induction and Demonstrative Science," *Synthese*, 40 (1979), p. 97.

[58] *Ibid.*, p. 113.

[59] *The Philosophy of Robert Grosseteste* (Oxford: Clarendon Press, 1982), p. 168.

[60] Translated by McEvoy, p. 168, from *Die philosophischen Werke des Robert Grosseteste, Bischop von Lincoln*, ed. Ludwig Baur, Volume XV of *Beiträge zur Geschichte der Philosophie und Theologie des Mittelalters* (Münster: Aschendorff, 1912), pp. 59-60..

[61] McEvoy, pp. 175-76.

[62] Translated by McEvoy, p. 176, from Annaliese Maier's transcription of the Venice Bibl. Marciana MS Lat. VI, 222, printed in her *Zwischen Philosophie und Mechanik: Studien zur Naturphilosophie der Spätscholastik* (Rome: Storia e letteratura, 1958), pp. 24n.-25n.

[63] McEvoy, p. 176..

[64] Quoted by McEvoy, p. 177, from Maier's transcription: "Sicut enim que vere in se finita sunt, nobis sunt infinita, sic que vere se sunt infinita, illi sunt finita. Iste autem omnia creavit in numero, pondere et mensura, et isti est mensurator primus et certissimus. Isti numeris infinitis, sibi finitis, mensuravit lineas quas creavit. Numero aliquo infinito sibi certo et finito mensuravit et numeravit lineam cubilem, et numero infinito duplo lineam bicubilem et numero infinito subduplo lineam semicubilem."

[65] Efrem Bettoni, *Duns Scotus: The Basic Principles of his Philosophy*, ed. and trans. by Bernardine Bonansea (Westport, Connecticut: Greenwood, 1978), p. 10. For additional information on Duns Scotus see Hermann Schwamm, *Das göttliche Vorherwissen bei Duns Scotus und seiner ersten Anhängern*, Volume V of *Philosophie und Grenzwissenschaften* (Insbruck: Felizan Rauch, 1934) and Étienne Gilson, *Jean Duns Scot* (Paris: J. Vrin, 1952).

[66] Bettoni, pp. 13-14. Bettoni points out that, in spite of his interesting ideas, Duns' writing style is so awkward that modern readers tend to avoid his works altogether. In Bettoni's opinion, the lack of current studies on Duns can give the wrong impression that he was a minor figure in the medieval universities; in fact, the numerous references to Duns in works of his contemporaries indicate that his views were quite influential.

[67] *Ibid.*, p. 15

[68] *Ibid.*, pp. 16-17.

[69] *Ibid.*, p. 21.

[70] *De rerum principio*, q. xviii, art. I, n. 4, quoted by Charles Reginald Schiller Harris in *Duns Scotus*, 2 vols. (New York: Humanities Press, 1959), II.129-30: ". . . motus et tempus non dicunt diversas res absolutas sicut quantitas et qualitas inhaerens, sed omnino dicunt eandem secundum diversas rationes denominatam aliquando tempus, aliquando motus." For a standard edition of this work see John Duns Scotus, *Opera Omnia*, ed. Luke Wadding (Paris: L. Vivès, 1891-95).

[71] *De rerum principio*, q. xviii, n. 6 (Commentary on Aristotle's *Physics*, Book IV, Cap. xi), quoted by Harris, p. 131: "Aristoteles videtur suadere tempus extra animam nihil esse . . . . Si ergo ipsum est aliquid, est ab actione animae . . . . Hanc autem rationem videtur Philosophus deducere 'quia cum nihil ipsi mutamur secundum intellegentiam aut latet nos mutari, non videtur nobis fieri tempus sicut neque his qui in Sardo fabulantur dormire apud Heroas, cum expergis cuntur. Copulant enim primum nunc posteriori nunc, et unum faciunt removentis proper insensibilitatem medium.' Putabant enim esse numero tempus quo dormire coeperant et in quo evigilabant . . . . Unde etiam dormientes in obscuro loco, non perpendentis aliquid se motu coeli per lucem solis, quando evigilant quaerunt tempus, nec scimus quae hora sit certitudinaliter, nisi referemus nos ad alia signa."

[72] Harris, pp. 131-32.

[73] *De rerum principio*, q. xviii, n. 13, quoted and translated by Harris, p. 134: "Patet ergo quod haec fuit ejus opinio, tempus habere esse in conceptu animae non extra."

[74] Harris, pp. 136.

[75] *De rerum principio*, q. xviii, n. 16, quoted by Harris, p. 136: "Alii dicunt magis realiter, ut credo quod tempus sit idem in re quod motus, differens formali ratione, per quam rationem vocatur vere tempus: secundum suum esse materiale est in rebus extra, secundum suam vero rationem formalem est ab anima et est in ea."

[76] *De rerum principio*, q. xviii, n. 16, quoted by Harris, p. 136: "Et huius opinionis videtur fuisse Commentator . . . . Et ista est doctrina Aristotelis . . . ubi vult quod tempus inest omnibus rebus per motum in terra, in mare et in coelo, cum sit passio et mensura motus, nec possint ab invicem separari. Motus autem est aliquid reale praeter actionem et conceptum animae. Quod autem habet aliquem motum essendi habeat ab anima immediate concedit, arguens quod tempus est numerans; ergo numerans; hoc autem est anima."

[77] *De rerum principio*, q. xviii, n. 32, translated by Harris, pp. 139-40.

[78] Harris, pp. 141-45.

[79] *Ibid.*, p. 145

CHAPTER FOUR

[1] For a concise account of the development of the natural philosophy curriculum in the medieval universities see Edward Grant, "Science and the Medieval University," in *Rebirth Reform and Resilience: Universities in Transition, 1300-1700*, ed. James M. Kittelson and Pamela J. Transue (Columbus, Ohio: Ohio University Press, 1984), pp. 68-102. In the same collection of essays William J. Courtenay traces the influence of Oxford on continental universities, especially Paris, in "The Role of English Thought in the Transformation of University Education in the Late Middle Ages," pp. 103-62.

[2] William J. Courtenay, *Schools and Scholars in Fourteenth-Century England* (Princeton, New Jersey: Princeton University Press, 1987), pp. 262-63. Courtenay's book presents a thorough study of fourteenth-century academic life in England. For a good brief review of the theological trends in fourteenth-century universities see Paul Vignaux, "La philosophie médiévale dans 'Le temps de l'église,'" in his *De saint Anselm à Luther* (Paris: J. Vrin, 1976), pp. 69-75.

[3] For an illustration of Bradwardine's method of argumentation see John Emery Murdoch, "Atomism and Motion in the Fourteenth Century," in *Transformation and Tradition in the Sciences: Essays in Honor of I. Bernard Cohen*, ed. Everett Mendelsohn (Cambridge: Cambridge University Press, 1984), pp. 45-66.

[4] Some notes on the name of this work are found in James A. Weisheipl, "Ockham and Some Mertonians," *Mediaeval Studies*, 30 (1968), p. 191. Marshall Clagett has published and discussed sections from an abbreviated version of the *De proportionibus* entitled *Tractatus brevis proportionum* in Chapter 7 of *The Science of Mechanics in the Middle Ages* (Madison, Wisconsin: University of Wisconsin Press, 1959), pp. 421-44, 465-84. The edition of the *De proportionibus* which will be used in this dissertation is *Thomas Bradwardine, His Tractatus de Proportionibus: Its Significance for the Development of Mathematical Physics*, ed. H. Lamar Crosby

(Madison, Wisconsin: University of Wisconsin Press, 1961). Hereafter citations to Bradwardine's text will appear in the notes as *De proportionibus* and references to Crosby's introduction will be noted as "Crosby."

[5] Weisheipl, "Ockham and Some Mertonians," p. 189. Some studies of medieval commentaries on the *De proportionibus* include Anne Harrison, "Blasius of Parma's Critique of Bradwardine's 'Tractatus de proportionibus,'" *Scienza e filosofia all'Università di Padova nel Quattrocento*, Centro per storia dell'Università di Padova I (Trieste: Edizione Lint 1985), pp. 19-69; Michael McVaugh, "Arnold of Villanova and Bradwardine's Law," *Isis*, 50 (1967), pp. 56-64; and Graziella Frederice Viscovini, "Due commenti anonimi al 'Tractatus proportionum' di Tommaso Bradwardine," *Rinascimento*, Series 2, 19 (11979), pp. 231-33.

[6] *Die Vorläufer Galileis im 14. Jahrhundert*, 2nd edition (Rome: Storia e letteratura, 1966), p. 86, note 10. See also Edward Grant, "Bradwardine and Galileo: Equality of Velocities in the Void," *Archive for the History of Exact Sciences*, 2 (1965), pp. 344-64; and Edith Sylla, "Compounding Ratios: Bradwardine, Oresme, and the First Edition of Newton's *Principia*," in *Transformation and Tradition in the Sciences*, pp. 11-43.

[7] Weisheipl, p. 198. See also Crosby, p. 4.

[8] *De proportionibus*, pp. 64-65.

[9] For the following discussion I am dependent on David C. Lindberg, "On the Applicability of Mathematics to Nature: Roger Bacon and his Predecessors," *British Journal for the History of Science*, 15 (1982), pp. 3-25. For additional material on late medieval applications of mathematics to natural philosophy see *MTSM*; Ernest Moody, "Laws of Motion in Medieval Physics," *SMPSL*, pp. 189-201; and James A. Weisheipl, "Matter in Fourteenthh-Century Science," in *The Concept of Matter in Greek and Medieval Philosophy*, ed. Ernan McMullan (Notre Dame, Indiana: University of Notre Dame Press, 1965), pp. 147-69.

[10] *Metaphysics*, xi.3.1061a30-35, trans. Hugh Tredennik (London, 1935), quoted by Lindberg, p. 7.

[11] *Posterior Analytics*, i.13. 78b34-79a3, quoted by Lindberg, p. 7.

[12] Lindberg, pp. 7-8.

[13] Jerome Taylor, ed. and trans., *The Didascalicon of Hugh of Saint Victor: A Medieval Guide to the Arts* (New York: Columbia University Press, 1961), p. 72, quoted by Lindberg, p. 9.

[14] Taylor, p. 64, quoted by Lindberg, p. 9.

[15] Crombie, *Grosseteste*, pp. 105-6.

[16] *Commentarius in VIII Libros Physicorum Aristotelis*, trans. Crombie, p. 94.

[17] See Lindberg's edition and translation of the text *Concerning Lines, Angles, and Figures*, in *Sourcebook in Medieval Science*, ed. Edward Grant (Cambridge, Massachusetts: Harvard University Press, 1974), p. 385; also quoted by Lindberg in "Applicability," p. 12.

[18] *De natura locorum* in *Die philosophischen Werke des Robert Grosseteste*, ed. Ludwig Baur (Beiträge zur Geschichte der Philosophie des Mittelalters, ix) (Münster: Aschendorff, 1912), pp. 59-60; translated and quoted by Lindberg, p. 12.

[19] *The Opus Major of Roger Bacon*, Volume I, ed. John Henry Bridges (Oxford: Clarendon Press, 1897-1900), pp. 168-69; translated by Lindberg, p. 18.

[20] Bridges, p. 107; translated by Lindberg, p. 18.

[21] Bridges, p. 175; translated by Lindberg, p. 19. For an edition of the *Geometria speculativa* see A. G. Molland, ed., "The *Geometria Speculativa* of Thomas Bradwardine: Text with Critical Edition," Dissertation, University of Cambridge, 1967.

[22] Molland discusses the dating and authenticity of this treatise in "An Examination of Bradwardine's Geometry," *Archive for the History of Exact Sciences*, 19 (1978), pp. 115-20.

[23] *Ibid.*, p. 121.

[24] Molland provides an informative synopsis of the contents, pp. 122-31.

[25] *Ibid.*, p. 131.

[26] Pedro Sanchez Cirvelo, first editor of the *Geometria speculativa*, on the title page (Paris: 1495); quoted in A. G. Molland, "The Geometrical Background to the 'Merton School': An Exploration into the Application of Mathematics to Natural Philosophy," *British Journal for the History of Science*, 4 (1968), p. 112.

[27] Molland, "Examination," pp. 170-72.

[28] *Ibid.*, p. 174.

[29] *Geometria speculativa*, translated by Molland in "Examination," pp. 150-51.

[30] *Ibid.*, p. 151.

[31] Molland, "Examination," p. 154.

[32] *Geometria speculativa*, translated by Molland in "Examination," pp. 154-55. "Double ratio" in this context means a squared ratio. Fourteenth-century mathematicians did not have two separate expressions to distinguish 2x from x^2.

[33] *Ibid.*, p. 157.

[34] John Emery Murdoch, "The Medieval Language of Proportions: Elements of the Interaction with Greek Foundations and the Development of New Mathematical Techniques," in *Scientific Change*, ed. A. C. Crombie (London: Heinemann, 1961), p. 265. See also Murdoch, "From Social to Intellectual Factors: An Aspect of the Unitary Character of Late Medieval Learning," in *The Cultural Context of Medieval Learning*, ed. Murdoch and Edith Dudley Sylla (Boston, Massachusetts: D. Reidel, 1975), pp. 280-89, in which Murdoch describes the application of proportion theory to a wide variety of logical problems in the early fourteenth century.

[35] Crosby, p. 13.

[36] *Ibid.*, p. 14.

[37] *Ibid.*, p. 15.

[38] *Ibid.*, p. 14.

[39] *Ibid.*, p. 15.

[40] *Opera Aristotelis cum Averrois commentariis*, Volume IV, fol 132v (Venice: 1560), translated by Ernest A. Moody in "Galileo and Avempace," *Journal of the History of Ideas*, 12 (1951), p. 191.

[41] *De proportionibus*, pp. 86-87.

[42] *Ibid.*, pp. 86-89.

[43] *Ibid.*, pp. 88-89.

[44] *Ibid.*, pp. 110-11.

[45] James A. Weisheipl, *The Development of Physical Theory in the Middle Ages* (London: Sheed and Ward, 1959), p. 75.

[46] Stillman Drake, "Medieval Ratio Theory vs. Compound Medicines in the Origins of Bradwardine's Rule," *Isis*, 64 (1973), pp. 72-73.

[47] *De proportionibus*, pp. 130-31.

[48] *Ibid.*, pp. 94-95. The meaning of "proportio" in this context is slightly different from Bradwardine's use of this term in his treatment of velocity. Here Bradwardine uses the word "proportio" to mean a simple ratio or comparison of two times or two distances.

[49] "Aristotle's Physics and the Science of Motion," *CHLMP*, p. 535.

[50] *Ibid.*, p. 534.

[51] *De proportionibus*, pp. 92-93.

[52] Crosby, p. 31.

[53] *Augustine to Galileo*, II, p. 79.

[54] *Ibid.*

[55] Weisheipl, *Development*, pp. 68-69.

[56] "Empiricism and Metaphysics in Medieval Philosophy," *SMPSL*, p. 301.

[57] *Ibid.*, p. 302.

[58] "The Analytical Character of Late Medieval Learning: Natural Philosophy Without Nature," in *Approaches to Nature in the Middle Ages*, ed. Lawrence D. Roberts (Binghampton, New York: Center for Medieval and Early Renaissance Studies, 1982), pp. 174-75.

[59] Crosby, p. 17.

[60] See Anneliese Maier, "Die Subjectivierung der Zeit in der scholastichen Philosophie," *Philosophia Naturalis*, 1 (1951), pp. 361-98.

[61] *De proportionibus*, pp. 140-41.

CHAPTER FIVE

[1] *De incipit*. For a full discussion of this text, see Chapter Six.

[2] References to the *De continuo* in this thesis are from John Emery Murdoch's edition of the text which also includes a good introduction to the philosophical aspects of continuity in late medieval academic debates.

[3] "The Interpretation of Aristotle's Physics and the Science of Motion," *CHLMP*, p. 523. Grosseteste's atomism came not from a rejection of Aristotelian physics but from his particular interpretation of Aristotle to support his metaphysics of light. Although Bradwardine was influenced by Grosseteste's use of mathematics, he did not consider atomism in the *De continuo* from the perspective of Grosseteste's metaphysical system. Therefore, Grosseteste's views will not be treated in this chapter. See McEvoy, *The Philosophy of Robert Grosseteste*, pp. 153-54.

[4] Murdoch, "Infinity and Continuity," *CHLMP,* p. 564. For an introduction to the classical origins of the problems of infinity and continuity see Leo Sweeney, *Infinity in the Presocratics: A Bibliographical and Philosophical Study* (The Hague: Martinus Nijhoff, 1972); for discussions of various aspects of these problems from the classical period to the late Middle Ages see Norman Kretzmann, *Infinity and Continuity in Ancient and Medieval Thought* (London: Cornell University Press, 1982).

[5] Murdoch, "Infinity and Continuity," p. 565.

[6] Edwin Schrödinger, *Nature and the Greeks* (Cambridge: Cambridge University Press, 1954), pp. 74-77.

[7] Sorabji, p, 321.

[8] *On Generation and Corruption*, I, 2.316b19-317a2, in Barnes, pp. 517-18. For an analysis of Aristotle's method of refuting Zeno see Sorabji, pp. 336-38.

[9] *On Generation and Corruption*, VIII, 325a13-22, in Barnes, p. 531.

[10] *Physics*, V, 3, 226b34-227a16, in Barnes, pp. 383-84.

[11] *Ibid.*,227a30-33, in Barnes, p. 383.

[12] *Ibid.*, V, 2, 231a24-231b9, in Barnes, p. 391.

[13] *Ibid.*, V, 2, 232b20-233a12; 233a18-21, in Barnes, p. 393.

[14] *Ibid.*, IV, 219a4-14, in Barnes, p. 371.

[15] F. D. Miller, "Aristotle against the Atomists," in *Infinity and Continuity in Ancient and Medieval Thought*, pp. 106-7.

[16] *Ibid.*, p. 109.

[17] Sorabji, p. 401.

[18] Murdoch, "Infinity," p. 566.

[19] *Physics*, III, 7, 207a32-207b1; 207b16-21, in Barnes, p. 353.

[20] Murdoch, "Infinity," p. 569.

[21] *Ibid.*, pp. 569-70.

[22] Murdoch, "Medieval Language," p. 520.

[23] See Murdoch, "Superposition, Congruence and Continuity in the Middle Ages," in *L'Aventure de la science: Mélanges Alexandre Koyré*, I (Histoire de la pensée, XII) (Paris: École pratique des hautes études, 1964), p. 424. Here Murdoch quotes from commentary twenty-two of Averroes' *Commentary on the Physics*, Volume IV of *Aristotelis Opera cum Averrois Commentarius* (Venice: Juntas, 1562-74): "Deinde dixit: *Et dico contingua et cetera*, id est, et contigua sunt corpora quorum ultima, scilicet superficies, sunt simul ita quod inter illas non est corpus extraneum; et hec est contiguatio naturalis. Contiguatio vero mathematica est in magnitudinibus quorum ultima superponuntur. Si igitur fuerint corpora, superponuntur superficies eorum contigue; et si superficies, superponentur linee; et si linee, superponentur puncta, sicut dicitur punctus superponitur puncto. Set hic non intendit mathematica, quoniam in mathematicis duo ultima revertuntur in

unum, et sic assimilantur continuo. In naturalibus vero duo ultima remanent duo demonstrata."

[24] Murdoch, "Superposition," pp. 428-29.

[25] Murdoch examines Albertus' approach to Euclid in "Superposition," pp. 428-29.

[26] Henry of Harclay, *Quaestio de infinito et continuo* (MS Tortosa Cated. 88, 83v; MS Firenze Naz. II.II. 281, 95r), quoted and translated by Murdoch in "Infinity," p. 571: "Illud quod continet aliud et aliquid ultra illud vel praeter illud est totum respectu illius."

[27] Murdoch, "Infinity," p. 572. For further information on Gregory of Rimini's philosophical outlook see Gordon Leff, *Gregory of Rimini: Tradition and Innovation in Fourteenth-Century Thought* (Manchester: Manchester University Press, 1961).

[28] Murdoch, "Infinity," p. 572.

[29] Aquinas' position on continuity is thoroughly discussed by Bodewig in "Zahl und Kontinuum." According to Bodewig, Thomas' view of continuity was essentially Aristotelian except for a somewhat Platonic tendency to consider continuity in terms of being, that is, as a metaphysical problem not a physical or mathematical problem, and to emphasize the symbolic importance of number in his analysis.

[30] Ernest Moody, "William of Ockham," *SMPSL*, p. 409.

[31] For a discussion of this problem see William J. Courtenay, "The Reception of Ockham's Thought in Fourteenth-Century England," in *From Ockham to Wyclif*, Studies in Church History, 5 (Oxford: Basil Blackwell, 1987), pp. 89-107.

[32] Weisheipl, "Ockham and the Mertonians," in *The History of the University of Oxford*, I, ed. Jeremy I. Catto (Oxford: Clarendon Press, 1984), pp. 609-10.

[33] *SMPSL*, pp. 412-13.

[34] *Ibid*, p. 413.

[35] Weisheipl, "Ockham and the Mertonians," p. 611.

[36] *Ibid.*, p. 610.

[37] *Ibid.*

[38] *Ibid.*, p. 612.

[39] Moody, "William of Ockham," p. 429.

[40] *Ibid.*, p. 430.

[41] André Goddu, *The Physics of William of Ockham* (Leiden: E. J. Brill, 1984), p. 83.

[42] *Ibid.*, p. 84. By "imagination experiment" Goddu simply means that Aristotle, Ockham and, as we shall see, Bradwardine used a method for investigating physical problems which somewhat resembles modern scientific methods, in that it involved proposing hypotheses and devising specific procedures for testing their validity. Since these enquiries were conducted according to a precise methodology but were nevertheless confined to purely mental speculation and did not involve laboratory experimentation, Goddu calls them thought or "imagination" experiments.

[43] *Ibid.*, p. 110.

[44] *Ibid.*, p. 236.

[45] In "Infinity," p. 573, Murdoch quotes the following from Thomas Bruce Birch's edition of *The De Sacramento Altaris of William of Ockham* (Burlington, Iowa: The Lutheran Literacy Board, 1930), pp. 36-38: "Et si queratur quid est punctus, aut est res divisibilis, dicendum est quod, si sic dicendo 'punctus est aliquid' vel 'punctus est res' vel huiusmodi li 'punctus' supponat pro aliquo ita quod habeat precise vim nominis et non includat equivalenter unum complexum ex nomine et verbo vel aliquid consimile quod secundum proprietatem vocis potest reddere suppositum verbo, debet concedi quod punctus est aliquid et quod punctus est res;

et hoc quia debet concedi quod punctus est linea et punctus est quantitas, quia tunc hoc nomen 'punctus' equivalet toti isti: 'linea tante vel tante longitudinis' sive 'linea non ulterius protensa vel extensa' vel alicui toti composito ex adiectivo et substantivo vel alicui toti composito ex nomine et verbo mediante coniunctione vel adverbio vel hoc pronomine 'qui,' secundum quod placet dare diversas diffinitiones exprimentes quid nominis illius 'punctus.'

[46] Murdoch, "Infinity," p. 574.

[47] Herman Shapiro, *Motion, Time and Place According to William Ockham* (St. Bonaventure, New York: The Franciscan Institute, 1957), p. 36, n. 75. Also discussed in Gordon Leff, *William of Ockham: The Metamorphosis of Scholastic Discourse* (Manchester: Manchester University Press, 1975), p. 585.

[48] Leff, p. 585.

[49] *Philosophia Naturalis Guilielmi Ockham*, Book III, p. 1, ed. Bonaventura Theulo (Rome: Typis B. I. Robletti, 1637); quoted in Leff, *William of Ockham*, p. 585: ". . . quamvis hoc probari non possit tamen est notum per experientia, propter quod contra negantem motum non habet philosophia naturalis disputare sicut nec aliquis habet disputare contra negantem sua principia per se nota."

[50] *Ibid.* Translated by Leff, p. 591.

[51] Leff, pp. 592-93.

[52] In his introduction to his edition to *The Tractatus de Successivis Attributed to William of Ockham* (St. Bonaventure, New York: The Franciscan Institute, 1944), p. 30, Philotheus Boehner refers the reader to the following passage from Part I, chapter 44 of Ockham's *Summa Logica*: "Ideo est alia opinio de quantitate, quae mihi videtur esse de mente Aristotelis, sive sit haeretica sive catholica, quam volo nunc recitare, quamvis nolim eam asserere. Et ideo quando illam opinionem posui et scripsi super Philosophiam [vz., the *Expositio aurea* and the *Expositio super libros Physicorum*], non scripsi eam tamquam meam, sed tamquam Aristotelis, quam

exposui ut mihi videbatur; et eodem modo nunc sine assertione recitabo eam. Est autem ista opinio, quam etiam multi theologi tenent et tenuerunt, quod scilicet nulla quantitas est realiter distincta a substantia et qualitate, sive tales propositiones: substantia est quantitas, qualitas est quantitas, sin concedendae, sive non." For the entire chapter see *Venerabilis Inceptoris Guillelmi de Ockham Summa Logicae*, ed. Philotheus Boehner, Gedeon G l and Stephanus Brown (St. Bonaventure, New York: The Franciscan Institute, 1974), pp. 132-39.

[53] Boehner, ed., *Tractatus de Successivis*, p. 96: " . . . tempus non est aliquid secundum se totum distincta a rebus permanentibus."

[54] *Tractatus de Successivis*, p. 97: "Dum motus durat, oportet necessario quod aliquid sit futurum, quod non habet esse extra animam, quamvis possit cognosci ab anima; et praeter illud est aliquid importatum realiter per hoc nomen motus, quod est est realiter extra animam; et ita si accipiatur quasi unum aggregatum ex omnibus, quae importantur per hoc nomen motus, oportet quod sit aliquid extra animam et aliquid quod non est extra animam, quamvis possit cognosci ab anima."

[55] *Ibid.*, pp. 98-99: "Verumtamen sciendum, quod aliquo modo magis dependet tempus ab anima quam motus, quia sicut declarabitur, tempus non est aliqua res distincta a motu. . . . Servando talem modum loquendi, isti aequivalent: motus est tempus, et: motus est motus, quo anima cognoscit, quantus est alius motus. Et ita cum illud praedicatum motus, quo aliquis cognoscit, quantus est motus alius, non possit competere alicui sine anima, ideo impossibile est, quod motus sit tempus nisi per animam; sicut impossibile, est quod motus sit illud, quo mensurat anima motum sine anima. Et ita patet, quod in definitione exprimente quid nominis temporis necessario ponitur operatio animae. Et propter hic dicit Commentator commento 88^{o}, quod 'tempus est de numero entium, quorum actus completur per animam.'"

[56] *Ibid.*, p. 99: ". . . unde tempus potest esse motus sine anima, sed nullo modo tempus potest esse tempus sine anima."

[57] Leff, *William of Ockham*, p. 593.

[58] In *The Logic of William of Ockham* (New York: Russell and Russell, 1965), p. 147, Moody takes the following quotation from Ockham's *Expositio aurea et admodum utilis super artem veterem edita . . . cum quaestionibus Alberti parvi de Saxonia* Part II, f. 55r (Bononiae: 1496): "Praeterea quod tempus non est aliqua res talis alia ostendo, quia omnis res per se una habens partes distantes realiter, si sic accidens, est in aliquo subiective tam secundum se quam secundum partes suas. Sed tempus non est in aliquo subiective tanquam unum accidens ipsius, quia subiectum non est subiectum alicuius nisi quod actualiter existit, sed partes temporibus non existunt secundum istos. . . . Praeterea, nulla pars temporis est, quid nec praeterita nec futura, igitur nec ipsum tempus est aliqua res distincta totaliter ab aliis rebus."

[59] *Ibid.*, II, 78v; quoted in Moody, p. 171: " . . . quando non dicat rem talem aliam . . . quia sic necessario derelinquitur ex tempore in re, sed hoc est impossible, nam tunc in illa re quae fuit infinitis instantibus esset tales res infinitate . . . ."

[60] Goddu, p. 167.

[61] *Tractatus de Successivis*, pp. 120-21: "Et quod instans non sit talis res raptim transiens secundum se totum distincta ab omni re permanente, sicut moderni ponunt, ostendo breviter sic: Tum quia aut est substantia aut accidens; non substantia, quia nec materia nec forma nec compositum. Nec accidens, quia quaero de subiecto eius primo: Aut est divisibile aut individibile. Non primum, quia quando subiectum primum est divisibile; ipsum accidens existens in eo est divisible. Si detur secundum, scilicet quod subiectum primum est indivisibile tunc quaero de isto subiecto: Aut est substantia aut accidens. Non primum, quia nec substantia corporea nec incorporea, sicut patet inductive. Nec accidens quia quaerendum est de subiecto eius primo, et sic in infinitum. Tum quia in tempore finito esset res

infinitae secundum se totas distinctae pertransitae. Tum quia non possit dari, quomodo talis res possit corrumpi, quia nec per corruptionem sui subiecti nec per inductionem contrarii nec per subtractionem causae conservantis vel per eius absentiam, sicut patet inductive."

[62] Goddu develops this idea at length in his chapter on Ockham's view of place, pp. 112-36.

[63] Goddu, p. 32.

[64] *Ibid.*, p. 144.

[65] *Ibid.*, p. 46.

[66] *Ibid.*, pp. 141-42.

[67] Goddu, p. 139, cites *Quaestiones in libros physicorum*, MS Paris Bib. Nat. Lat. 17841, quaestio 39; and also quaestio 40, "tempus est motus quo anima cognoscit quantus alius motus."

[68] Goddu, p. 167, suggests, for example, a connection between Bradwardine's critique of atomism and his derivation of instantaneous velocities. Although Bradwardine did not support the atomist position, he often took advantage of atomist reasoning when it suited his mathematical analysis.

[69] *De continuo*, p. 63, ll. 3-7: "Nullus enim physico certamine se speret gavisurum triumpho nisi mathematice utatur, consilio et auxilio confortetur. Ipsa enim revelatrix omnis veritatis sincere, et novit omne secretum absconditum, ac omnium literarum subtilium clavem gerit. Quicumque igitur ipsa neglecta physicari presumpserit, sapientie ianuam se numquam ingressurum agnoscat." The last part of this translation is based on Weisheipl's translation in *The Development of Physical Theory in the Middle Ages*, p. 73. See also Murdoch's introduction to the *De continuo*, p. 59, hereafter cited as "Murdoch."

[70] *De continuo*, p. 121, l. 5: "Nullam continuum ex athomis integrari. "Here Bradwardine uses the term "athomis" to mean an individual "now" or instant of time

which is itself infinitely divisible, as opposed to a time segment which consists of a series of consecutive instants. This use of the term "athomis" is consistent with Aristotelian physics and does not imply that an atom of time is indivisible.

[71] For a discussion of this problem see Murdoch, pp. 89-91.

[72] Murdoch, p. 247.

[73] *De continuo,* p. 1, ll. 1-15.

[74] *Ibid.*, p. 2, l. 5 - p. 3 l. 2: "17 - Aliquod post aliud esse, fuisse, vel fore est ipsum cum medio inter illa esse, fuisse, vel fore. 18 - Aliquod immediate post aliud esse, fuisse, vel fore est ipsum sine medio esse, fuisse, vel fore. 19 - Incipere esse per affirmationem de presenti et negationem de preterito est nunc esse et immediate ante hoc non fuisse. 20 - Incipere esse per negationem de presenti et affirmationem de futuro est nunc non esse et immediate post hoc fore. 21 - Destinere esse per negationem de presenti et affirmationem de preterito est nunc non esse et immediate ante hoc fuisse. 22 - Destinere esse per affirmationem de presenti et negationem de futuro est nunc esse immediate post hoc non fore." The implications of these definitions will be discussed at length in Chapter Six of this dissertation, which examines Bradwardine's view of contingency.

[75] *De continuo*, p. 4, l. 13: "Pro istis duabus diffinitionibus est sciendum, quod secundum Philosophum tertio *Physicorum*, ratio infiniti quantitati congruit."

[76] *Ibid.*, p. 9, l.6 - p. 10, l. 2: "Si autem dicatur quod est negativa, aut est universalis, aut particularis, indefinita, vel singularis. Singularis autem non est propter rationem predictam; nec est indefinita vel particularis, quia tunc ille essent vere: 'Infinitum est mundus,' 'Infinita puncta sunt duo puncta,' 'Infinita chymere currunt,' qui universales affirmative contradicentes eis sunt false, et alique illarum habent aliquas singulare veras ut: 'Hoc finitum non est mundus,' 'Hec puncta non sunt duo puncta.' Item, in sua exponente negation precedit totum, igitur est universalis negativa. Ideo, forte dicitur quod est universalis negativa, sed tunc sunt

iste vere: 'Infinitum est mons aureus,' 'Infinita chymere currunt,' 'Infiniti mundi sunt,' quia particulares affirmative contradicientes eis sunt falsa. Et iste sunt false: 'Infinitum tempus est finitum,' et 'Infinita puncta sunt finita'; significent enim quod nullam tempus est finitum, et quod nulla puncta sunt finita; que tamen solent concedi et debent."

[77] *Ibid.*, p. 11, l. 13 - p. 12, l. 6: "6 - Omne corpus, superficiem, lineam, acque punctum, uniformiter et continue posse moveri. 7 - Omnium duorum motuum localium eodem tempore vel equalibus temporibus continuatorum velocitates et spacia illis pertransita eodem tempore proportionales existere. Id est, sicud una velocitatum ad aliam, ita spaciam per unam velocitatem pertransitum ad spacium per aliam pertransitum. 8 - Omnium duorum motuum localium super idem spacium vel equalia deditorum, velocitates et tempora proportionales econtrario semper esse. Id est sicud velocitas prima ad secundam, ita tempus secunde velocitatis ad tempus prime. 9 - Quacumque velocitate vel tarditate potest unum mobile moveri, vel unum spacium quodcumque pertransiri potest quocumque. 10 - Esse vel non esse finitum certo tempore mensuratur." Suppositions 6-8, trans. Clagett, pp. 230-31. Suppositions 9 and 10 my translation.

[78] Murdoch, pp. 96-97. In proposition 121 Bradwardine applies the same arguemnt to the physical continuum of temperature (*De continuo*, p. 106, l. 15 - p. 107, l. 1).

[79] *De continuo*, p. 38, ll. 8-12: In a slightly different context, in proposition 124, Bradwardine makes a similar observation about the importance of time in other physical continua, again using temperature as an illustration.

[80] Murdoch, pp. 166-67.

[81] *De continuo*, p. 52, ll. 7-11: "Si sic, motus uniformis per unum gradum velocior alio equali sibi in tempore acquirit plus illo, et per nullam divisibile sed per

indivisibile tantum. Postquam reprobavit opiniones Pytagori et Henrici in quo conveniunt per rationes geometricas, hic incipit facere idem per rationes naturales."

[82] *De continuo*, p. 94, ll. 10-12: "Si sic de substantia, velocitatem in motibus proportionem motorum ad sua mota non sequi. Quare manifestum est: substantiam naturalem compositam ex finitis athomis non componi."

[83] *De continuo*, p. 94, l. 12 - p. 95, l. 14.

[84] *De continuo*, p. 97, l. 19 - p. 98, l. 6: "Si sic, omnis motus similis speciei in velocitatibus adequari. Quia per quemlibet, in quolibet instanti temporibus mensurantis motum, acquiritur unum indivisibile tantum, ut patet per 26^{am} et eius corollarium manifeste; igitur omnia illa indivisibilia acquisita sunt equalia illis instantibus tempori, igitur sunt equalis inter se, igitur per secundam, continua composita ex illis sunt equalia, ex quo patet propositum."

[85] *De continuo*, p. 116, ll. 3-10: "Si sic, omnes velocitates et tarditates motuum equale esse. Hec sequitur ex proxima. Ad item: per 26^{am} et eius corollarium, per omnem motum semper in uno instanti acquiritur unum indivisibile tantum; igitur indivisibilia acquisita per quemcumque motum in aliquo tempore sunt equalia numero instantibus illius temporis, et per consequens quibuscumque indivisibilius acquisitis per motum in eodem tempore. Igitur, per 26^{am}, continua composita ex illis sunt equala. Igitur motus sunt equeveloces."

[86] *De continuo*, p. 132, l. 20: "Superficiem, lineam, sive punctum omnio non esse."

[87] Murdoch, p. 196.

[88] Murdoch, p. 173.

CHAPTER SIX

[1] See Norman Kretzmann, "Incipit/Destinit," *MTSM*, p. 102.

[2] 237a17-28, in Barnes, p. 400.

[3] *Ibid.*, 237b10-22, in Barnes, p. 401.

[4] *Ibid.*, 263a9-31, in Barnes, p. 440.

[5] See Nielsen's discussion of Aristotle in the introduction to his "Thomas Bradwardine's Treatise on 'incipit' and 'destinit': Edition and Introduction," pp. 8-9, hereafter cited as "Nielsen." References to Bradwardine's text will be cited as *De incipit*.

[6] Nielsen, pp. 10-11.

[7] In "Incipit/ Destinit," pp. 104-5, Kretzmann suggests that early medieval interest in these words was primarily grammatical and based on the rediscovery of Aristotle's *De sophisticis elenchis*. This is in contrast to Curtis Wilson's thesis, developed in *William Heytesbury: Medieval Logic and the Rise of Mathematical Physics* (Madison, Wisconsin: University of Wisconsin Press, 1960), that medieval logicians were inspired mostly by the passage from Aristotle's *Physics* quoted above.

[8] For discussions of syncategorematic words, see especially Wilson, pp. 11-12, and Nielsen, pp. 10-11.

[9] Nielsen, pp. 10-11.

[10] William Sherwood was an English master at the University of Paris in the first half of the thirteenth century who wrote extensively on syllogisms and dialectics. Peter of Spain (d. 1277), also a logician at Paris, wrote a number of very influential treatises on logic and physics. For details of their work see Gilson, *History of Christian Philosophy*, pp. 317-23. Walter Burley (ca. 1275-1345), a contemporary of Ockham, was a master of arts at Oxford and, like Bradwardine, was both a fellow at Merton and a member of Richard de Bury's household. Like William of Sherwood

and Peter of Spain, Burley specialized in logical studies. For additional information on Burley see *CHLMP*, pp. 888-89.

[11] Nielsen, pp. 11-15. For an edition of Sherwood's treatise on syncategorematic words see "Syncategoremata," ed. J. Reginald O'Donnell, *Mediaeval Studies*, 3 (1941), pp. 46-93. For a translation and analysis of this text see Norman Kretzmann, *William Sherwood: Treatise on Syncategorematic Words* (Minneapolis, Minnesota: University of Minnesota Press, 1968).

[12] Nielsen, p. 16. See also Wilson, pp. 32-33. For an edition of Burley's text see "'De Primo et Ultimo Instanti' des Walter Burley," ed. Herman and Charlotte Shapiro, *Archiv für Geschichte der Philosophie*, 47 (1966), pp. 157-73.

[13] Kretzmann, "Incipit/ Destinit," pp. 108-9.

[14] *Ibid.*

[15] From an excerpt from *Tractatus syncategorematum*, translated by Kretzmann, "Incipit/ Destinit," in Appendix A, pp. 122-23.

[16] *Ibid.*, p. 123.

[17] *Ibid.*, pp. 123-24.

[18] See Kretzmann, "Incipit/ Destinit," p. 121 and Wilson, p. 31.

[19] Nielsen, p. 6. The *De incipit* is a fragment and has no specific title. The first sentence of the fragment (*De incipit*, 1.1, p. 47) reads as follows: "Ad clariorem igitur notitiam istarum duarum dictionum 'incipit' et 'destinit' habendam in primis taliter procedimus."

[20] Nielsen, pp. 5-6. Because their disagreement concerned an aspect of proportional logic and has no bearing on either man's view of time, it will not be considered here.

[21] *Ibid.*, pp. 3-4.

[22] *Ibid.* Nielsen also suggests that Bradwardine might have written the *De incipit* before his conversion experience, when he was immersed in the study of

natural philosophy and convinced of Aristotle's authority. Certainly the narrow scope of the treatise and its relatively unsophisticated style indicate Bradwardine's youth. Yet since Bradwardine never says precisely when his conversion experience occurred, it is difficult to use this event for dating a text. As Nielsen points out, however, Bradwardine could have written the *De incipit* either before or after his conversion experience since he left theological questions out of consideration.

[23] *De incipit*, 2.3, p. 50: "Quod hec est necessaria 'omnia motus est,' probo sic physice loquendo." See also Nielsen, pp. 24-25. In spite of Bradwardine's remark, his approach in this text was mostly logical. See Murdoch, "Proportional Analysis in Medieval Philosophy: A Case Study," *Synthese*, 40 (1979), 125-26.

[24] *De incipit*, 2.3, p. 51: "Istis prehabitis TERTIA CONCLUSIO est, quod hec propositio est impossibilis 'motus incipit esse.' Istam conclusio probo sic: ista propositio est necessaria 'omnis motus est' igitur sua opposita simpliciter est impossibilis, videlicet 'aliquis motus non est,' et per consequens ista est impossibilis 'motus non est.' Consequentia est bona, ergo ista copulativa est impossibilis 'motus nunc non est et immediate post hoc erit.' Sed ista copulativa - ut prehabitum est - convertitur cum ista propositione 'motus incipere esse,' igitur ista propositio 'motus incipt esse' est impossibilis." Nielsen, p. 24, refers the reader to Aristotle's assertion in Book V of the *Physics* (236b.34, in Barnes, p. 400) that " . . . it is evident that everything in motion must have been in motion before."

[25] See Nielsen's discussion of instantaneous being, p. 23 and pp. 29-30.

[26] *De incipit*, 2.3.1.1, pp. 55-56: ". . . pro cuius solutione notandum est quod futurum contingens dupex est, quia quoddam est futurum contingens quod pro illo pro quo est verum nullo modo potest esse falsum, et tale futurum contingens est 'nunc futurum contingens,' quod sequitur necessario ex propositione vere et mere de presenti. . . . Per hoc dico ad argumentum concedendo quod de primis futuris contingentibus potest esse determinata veritas et determinata et distincta scientia

sicut de propositionibus mere de presenti ex quibus talia contingentia sequuntur. De futuris secundis contingentibus nulla est veritas determinata nec certa scientia et de talibus loquitur Aristoteles in loco sepius allegato."

[27] Nielsen, pp. 24-25.

[28] *De incipit*, 2.3.1.2.1.1, pp. 57-58: ". . . si ista consequentia sit bona 'Sortes movetur localiter, ergo Sortes movebitur localiter,' cum illud consequens sit de futuro contingenti de quo non est aliqua determinata veritas, sequitur etiam quod de isto antecedente 'Sortes movetur localiter' non erit aliqua determinata veritas, quia in omni bona consequentia si consequens sit alicui dubium et antecedens erit eidem dubium. Et si consequens sit indeterminate verum vel falsum, et antecedens erit indeterminate verum vel falsum. Et per consequens sequitur quod aliqua propositio mere de presenti non erit determinate vera vel falsa."

[29] *Ibid.*, p. 60: "Ad aliud quod dicitur de Aristotele qui ponit motum esse sensibile commune, hoc ideo dicit non quia sentimus aliquid moveri, sed quia pluribus sensibus percepimus quod aliquid movebatur. Quia sicut nos non possumus percipere per sensum vel per intellectum quod aliquid movebitur, ita etiam non possumus percipere per sensum vel per intellectum quod aliquid movetur."

[30] *De incipit*, 2.3.1.2.1.2, p. 62: "Ista enim - ut videtur - non stant simul 'nullam spatium immediate post hoc erit pertransitum' quia ista sunt contradictoria, ut patet de se. Sed ista videntur equivalere 'aliquod spatium erit pertransitum immediate post hoc' et 'immediate post hoc aliquod spatium erit pertransitum.' Antecedens prime consequentie patet inductive, videlicet quod nullum spatium erit pertransitum immediate post hoc, quia quocumque spatio dato tempus erit antequam illud spatium erit pertransitum, ut de se patet. Item, immediate post hoc aliquod spatium erit pertransitum, igitur sine medio aliquod spatium erit pertransitum. Et ultra, in nullo tempore aliquod spatium erit pertransitum, ergo in

non-tempore aliquod spatium erit pertransitum, igitur motus erit sine tempore. Consequens est impossible, igitur illud ex quo sequitur."

[31] Of course Bradwardine is speaking here only about predicting the future of real beings using *incipit* and *destinit* propositions. He is not concerned with whether time and space are theoretically infinite.

[32] *De continuo*, p. 2, ll. 5-8; translated by Murdoch in his introduction of the text, p. 176.

[33] *De continuo.*, p. 40, ll. 1-2: "Omnis incepto vel destino non mensuratur tempore sed instanti."

[34] See Murdoch, pp. 178-80.

[35] *Ibid.*, pp. 185-86.

[36] *Ibid.* See also Wilson, pp. 51-56. As a mathematician like Bradwardine, William Heytesbury approached the problem of beginning and ceasing by analyzing instantaneous motion, a concept which Burley had suggested and Bradwardine almost completely ignored. In the process, Heytesbury derived several important theories regarding motion, continuity and infinity. The work of Heytesbury and Bradwardine illustrates the strong connection which existed between logic and natural philosophy in early fourteenth-century Oxford.

[37] Jaakko Hintikka, "The Once and Future Sea Fight: Aristotle's Discussion of Future Contingents in *De interpretatione 9*," in *Time and Necessity: Studies in Aristotle's Theory of Modality* (Oxford: Clarendon Press, 1973), p. 147. In this essay Hintikka thoroughly explores Aristotle's extensive but rather confusing treatment of the logical implications of contingency. Although it is not possible to cover all of this material in this dissertation, relevant aspects of Aristotle's view of contingency will be treated below.

[38] Hintikka, p. 152.

[39] 17b8-22; 19b1-3, in Barnes, p. 30.

[40] Hintikka, pp. 164-65.

[41] See M. Jean-François Genest's discussion in "Le *De futuris contingentibus* de Thomas Bradwardine," *Recherches augustiniennes*, 14 (1979), p. 253.

[42] *Concerning the City of God against the Pagan*, trans. Henry Bettensen (Harmondsworth, Middlesex: Penguin, 1972), p. 191. Quotation from Cicero, *De Fato*, 17.40.

[43] *City of God*, p. 194.

[44] See Jordan, "Time and Contingency," pp. 268-69.

[45] Chadwick, *Consolations*, pp. 157-59.

[46] *The Consolation of Philosophy*, trans. H. R. James (London: Elliot Stock, 1897), p. 260-61.

[47] *Ibid.*, p. 228.

[48] *Ibid.*, pp. 231-32.

[49] The material for the following summary is taken from Calvin Normore, "Future Contingents," *CHLMP*, pp. 359-69.

[50] Normore, pp. 359-61, notes that Anselm discussed aspects of antecedent and subsequent necessity in several works, including *Cur Deus Homo*, II, 17; *De concordia praescientiae et praedestinationis et gratiae Dei cum libero arbitrio*, Quaestio I; *De concordia*, I, 3; and in his *Incomplete Works*, sometimes called the *Philosophical Fragments*. The standard edition for all of these texts is *Sancti Anselmi Opera Omnia*, ed. Franciscus Salesius Schmitt (Rome: 1938).

[51] Normore, pp. 361-63, cites the following texts in which Abelard discussed aspects of future contingency: *Editio super Aristotelem De Interpretatione*, ed. Mario dal Pra, in *Pietro Abelardo: Scritti di logica* (Florence: La nuova Italia Editrice, 1969), p. 103; *Logica 'Ingredientibus,'* ed. Bernhard Geyer, in *Peter Abaelards philosophischen Schriften* (Münster: Aschendorff, 1919-27), pp. 427 ff.; and

Dialectica, ed. Lambertus Maris De Rijk, Wijsgerige teksten en studies, I (Assen: Van Gorcum, 1970), p. 212.

[52] Normore, p. 363, cites Lombard's *Sentences*, Book I, Distinctions 38-40. For a standard edition of this text see *Libri IV Sententiarum*, ed. Albanus Heysse (Florence: Editiones Collegii S. Bonaventura ad Claras Aquas, Grottaferrata, 1916).

[53] Normore, pp. 364-66, cites Grosseteste's *De liber arbitrio*, Chapter 6, ed. Ludwig Baur, in *Die philosophischen Werke des Robert Grosseteste, Bischof von Lincoln* (Münster: Aschendorff, 1912).

[54] Normore, pp. 366-67, cites especially Aquinas' *Summa Theologica*, Book I, Questions 14, 25 and 62. For a standard edition of this work see *Opera Omnia*, ed. S. E. Frette and P. Maré (Paris: L. Vivès, 1874-89).

[55] Normore, pp. 367-69, cites Duns Scotus' *Lectura* on Lombard's *Sentences*, Book I, Distinctions 39 and 40. For an edition of Scotus' *Lectura* see *Opera Omnia*, ed. Luke Wadding (Paris: L. Vivès, 1891-95).

[56] Normore, pp. 369-70.

[57] *Ibid.*, p. 370.

[58] See Philotheus Boehner, "Ockham's *Tractatus de praedestinatione et de praescientia Dei et de futuris contingentibus* and its Main Problems," in *Collected Articles on Ockham*, ed Eligius M. Buytaert (St. Bonaventure, New York: The Franciscan Institute, 1958), p. 423.

[59] Boehner, *The Tractatus praedestinatione et de praescientia Dei et de futuris contingentibus* (St. Bonaventure, New York: The Franciscan Institute, 1945), pp. 49-50.

[60] *William Ockham: Predestination, God's Foreknowledge and Future Contingents*, trans. Marilyn McCord Adams and Norman Kretzmann (New York: Appelton-Century-Crofts, 1969), pp. 48-50.

[61] Question II, article III, trans. Adams and Kretzmann, pp. 61-62.

[62] From Book I, Distinction 38 of Ockham's commentary on Lombard's *Sentences*, also called his *Ordinatio*, ed. and trans. Adams and Kretzmann in Appendix I of *William Ockham, Predestination*, p. 90: "This conclusion [concerning God's complete knowledge of future contingents], although it cannot be proved *a priori* by means of the natural reason available to us, nevertheless can be proved by means of the authorities of the Bible and the Saints, which are sufficiently known."

[63] The issue of Ockham's view of time and Bradwardine's reaction to it will be discussed at length below in Chapter Seven. Bradwardine's reaction to some of Ockham's followers will be explored in Chapter Eight.

[64] Genest, p. 253. See also *De futuris*, Opinion 7, 20, p. 293, which simply states: "Septima opinio est que ponit quod nihil est in futurum contingens ad utrumlibet, sed omnia que eveniunt necessario eveniunt. Sed ista opinio est tam contra philosophiam quam theologiam, ideo hic illa non reprobantur."

[65] *De futuris*, Opinion 6, 17-18b; 18e; 18h-19; p. 292: "Respondetur pro intencione Anselmi et aliorum diciencum quod omnia sunt Deo presencia: verum est in esse cognito, et consimiliter dicet Philosophus quod anima est quodammodo omnia, scilicet sensibilia omnia comprehendit per sensum et omnia intelligibilia per intellectum, et non excluditur quin aliqua sint futura et quod illa Deus prescit. Nec similiter vult Anselmus dicere quod omnia sunt Deo presencia, scilicet futura. Sed verum est quod hec consequencia non valet: 'omnia sunt sibi presencia in esse cognito, igitur non habet prescienciam'; sed verum est quod bene sequitur 'igitur non habent prescienciam excludendo de illis scienciam.'"

[66] *Ibid.*, p. 294: ". . . si Deus habet prescienciam futurorum contingencium ad utrumlibet, sequitur quod Deus potest velle et promittere oppositum nunc sciti, promissi et voliti ab eo. Consequens est falsum, quia sic Deus potest mutari de scitis, volitis et promissis, quod est contra illud *Malachie* 3^{o} [Malachi 3:6]: 'Ego

Dominus et non mutor'; et ita sequitur quod non erit si sicut Deus promisit vel voluit fore, igitur Deus mutatur.... Sed contra: quia sic sequitur quod contingenter potest scire aliquid fore futurum postquam non fuit futurum et e converso. Consequens est falsum, quia sciencia sua est necessaria preteritorum, ut hujus: 'diluvium fuit,' et idem est apud Deum scire diluvium fuisse et scire ipse fore quando non fuit. Igitur sequitur quod sciencia sua est necessaria futurorum."

[67] See especially *De futuris*, Opinion 8, 24a-25p, pp. 295-98; also Genest's introduction, pp. 263-64.

[68] *Ibid.*, 35j, p. 303: "Confirmatur, quia si Deus velit illum actum stare in voluntate ejus per diem continue et voluntas illius potest tunc illum actum ante finem diei dimittere, sequitur quod Deus non foret omnipotens, quia non potest uti creatura sua ut nunc vult ea uti. Consequens est falsum. Et quod Deus possit velle hominis voluntatem immutabiliter stare per diem vel in eternum, consequencia patet per Augustinum in *Enchiridion* et 5^{o} *De civitate Dei*, c. 10^{o}, ubi arguit conta Stoycos, qui maluerunt negare prescienciam in Deo quam libertatem arbitrii in hominibus. Contra quos dicit Augustinus ibidem quod necessitas et libertas non repugnant in aliquo, quia necesse est Deum velle se esse in vivere in tamen libere, et sic de beatis, et sic potest esse in nobis; dicit quod necessitas ex natura, ut est illa qua moriemur, repugant libertati arbitrii, sed non illa qua dicitur necesse est hoc esse vel fore universaliter. Et sic concedit quod necessitas aliqua est in voluntate, que non repugnat libertati arbitrii, ut predictum est, igitur merito de demerito." For a standard edition of the *Enchiridion* see *Enchiridion ad Laurentium de Fide et Spe et Caritate*, ed. Ernest Evans, in *Aurelii Augustini Opera*, Part XIII, 2, Volume XLVI of *Corpus Christianorum Series Latina* (Turnholti: Typographi Brepols, 1969), pp. 21-114.

[69] See for example *De futuris*, Opinion 8, 35p, p. 304: "Et sic potest Deus facere, et movere ad faciendum illud quod bonum est fieri omnia instrumenta, et

tamen credimus nos facere nostra voluntate et contra voluntatem Dei, et sic peccamus necessario. Et hoc patet in illo processu: 'Ve Assur' (Is., 10:15), ubi dicitur virga et baculus Jude rex Assur; et simul habetur *Enchiridion* c. 25[O]" (See *Enchiridion*, 25:99 and 26:100-1)." Also 44c, p. 313: "Item hoc patet per Augustinium per super *Genesim* [*Contra Gaudentium* 1:30:35], ubi dicitur quod non potuit in superversione Sodome perdere justos cum impiis, quia foret contra justiciam et ideo hoc non potest velle facere, et per consequens non potest hoc facere; sed tamen de potencia absoluta potuit hoc fecisse si voluisset." Also 45g, pp. 314-15: "Similiter Boecius in *De consolacione*, prosa ultima (5:6:36), dicit quod necesse est futura evenire referendo illa ad cognicionem divinam, sed propria natura libera sunt et a nexibus necessitatis absoluta." And again, 47h, p. 316: "Item Anselmus [*De concordia*, 1:2] et Boecius [*Philosophiae consolatio*, 5:6:27-36], ubi supra, distinguunt de necessitate, que est duplex, quedam antecedens et quedam consequens, et dicunt quod in futuro est necessitas consequens et non antecedens."

[70] *De futuris*, Responsio propria ad questionem, 54a, p. 323: "Sed accipiendo contingens ad utrumlibet simpliciter, sic conceditur consequencia et consequens, scilicet quod nihil est vel erit contingens ad utrumlibet, eo quod nihil est vel erit in eternum nisi quod determinatum ad volitum et prescitum a Deo fore, quia nihil fiet in eternum nisi a potencia ordinata cause superioris vel inferioris. Sed secundum quid fient plura contingencia, quia illa potencia non est plus ordinata ad unam partem contradictionis quam ad aliam, ut est potencia absoluta in utraque causa. Et sic dico de casu et fortuna, quia nihil eveniet in eternum immediate a Deo, vel a Deo creatura mediante, quin fiet a proposito saltem cause superioris, licet plura in istis inferioribus a casu et fortuna secundum quid fiant, et non a proposito cause inferioris; et hoc intendit Philosophus de contingenti equaliter vel utrumlibet, vel de casu et fortuna."

CHAPTER SEVEN

[1] *Bradwardine and the Pelagians*, p. 16.

[2] *Archbishop Thomas Bradwardine*, p. 1.

[3] *A History of Medieval Philosophy* (London: Methuen, 1972), pp. 259-60.

[4] *Ibid.*, p. 258.

[5] These points are developed at greater length in the Introduction.

[6] From a conversation with Dr. Jeremy I. Catto, Oriel College, Oxford, January, 1987. Dr. Catto has suggested that the comforting tone of some passages of the *De causa Dei* might have been prompted by Bradwardine's desire to reassure people in the court of Edward III (among others) who did not fully understand contemporary theological debates and were disturbed by them.

[7] See J. A. Weisheipl, "Ockham and the Mertonians," in *The Early Oxford Schools*, ed. J. I. Catto, Volume I of *The History of the University of Oxford*, ed. T. H. Aston (Oxford: Clarendon Press, 1984), p. 652.

[8] *De causa Dei*, I, 40, p. 364, A: "Quod gratia, quae est habitus gratis datus a Deo una cum voluntate humana est causa efficiens proprie cuiuslibet boni et meritorij actus sui."

[9] *Ibid.*, I, 41, p. 371, A: "Quod gratia prius naturaliter quam voluntas humana efficiat actus bonos."

[10] *Ibid.*, II, p. 540, B: "Quod cuiuslibet actus voluntatis creatae Deus est necessarius coeffector." See also chapter 29, p. 577, B: "Quod voluntas increata et creata in coefficiendo actum voluntatis creatae, non sunt coaequales, nec coaequaeuae in ordine naturali."

[11] See Weisheipl, "Mertonians," p. 652.

[12] Leff, pp. 56-57.

[13] *De causa Dei*, I, 26, p. 251, A: "Quod tota vniuersitas rerum est bona, et nulla res per se mala"; and I, 30, p. 271, E: "Quod res voluntariae diuinae prouidentiae legibus gubernantur."

[14] *Ibid.*, I, 4, p. 174, B: "Prima, quod nihil potest quicquam mouere sine Deo idem per se et proprie comouente. Secunda, quod nihil potest quicquam mouere sine Deo immediate idem mouente. Tertia, quod nihil potest quicquam mouere sine Deo idem mouente immediatius alio motore quocunque."

[15] *Ibid.*, E: "Pro secundo dicendum quod Philosophus in talibus loquitur, sicut Philosophus naturalis, scilicet de immediatione causae secundae, causae scilicet naturalis; et haec est immediatio secundum quid, quia tantum in genere creatorum; non autem de immediatione simpliciter, quae simpliciter omnem mediam causam priuat."

[16] For example, Bradwardine states as a corollary to his first proposition that the created world has to be limited, temporally and spacially, in order to distinguish the mutability of created being from the perfect, infinite simplicity of God. See *De causa Dei*, I, 1, 6, p. 5, A: "Mvtentur credentes Deum non necessario, sed contingenter esse summe perfectum et Deum, ipsumque esse mutabliem [nouiter] irascibilem, placibilem, tristabilem, laetabilem, atque possibilem, nouiter quacunque alia passione: opinantes quoque quod Deus sit nomen accidentale, et non essentiale simplicter. Quod autem Deus sit necessario summe perfectus et Deus, ex prima suppositione consequitur euidenter; cum perfectus et melius sit sic esse; quam contingenter, sicut patet ex premisses in ostensione suppositionis illius."

[17] Bradwardine devotes Book I, chapter 1, corollaries 33, 34, 37 and 40 to various aspects of creation in time. See especially *De causa Dei*, I, 1, 34, p. 66, B-C: "Constat autem Philosophis quod prius, et ante accipitur dupliciter ad propositum, scilicet secundum naturam et secundum tempus. Pono igitur contrate Aristoteles et Averroes quod mundus incepit et motus in A instanti, et quod nullum fuit tempus,

mutatio, neque successio temporalis, aut aliqua duratio vera mutalibis, aut partibilis, magna, vel parua ante illium primum motum qui sit B. Pono igitur consequenter quod nihil omnino praecessit A prioriate aliqua temporali, sicut nihil praecedit coelum exterius prioriate vel superioritate locali, et quod hoc sit consequens, patet per teipsum 10. ilius 8^{i} dicentem; Prius et posterius quomodo erunt, tempore non existente, aut tempus, si non sit motus? et ex alia parte pono, quod Deus aeternus, euisque aeterna sapientia ac voluntas praecessit A prioritate naturae, sicut causa causarum. Cum ergo tu Aristoteles per totum illum processum supponis quod cuiuslibet rei factae non esse praecedit necessario suum esse, et hoc loquendo de praecessione temporali, vt innuis 10. et tu Averroes hoc idem dicis expresse in comment. decimaoctavo quoque decimoquinto ac alijs hoc supponis."

[18] *Ibid.*, I, 1, p. 1, C.

[19] *Ibid.*, I, 1, parts 33-34, pp. 65-71.

[20] *Ibid.*, I, 1, corollary 40, pp. 119-45.

[21] *Ibid.*, I, 40, p. 125, D: "Puto autem quod Democritus primo istam sententiam adinuenit, et Epicurus postea confirmauit, sicut de sententia affirmante cuncta geri fortuito, Lactantius primi institutionum diuinarum aduersus Gentes primo, recitat manifeste, sicut 27. huius primi plenius recitatur. Et haec videtur opinio, quam Aristoteles I. de Coelo et Mundo 76. et post, nitium reprobare. Singula namque minima corpora, qualis videtur minimus puluis terrae, de singulis mundis assumpta, et modo praedicto ad inuicem cumulata, vuniuersum locum, situm, spacium, seu vacuum verum vel imaginarium totaliter occuparent. Vbi ergo hospitarentur alia corpora plura incomparabiliter et maiora? quomodo contenarentur illa situ minori, et non totale spatium vniuersum totaliter occuparent? Quomodo etiam cubi illi, partes fili, seu corpora minima de mundis singulis nunc collecta, et sphaerice cumulata non prius occurabunt tantum spacium, quantum modo spacium vniuersum? et quomodo nunc occupant spacium amplius, quam tunc

fecerunt? praesertim cum secundum doctrinam Geometrarum certissimam, sphaera sit capacissima figurarum."

[22] *Ibid.*, p. 126, E: "Infinito namque simpliciter maius esse non potest, sed secundum quid tantum, et secundum quid finite."

[23] *Ibid.*, p. 130, D: "Nec potest quis vlterius fingere cauillando, quod tam B quam C secundum quid est infinitum, et secundum quid finitum, sicut secundum sententiam Aristotelis, partes praeterita et futura temporis simpliciter infiniti, quas copulat praesens instans; quia infinitum intensiue quantumlibet modicum remittatur, est simpliciter et omniquaque finitum intensiue: vt patet de caliditate posita infinita intensiue, quae si quantumlibet remittatur, necessario est simpliciter omniquaque finita; Finitur enim superius intrinsece ad certum gradum finitum, et inferius extrinsece ad non esse caliditatis, sicut et quaelibet forma intensibilis terminatur."

[24] *Ibid.*, p. 131, B: "Ideo fortassis dicetur quod Deus non potest facere creataram, quae sit ex se necesse esse et aeterna, quare nec Deum. Sed etsi non possit facere creaturam istas virtutes seu proprietates habere, faciat ipsam habere omnes alias virtutes possibiles creaturae, et quamlibet simpliciter infinite."

[25] *Ibid.*, I, 26, p. 251, A: "Hic autem in mediastino pro praecedentibus et sequentibus ostendendum, totum vniuersitatem rerum omnium esse bonam, nec esse in ea aliquid quod sit malum. Huius enim oppositum Empedocles, Pictagoras, Manes, Manichaei haeretici dicere videbantur, sicut 18[a] pars Corollarij primir docet. Omne sequidem per se volubile et amabile a bono sapiente, est aliquo modo bonum, vt tam Philosophi, quam Theologi partier contestantur: et quaelibet pars mundi est per se volubilis et amabilis a Deo, sicut et per se creabilis, et conseruabilis est ab eo, sicut ex capitulis 2.3.6.8.&9. poterit apparere."

[26] In fact, says Bradwardine, the act of applying reason to the observation of the natural world, as Aristotle had done, is one of the best ways of arriving at an

understanding of God's infinite goodness. See, for example, *De causa Dei*, I, 11, p. 198, C-D: "Dicit enim Philosophus 4. Metaph 9. quod hoc est primum principium complexorum, Idem simul inesse, et non inesse eidem, et secundum idem est impossibile; sed ne tanto Philosopho tantillus videar obgarrire, sciendum quod duplex est principium, cognoscendi scilicet et essendi, vel, quoad nos et quoad naturam; Ipse autem loquitur ibi de primo principio cognoscendi, et apud nos tantum, per quod generaliter in omnibus scientijs regulamur, sicut processus textus et comment. satis ostendit. Principium autem complexorum primum simpliciter est de Deo vt puta Deus est, vel Deus scit omnia, vel Deus vult omnia, vel aliquid quicquam tale."

[27] *Ibid.*, I, 1, part 13, pp. 8-10.

[28] *Ibid.*, p. 10, A: "Nulla ergo res temporalis, generabilis, corruptibilisue est Deus."

[29] *Ibid.* "O miserabiliter miserabilis, miser homo, si tamen homo, cur non verecundaris naturam irrationalem naturaliter viliorem, ignobiliorem, imperfectiorem et tibi subiectam adorare et colere pro Domine Deo tuo? cuius etenim animus non praeponit Deum suum sibi ipsi, et omnibus alijs in ordine dignitatus. . . ."

[30] Leff, pp. 48-49. Bradwardine compares God's causality to that of an architect who transforms the idea of a house into an actual physical object in *De causa Dei*, I, 2, p. 154, B: "Imaginare itaque in mente Architecti formam domus fabricandae quam solummodo respicit, vt ad eius imitationem domum faciat, et imaginare cum hoc per impossibile ipsius voluntatem ita potentem, quod se sola applicet materiam formandam in domum; et imaginare cum his quod materia domus esset fluida, nec posset permanere in forma recepta in se, si separatetur a forma in mente Architecti, sicut aqua figurata sigillo argenteo, separato sigillo, statim amitteret figuram receptam. Imaginare itaque voluntatem artificis

applicantem materiam domus ad formam in mente sua, non solum vt sic formetur in domum, sed quamdiu domus manet in esse domus, vt formaliter in esse seruetur. Eo itaque modo quo forma huiusmodi in mente Architecti esset forma domus, est ars siue sapientia, siue verbum omnipotentis Dei, forma omnium creaturum; Ipsa enim simul est examplar efficiens, Formans, et in forma data conseruans. Et infra dicit aeternam Dei sapientiam sic esse formam omnium, velut si imagineris figuram sigilli argente vitam et intelligentiam, intelligentem se volentemque figuare ad sui imitationem simultudinem magis minusue expressam ceram fluidam, non potentem per se permanere in aliqua figuratione recepta, ipsaque hac sola voluntate informem et fluidam ceram ad se moueret, sibique applicaret, et sic suam simultudenem aliquantam imprimeret, et impressam seruaret; sic aeterna Patris sapientia est forma omnium."

[31] See, for example, *De causa Dei*, I, 2, p. 147, B-C: "Quare et Chrysostomus istud expondendo, homilia 2ª sic ait; Ferens, inquit, omnia hoc est gubernans; siquidem cadentia et ad nihilum tendentia contenit. Non enim minus est continere mundum quam fecisse; sed si oportet aliquid audacius dicere, adhuc amplius est. Nam in faciendo quidem ex nullis existentibus rerum essentiae productae sunt; In continendo vero, ea quae facta sunt, ne ad nihilum redeant, continentur. Hic ergo dum reguntur, et ad inuicem sibi repugnantia coaptantur, magnum et valde mirabile plurimumaeque virtutis indicium declaratur. Dicitque Augustinus in De diuinitatus Dei essentia, et de inuisibilitate, atque incommutabilitate, 1º sic de Deo; Procu dubio nullus est locus ab eius praesentia absens: Super omnem quippe creaturam praesidet regendo, subtus est omnia sustinendo atque portando, non pondere laboris, sed infatigabili virtute; quoniam nulla creatura ab eo condita per se subsistere valet, nisi ab eo sustinetur qui eam creauit; extra omnio est, sed non exclusus, intra omnia est, sed non conclusus."

[32] *Ibid.*, p. 154, E: "An forte et hoc est quod Deus sciscitanti Moysi nomen eius, velate respondit, Ego sum qui sum, sic dices filijs Israel, Qui est, misit me ad vos. Exod. 3 quasi velit innuere se esse seipsum simpliciter per seipsum, et se etiam esse quodammodo totum ens, essentificando videlicet alia vniuersa."

[33] *Ibid.*, I, 1, part 40, pp. 139-40, E-A: "Ex his omnibus potest cuilibet sobrio non proteruo rationabiliter apparere, mundum nedum habuisse principium temporale, verum et fuisse creatum ex nihilo. Ex qua namque materia fieret praecedente? qualis esset illa, simplex, vel composita; aeterna vel nova? Quare et tu, Aristoteles, multum rationabiliter saepe probas, mundum non fuisse factum ex materia praeiacente? Quid ergo consequentius consequentia naturali, quam concesso mundum habuisse principium temporale, concedere ipsum fuisse creatum ex nihilo consequenter?" See Oberman, pp. 53-54.

[34] *Ibid.*, I, 7, p. 189, C: "Deus enim scit omnia simul et semper, non per vices temporum; sicut ipsa scita incipiunt esse, vel desinunt more humano, quoniam apud ipsum non est transmutatio, nec vicissitudinis obumbratio." See Oberman, p. 54.

[35] *Ibid.*, I, 6, p. 183, C: "Quare et Auicenna 4. de Anima 2. dicit, Omnia quae in mundo sunt praeterita, praesentia, et futura, habent esse in sapientia creatoris."

[36] *Ibid.*, E: "Et si ipsi habuerunt scientiam huiusmodi saltem paruam, vel qualemcunque coniecturam tenuissimam, verum tamen, quis nesciens, seu potius insaniens Deum audebit asserere nescium futurorum; cum per primam Suppositionem, tertiam partem, et quartam Corollarij primi huius, necessario consequatur ipsum ea cognoscere perfectius infinite. Amplius autem si Deus secundum praemissa habet scientiam omnium praesentium, praeteritorum, et similiter futurorum, cum scire actualiter et particulariter, distincte et certe sit perfectius, quam scire tantum habitualiter, potentialiter et vniuersaliter, confuse et incerte."

[37] *Ibid.*, p. 184, A: "Quod Deus habet distinctam scientiam omnium, nedum praesentium, praeteritorum et futurorum: verum et omnium possibilium et impossibilium, imaginabilium et cognoscibilium quouismodo, unde et omnisciens, sicut et omnipotens veraciter dici potest."

[38] *Ibid.*, III, 51, p. 826, B-C: "Constat siquidem secundum Philosophorum sententiam, quod mensura debet esse vnigenita et similis mensurato: homo autem mutabilis est, et actiones eius mutabile, quare et mensurantur mensura mutabili, scilicet temporali, ipso videlicet tempore vel instanti: Deus vero, et quaelibet actio eius intrinseca, puto cognito et volutio, immutabilis est omnino, sicut quintum et vicesimum tertium primi docent; quare nec Deus, nec aliqua actio eius intrinseca per se immediate et proprie mensuratur mensura mutabili, scilicet tempore vel instanti, sed mensura immutabili, inuaribili, stabili, et aeterna, seu potius ipsa aeternitate immutabiliter penitus, insuccessibiliter, vniformiter atque stabiliter permanente. In ipsa namque nulla diuisibilitas, nulla maioritas, nulla minoritas, nulla prioritas, nulla posterioritas, nulla mutabilitas, nulla accessio, nulla recessio, nulla successio, nihil praeteritum, nihil futurum, nec vlla penitus differentia successiua, sed indiuisibilis, simplex, vnica, eadem, insuccessibilis, ac instantanea praesentialitas et simultas, sicut ostenditur primo primi, imo superindiuisibilis, supersimplex, superunica, supereadem, superinsuccessibilis, ac superinstantanea praesentialitas et simultas temporalis instantis."

[39] *Ibid.*, p. 827, A-B: "Vnde Plato 1. Timei 9. vtens aeuo pro aeternitate sic ait, Dies et noctes et menses et annos, qui ante coelestem exordinationem non erant, tunc nascente mundo iussit existere, quae omnia partes sunt temporis, nosque haec cum aeuo assignamus eidem solitariae naturae, non recte partes indiuiduae rei singimus. Dicimus enim fuit, est, erit; At illi solum esse competit iuxta veram sui certamque rationem, fuisse vero deinceps et fore non competit; haec quippe

geniturae temporis propria. Motus enim sunt, vnus praeeuntis, alter imminentes non aeui sed temporis."

[40] *Ibid.*, D: "Tempus fluxibile sequitur fluxibilem actionem, scilicet motum coeli; sic aeternitas stabilis sequitur stabilem actionem, scilicet esse Dei, et ab ipsa quodammodo deriuatur, defluit et emanat. Sicut enim punctus fluens lineam, et instans tempus; sic et Deus instans stabilissimus per actum suum veluti quendam fluxum videtur aeternitate causare, et hoc maxime apud cognitionem humanam, quae secundum Philosophum in de memoria et reminiscentia, non sit sine continuo, nec sine ratione temporis atque motus, licet in Deo nullus sit fluxus mutabiliter, aut temporaliter successiuus."

[41] Oberman, p. 54.

[42] For a full discussion of the implications of the notion of absolute power in late medieval theology and natural philosophy see Edward Grant, "The Condemnation of 1277, God's Absolute Power, and Physical Thought in the Late Middle Ages," *Viator*, 10 (1979), pp. 211-44. Grant attibutes the upsurge of speculation on such topics as whether God can undo the past or create more than one world to a response to the condemnations which claimed that Aristotelian natural philosophy restricts the scope of God's power.

[43] See above, Chapter Six, note 62. Goddu, p. 8, argues that Ockham's tendency to separate natural philosophy and theology stemmed form his deeply held convictions about the necessity of protecting faith from over-zealous reasoning: "For Ockham the issues concerning the relation of faith and reason, theology and science were expressed typically with utter clarity, although the strength of the analogy of science and theology was too strong for him to discard it altogether. But Ockham's characterization of theology as a science was an attempt to restrict theology to a niche safe from questionable metaphysical entities and logical criticisms. . . . By analytical inquiry Ockham demonstrated that philosophy was

incompetent to deal with matters of theology, and freed philosophy even further for the examination of the natural world."

[44] Oberman, p. 52.

[45] Copelston, p. 258.

[46] *Ibid.* Bradwardine's opposition to certain younger contemporaries, such as Robert Holcot, Thomas Buckinghan and Adam Wodeham, stems from their tendency to go beyond Ockham's rather moderate treatment of the problem of contingency to a much more radical contingency. All three of these theologians used logical and grammatical arguments to safeguard human freedom against rigid determinism. Their main similiarity to Ockham was their use of the concept of God's absolute power to question the capacity of human reason to determine the truth about God and the natural world. Unlike Bradwardine and Ockham, they did not generally try to approach contingency from a cosmological perspective. Thus their opinions shed little light on Bradwardine's use of time as a factor in contingency. Not being a logician and preferring a cosmological approach, Bradwardine dismissed many of their arguments. J. A. Robson suggests, however, in *Wyclif and the Oxford Schools*, pp. 48-49, that Bradwardine may have persuaded Buckingham, a fellow Mertonian, to moderate his approach to contingency. For a fuller treatment of this issue, see Chapter Eight below. For discussions of Holcot's view of contingency, see Normore, pp. 373-74; Paul A. Stretveler, "Robert Holkot's View of Contingency: A Preliminary Account," *Studies in Medieval Culture*, 8-9 (1976), pp. 163-71; Leff, pp. 216-227; and Oberman, pp. 43-46. For Wodeham, see Leff, pp. 241-54, and Oberman, pp. 46-48.

[47] Normore, p. 369.

[48] *Ibid.*, pp. 372-73.

[49] Both Oberman (p. 54) and Normore (p. 374) emphasize this point.

[50] See *De causa Dei*, III, 50, p. 810, C-D, in which Bradwardine cites his favorite authorities, including Aristotle, Grosseteste, Boethius and Anselm.

[51] *Ibid*, I, 14, p. 209, E: "Si Deus esse desineret, nihil esset praeteritum, nec futurum, verum nec falsum, possibile vel impossibile, necessarium vel contingens, nec etiam posset esse: ex quo et oppositum sequitur euidenter, scilicet ipsum Deum, et sic aliquid praefuisse, esse et fore, et similiter alia posse esse per omnipotentiam Dei magnam. O quam necessarium est hunc esse, quem tam impossibile est desinere vnquam esse, et quod Deum qualitercunque non esse, contradictionem necessarissime continet et importat; et quod necesse esse, videtur maxime proprium nomen Dei." See Normore, pp. 374-75.

[52] *De causa Dei*, III, 52, p. 857, B: "Respondebitur forsitan, quod ex praeteritione rei praeteritae oritur quaedam relatio, qua necesse est simpliciter illam fuisse, quare impossibile est simpliciter illam non fuisse. Sed hoc reprobatum est prius, quando monstrabatur 'A' non fuisse, nullam contradictionem formaliter implicare. Illam etiam relationem, non est necesse simpliciter esse vel fuisse; Aliquando enim non fuit; quare nec repugnaret formaliter eam nunc non esse; ergo nihil facit necessarium simpliciter. Illa quoque relatio vel est ad Deum, seu ad voluntatem diuinam, vel rem aliquam naturalem seu res aliquas naturales. Primum erat destructum per 30^{um} huius; Secundum stare non potest." Also III, 53, proposition 23, p. 875, D: "Quod cum futura contingentia fiant praesentia, aut in praeteritum dilabuntur, voluntas diuina respectu illorum non desinit esse libera aliqua libertate, seu aliquo modo libertatis intrinsecus, qua vel quo prius fuerat libera, nec incipit esse necessaria aliqua necessitate opposita respectu ipsorum."

See also William J. Courtenay, "John of Mirecourt and Gregory of Rimini on Whether God Can Undo the Past," *RTAM*, Part II, 40 (1973), pp. 149-50. In taking this position, of course, Bradwardine found himself at odds with prevailing scholarly opinion. Courtenay analyzes the debate over whether God can undo the past, which

reached its climax in Paris in the late 1340s. Although Bradwardine was not directly involved in the Paris condemnations of 1347, the theory that the past is no more necessary than the future was criticized by some theologians as being too deterministic. Courtenay describes Mirecourt's attempt to reach a middle ground between Bradwardine's view that God can freely undo the past and Thomas Buckingham, who insisted that the past cannot be changed even by God. Mirecourt's solution was to argue that God was initially free to make the past in any way he wished, but he cannot change the past once it has occurred (see especially Part II, pp. 147-54). Here again, the heart of the problem seems to be the difficulty of relating God's experience in his eternal present to the human experience of time. In Bradwardine's view, Mirecourt's solution would affirm his own idea that God can freely act within his creation. When he says that God could alter a past event without contradiction, Bradwardine is stressing that God's will is not temporally limited: even if God "changes his mind," he is not bound by the before-and-after which is inherent in change in the created world. Mirecourt reflects sympathy with the philosophical impulse of his age to think that God somehow is able to change through time without impairing his fundamental attribute of immutability. For a more thorough treatment of this particular issue, see also M. Jean-François Genest, "La liberté de Dieu à l'égard du passé selon Pierre Damien et Thomas Bradwardine," *Annuaire de l'école pratique des hautes études*, 85 (1977-78), pp. 391-93.

[53] *De causa Dei*, I, 24, p. 243, D: "Deus autem ex sua infinitissima claritate comprehendit omnes res particulares, et omnes particulas temporis, sicuti sunt, verissime per seipsum: Non enim indiget comparatione vel relatione praeteritorum vel futurorum ad praesens instans, more infirmitatis humanae, sed intelligit omnia simul et praesentialiter aeque clare; et hoc est, quia non scit per tales propositiones verbales mutabiles, sed per suam essentiam, et propriam voluntatem, quae semper

vniformiter, et inuariabiliter omnia repraesentant. Quemadmodum si poneretur visus punctualis quiescens in centro coeli circumuoluti, et videret per extramissione et actiue non passiue, sicut Deus res videt; videret semper vniformiter, sine omni mutatione sui, circumgiratas continue singulas partes coeli, et eandem partem nunc in oriente, nunc in meridie, nunc in occidente: Sic et Deus omni eodem modo ex parte sui intrinsece videt aliquid primo futurum, secundo praesens, tertio vero praeteritum; et hoc est quia non videt patiendo quicquam a visis, seu passiue sed agendo potius seu actiue, sicut superius est ostensum." See Normore, p. 375.

[54] *De causa Dei*, III, 1, p. 637, D-E: "In primis igitur ostendendum, Deum posse necessitare quodammodo omnem voluntatem creatam ad liberum, imo ad liberrimum actum suum, similemque cessationem et vacationem ab actu. Deus enim potest velle voluntatem creatam producere liberum actum suum, et hoc antecedenter, et prius naturaliter voluntate creata; quare et per 10. primi, illa de necessitate obediret, et hoc, quamdiu Deus sic voluerit ipsam velle. . . . Quoniam enim quod Deus vult, non potest non esse, cum vult hominis voluntatem nulla cogi vel prohiberi necessitate ad volendum vel non volendum; et vult effectum sequi voluntatem, tunc necesse est voluntatem esse liberam, et esse quod vult." See Leff, p. 98.

[55] As creator and first cause, God has an understanding of the universe too perfect for created beings to comprehend. See *De causa Dei*, I, 12, p. 201, B: "Quamdiu igitur corpus quod corrumpitur, aggrauat animam, et terrena habitatio deprimit sensum plurima cogitantem, non potest homo intelligere Deum perfecte sicuti est, ipsom et dicente Mosi deprecanti. Non poteris videre faciem meam, non enim videbit homo, et viuet, Exod. 33. Quare secundum Philosophum, 1. Physic. et alibi; Innata est nobis via a notioribus nobis ad notioria naturae, quae sunt simpliciter notioria, a posterioribus siclicet ad prioria, et a causatis ad causas. Nomina igitur quibus Deum cognoscimus, non significant ipsum per se essentialiter,

et penitus absolute, quoniam a creaturis, et effectibus notioribus nobis transferuntur ad ipsum ignotiorem nobis, licet simpliciter notiorem."

[56] Bradwardine develops at considerable length the connection between necessity and free will in *De causa Dei*, III, chapter 2, pp. 444-48. In a corollary to this chapter Bradwardine makes the point that the human will is free to choose from the possibilities which God makes available to it, p. 448, D-E: "Corollarium, quod non ideo dicitur liberum Arbitrium, quia libere potest velle et nolle quodcunque, sed quia libere potest velle quodcunque obiectum suum volubile, et nolle quodcunque obiectum suum nolubile; sicut si visus esset potentia libera, non ideo tamem posset videre sonam, et visibilia sua tantum. . . . Nec ideo dicitur liberum arbitrium quia libere potest in oppositum cuiuslibet actus sui, vt praemissa demonstrant, sed quia ex rationali arbitrio siue iudicio spontanee illum agit, sicut primum huius ostendit. Nec ideo dicitur liberum arbitrium quia libere potest benefacere et peccare, sicut ex praemissis consequitur euidenter, sed propter causam proximo assignatam."

[57] *De causa Dei*, I, 27-29, pp. 261-271.

[58] *Ibid.*, I, 28, p. 266, D: "Fatum vero inhaerens rebus mobilibus dispositio, per quam prouidentia suis quaeque nectit ordinibus. Prouidentia namque cuncta pariter quamuis diuersa, quamuis infinita complectitur; Fatum vero singula digerit, in motu, locis, formis, ac temporibus distributa, vt haec temporalis ordinis explicatio in diuinae mentis adunata prospectu, prouidentia sit; eadem vero adunatio digesta atque explicata temporibus, Fatum vocetur, quae licet diuersa sint, alterum tamen pendet ex altero."

[59] I, 30, p. 271, E: "Quod res voluntariae diuinae prouidentiae legibus gubernantur."

[60] Leff, p. 104.

[61] *De causa Dei*, III, p. 685, B-C: "Ponamus igitur simul esse praescientiam Dei, quam sequi necessitas futurarum rerum videtur, et libertatem arbitrij, per quam multa sine vlla necessitate fieri creduntur. . . . Sed si aliquid est futurum sine necessitate, hoc ipsum possit praescire Deus, qui praescit omnia futura; quod autem praescit Deus necessitate futurum est sicut praescitur; necesse est igitur aliquid esse futurum sine necessitate, vel praesciri sine veritate. Nequaquam ergo recte intelligenti nomen, repugnare videntur praescientia, quam sequitur haec necessitas, et libertas arbitrij, a qua remouetur necessitas, quoniam et necesse est, quae Deus praescit, futura esse, et Deus praescit aliquid esse futurum sine omne necessitate." See Leff, p. 104.

[62] Leff, pp. 104-5. Leff cites *De causa Dei*, III, 50, p. 823, A: "Corollarium, quod omnem actum volutionis et cognitionis diuinae praesentem necesse est, necessitate sequente praedicta, semper fuisse, et similiter semper fore; quare et quod omnia, quae praesentialiter sunt, fiunt aut eueniunt, simili necessitate sunt, fiunt et eueniunt in praesenti; et quod omnia quae euenient, simili necessitate in futuro; imo et quod omnia quae nunc fiunt, de aliqua necessitate praecedente nunc fiunt; et quod omnia, quae eueniunt, de aliqua necessitate precedente, euenient in futuro."

[63] Leff, pp. 105-6.

[64] *Ibid.*, pp. 106-7.

[65] *De causa Dei*, III, 52, p. 843, E: "Quod Deus vult, non potest non velle, quia aliter sua voluntas esset mutabilis."

[66] Leff, p. 108. Leff cites *De causa Dei*, III, 52, p. 841, A-B: "Sic forte in Deo, vbi non est aliqua temporalis praecessio sed causalis, si respiciatur ipsa Dei natura non in ratione agendi, et comparetur liberae voluntati hominis nudae ab actu antequam velit, verum erit dicere, Deus potest non velle quod vult: Si vero respiciatur ipsa diuina natura in ratione agendi, et comparetur liberae voluntati

hominis cum iam actu vult, verum erit dicere, Deum necesse est velle quod vult, et non velle quod non vult: Impossibile est enim eum non velle quod vult, vel velle quod non vult. Quam distinctionem facit in nostro posse et actu prioritas temporalis hanc ibidem facit prioritas causalis et subiecti super quod redit praedicatio diuersa, diuersa consideratione, sed manifestior est distinctio vbi comitatur prioritas temporalis."

[67] Oberman, p. 65.

[68] *Ibid.* Quoted from *The Essentials of Theism* (London: Sheed and Ward, 1949), p. 123.

[69] Oberman, pp. 66-67.

[70] *Ibid.*, p. 70.

[71] *Ibid.*, p. 71. The similarities between Anselm's and Bradwardine's conception of God's eternal knowledge are spelled out most explicitly in Bradwardine's analysis of eternity in *De causa Dei*, III, 51, pp. 826-31. See especially the corollary to Book III, chapter 51, p. 830, D: "Huius autem transumptionis causa est, quia non habemus verbum significans proprie aeternitatis stabilem mansionem, quare necessario cogimur transferre secundum similitudinem qualemcunque verba nostra temporalia secundum differentias quaslibet temporales ad aeternitatem et Deum aeternum, actusque suos intrinsecos coaeternos, quia omni tempori coexistunt, nec vlli tempori defuerunt aut desunt, vel deerunt in futuro. Huic autem testimonium perhibet Anselmus de Concord. 3. Propositium, inquiens, secundum quod vocari sunt Sancti in aeternitate, in qua non est praeteritum vel futurum, sed tantum praesens, immutabile est in aeternitate: non enim fuit aliquid, aut erit aliquid, sed tantum est."

[72] In support of these points, Oberman cites *De causa Dei*, II, 30, pp. 578-97; here Bradwardine explains at great length how God leads the human will without forcing it consciously to follow a particular path.

[73] Oberman, p. 72, says nevertheless that Bradwardine turned the ideas of Anselm and Aquinas in new directions and often away from the orthodox position..

[74] *Ibid.*, pp. 73-75.

[75] *Ibid.*, p. 76.

[76] *Ibid.*

[77] "Free Choice and Liberty According to Thomas Bradwardine," Dissertation, University of Toronto, 1965.

[78] *Ibid.*, p. 179.

[79] *Ibid.*, p. 71. See *De causa Dei*, I, 19, p. 226, B: "Neque nonum procedit: Non enim Deus arguitiue tantum, et non intuitiue scit futura, sicut Astrologus calculator inclusus scit eclipsin futuram vel praesentem supra horizontem proprium, vel sub illo, per certam demonstationem, non per claram intuitionem; Sed sicut videns Solum, videt eum per specium eius receptam in oculo, priorem naturaliter visione et causam illius, sine quolibet argumento."

[80] See above, note 50.

[81] McCarthy, p. 3. See also p. 17 for a discussion of Augustine and p. 65 for a discussion of Scotus.

[82] For a recent comprehensive study of the problem of evil and sin in late medieval thought see "Philosophy of Mind in Action" and "Ethics," Parts VIII and IX of *CHLMP*, pp. 593-719.

[83] *De causa Dei*, I, 26, p. 251, B: "Omne siquidem per se volubile et amiabile a bono et sapiente, est aliquo modo bonum, vt tam Philosophi, quam Theologi pariter contestantur. . . . Item omnis veritas est bona, quia recta, iusta, et sancta; et omnis essentia est veritas. . . ." See Oberman, p. 124.

[84] *Ibid.*, p. 255, E: "Item si actus adulterij et homicidij per se sint mali, cum actus secundum essentiam similis sit in coniugatis, et non coniugatis, in innocentibus et reis mortis, erit et peccatum in istis." See Oberman, p. 125.

[85] *Ibid.*, II, 2, p. 448, D: "Corollarium, quod non ideo dicitur liberum arbitrium, quia libere potest velle et nolle quodcunque, sed quia libere potest velle quodcunque obiectum suum volubile, et nolle quodcunque obiectum suum nolubile." And *ibid.*, p. 447, B-C: "Et credo quod posset saltem per accidens, si videlicet nolendo et respuendo aliquod paruum bonum posset consequi aliquod maius bonum, vel vitare aliquod maius malum, sicut et potest velle malum. . . ." See Leff, p. 92.

[86] Leff, p. 58.

[87] *De causa Dei*, I, 12, p. 200, D: "Est etiam causa illius quia, enim bonum est bonum, ideo non est malum, et non e contra; quia non esse malum, penitus nihil ponit, et per consequens nihil causat. Primum ergo principium complexorum nullatenus negatiuum, sed affirmatiuum firmiter arbitrandum." See also I, 34, p. 294, D: "Deus ergo est causa huius veritatis, et non nisi voluntarie. Vult ergo Deus hanc esse veram, Peccatum est."

[88] *Ibid.*, I, 34, pp. 295-96, E-A: "Sic igitur et omnium constitutionem, Coeli, dico, et terrae vndique totius permixtam, maxime contrariorum principiorum vna decorauit harmonia, siccum humido, calidum frigido, graue leui, rectum circulato decorauit: totam terram, et mare, aetherem, atque Solem et Lunam, et totum coelum decorauit vna, quae per omnia transit virtus; ex immixtis et diuersis, ex aere, terra, igne et aqua totum orbem creans et disposens vnius sphaerae superficae; ac maxime contrarias in eo naturas cogens adinuicem concordare, et ex hic ingenians vniuerso salutem." See Leff, p. 60.

[89] According to Oberman, p. 129, Bradwardine followed traditional interpretations of the Old Testament, where, for example, God allowed the election of King Nebuchadnezzar as a means for punishing sinners and vindicating the righteous.

[90] Oberman, p. 128.

[91] *De causa Dei*, I, 47. Trans. Paul L. Nyhus in H. A. Oberman, *Forerunners of the Reformation: The Shape of Late Medieval Thought Illustrated by Key Documents* (London: Lutterworth Press, 1966), p. 158. See Saville edition, p. 438, D.

[92] Oberman-Nyhus, p. 154; see Saville edition, p. 437, B-C.

[93] *Ibid.*, p. 162; see Saville edition, p. 441, A.

[94] *Ibid.*, p. 161; see Saville edition, p. 440, E.

[95] "The *Sermo Epinicius*," pp. 295-306.

CONCLUSION

[1] Of course Bradwardine admitted that one could have general knowledge about the future but he denied that one could transform general knowledge of the future into certain knowledge through logic or any other means. For example, Bradwardine acknowledged the usefulness of astronomical prediction but he did not think that the prediction of astronomical events in the future constituted certain knowledge of the future since the prediction could only be verified by those events taking place. Similarly he believed in the truth of divine revelation but he considered it impossible for the human mind to determine how and when a given prophesy might be fulfilled.

[2] The essentially conservative nature of Ockham's thought is an underlying theme in Marilyn McCord Adam's extensive *William Ockham* (Notre Dame, Indiana: University of Notre Dame Press, 1987).

[3] Leff, p. 18. See Introduction, note 3.

[4] See Murdoch, "From Social to Intellectual Factors," pp. 271-72.

[5] William J. Courtenay, "John of Mirecourt and Gregory of Rimini on Whether God Can Undo the Past," Part I, *RTAM*, 39 (1972), p. 231.

[6] *History of Christian Philosophy*, pp. 498-99.

[7] *Ibid.*, pp. 499-500.

[8] *Ibid.*, p. 498.

[9] *Ibid.*, p. 489.

[10] *Ibid.*, p. 501.

[11] *Bradwardine and the Pelagians*, p. 131.

[12] *Ibid.*, pp. 131-32.

[13] Robson, pp. 41-43.

[14] Leff, pp. 228-30.

[15] *Ibid.*, p. 234.

[16] Robson, p. 32.

[17] Robson, p. 53, quotes and translates this passage from Buckingham's *Quaestiones*, New College, Oxford MS 134, Fo. 327r^{a}. See *De causa Dei*, III, 5, corollary 13, p. 657, E.

[18] Robson, p. 52.

[19] Fo. 335r^{a} of *Quaestiones*, trans. Robson, pp. 57-58.

[20] Robson, p. 58.

[21] Fo. 338r^{b}-v^{a} of *Quaestiones*, trans. Robson, p. 58. See above, note 18.

[22] For the subtle differences between Buckingham's and Ockham's views on God's capacity to undo the past, see, for example, Adams, *William Ockham*, pp. 1225-27.

[23] In "Thomas Buckingham's *Ostensio Meriti Liberae Actionis*, Conclusions 1-15: 'De Contingentia Futurorum er Arbitrii Libertate': An Edition and Study" (Dissertaion, University of Toronto, 1979), Bartholemew Ruben De La Torre examines Bradwardine's interaction with Buckingham on the issue of future contingents. De La Torre suggests that parts of Buckingham's sentence commentary and the first part of the *Ostensio Meriti Liberae Actionis* were direct replies to the *De causa Dei*. Buckingham, who might have been Bradwardine's student (see pp. 132, note 19), rejected Bradwardine's definition of antecedent necessity and tried to find a "Catholic middle way" between extreme determinism and the indeterminacy advocated by Cicero and, to a lesser extent, by Pelagius (p. 89). Since De La Torre's analysis of the 'De Contingentia Futurorum et Arbitrii Libertate' supports Robson's conclusions about Buckingham's relationship to Bradwardine without substantially adding any new material relevant to Bradwardine's view of time, De La Torre's study does not feature in the body of this dissertation.

De La Torre is not specific about the actual dating of Buckingham's writing as compared to the *De causa Dei*. He reports, however, (p. 185) a discovery made

by Zenon Kaluza that Bradwardine and Buckingham probably did not have a public debate over contingency in Paris which Leff, Oberman and Robson believed had taken place. In "La preténdu discussion parisienne de Thomas de Bradwardine avec Thomas de Buckingham: témoinage de Thomas de Cracovie," *RTAM*, 43 (1976), pp. 209-36), Kaluza demonstrates that Thomas of Cracow, the supposed witness to the debate, could not in fact have witnessed it since he was born eleven years after the deaths of Bradwardine and Buckingham. Kaluza argues instead that Thomas of Cracow was the owner of a manuscript (MS Paris Bib. Nat. Lat. 16409) written by Stephen of Chaumont who had summarized Bradwardine's and Buckingham's differences on future contingents. According to Kaluza, a misreading of the manuscript in the early twentieth century gave historians the idea that a public debate had taken place in Paris, when in fact the communication between Bradwardine and Buckingham occurred in England over a period of several years. Moreover, although this communication indicates disagreement on several points, it does not suggest the personal antagonism which is usually associated with the Paris debate.

[24] *Forerunners*, p. 133.

[25] Pantin, pp. 144-45.

[26] *History of Christian Philosophy*, pp. 500-1.

[27] *Ibid.*

[28] Leff, pp. 216-17.

[29] *Ibid.*, pp. 218-19.

[30] *Ibid.*, p. 226.

[31] Oberman, *Archbishop Thomas Bradwardine*, pp. 45-46.

[32] *Super Libros Sapientiae*, Chapter III, Lecture 35, ed. Heinrich Gran (Hagenau: 1494), trans. Paul L. Nyhus, in *Forerunners*, p. 143.

[33] Chapter XII, Lecture 145, in *Forerunners*, p. 149.

[34] In "Philosophical Scepticism in England in the Mid-Fourteenth-Century," *Vivarium*, 21 (1983), pp. 56-7, Leonard Kennedy challenges the definitions of skepticism commonly used by many historians of the late medieval period and suggests that mid-fourteenth-century theologians in England were more skeptical philosophically, if not theologically, than recent studies of their work indicate.

[35] In "Robert Holkot on Future Contingencies: A Preliminary Account," p. 168, Paul A. Stretveler contends that the Augustinian-Boethian solution was actually very similar to the nominalist one, since the definition of an eternal idea in the Augustinian-Boethian tradition corresponds very well to the late medieval definition of a proposition as a statement which is always true. If Stretveler is correct, it might be possible to identify points of agreement between late medieval thinkers on matters which seem on the surface to be controversial. Again, the main distinction between an eternal idea and a proposition depends not on the definition of a proposition as such but on the different approaches medieval natural philosophers and logicians took to the temporal factors which affect the truth of propositions.

[36] William J. Courtenay, "Recent Work on Fourteenth-Century Oxford Thought," p. 232.

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