

Introduction

Spiritual Calculations

But you have arranged all things by measure and
number and weight.

—Wisdom 11:20

For he maad alle by myght and sleyght
In certeyne noubre of mesure and weyght;
Bot sotyl may there no mon bee
That mesuryng to know bot hee.

—*Prik of Conscience* 7.157–60

For God made all by might and wisdom
In certain number of measure and weight
But of cunning there is no one
Who knows that measuring except for him.

If medieval people believed that God ordered everything in the world in a certain number and measure and weight, they also knew, according to the incredibly popular fourteenth-century penitential poem *Prik of Conscience*, that it was impossible to appreciate fully God's supreme measuring abilities. But this did not stop late medieval preachers from encouraging their audiences to measure, quantify, count, and perform quantitative acts to describe God as well as to venerate him. This book explores the use of numbers, arithmetic, and other mathematical operations in late medieval English sermons,

both Middle English and Latin. It argues that these texts teem with examples of quantitative reasoning, from the arithmetical to the numerological, and that they engage with numerical concepts in ways that are largely underappreciated by today's scholars. These examples are significant because they demonstrate that mathematical concepts were promoted as a way for audiences to connect with the divine and to appreciate divine truth. However, many of the texts reveal a tension between the desire and ability to know the divine through number, while at the same time offering resistance to the divine's ultimate quantification. My thesis is that medieval sermons educated audiences in what I call a hybrid form of numerate practice—one that relied on the audiences' pragmatic quantitative reasoning combined with spiritual (i.e., numerological) interpretations of number provided by the preacher, which created a deep and rich sense in which number was the best way to approach and understand the divine mysteries of the world, as well as how one could best live as a Christian in that world.

Attention to numbers and mathematical operations can be found in a wide variety of medieval religious texts. Middle English treatises such as *Prik of Conscience* and Walter Hilton's *Scale of Perfection*, visionary texts including Catherine of Siena's *Orcherd of Syon* and Margery Kempe's *Book*, biblical cycle plays, the poetry of John Lydgate, Geoffrey Chaucer, and the Pearl Poet, metrical charms, and so forth all engage with discussions of number, measures, or quantitative reasoning in various forms, and many of these texts will be referred to during the course of this study. My book, however, focuses on sermons because discussions of quantitative reasoning in sermons are often more developed and more intense than those found in other genres. Moreover, sermons reveal a range of remarkable approaches to engaging with number. As a form of pastoral literature, sermons are rhetorically crafted for exhortation and instruction, as well as for enjoyment, and I have come to consider sermons to be some of the most intriguing and interesting texts of the Middle Ages. As Holly Johnson persuasively describes in her introduction to the sermons of the early fifteenth-century Benedictine Robert Rypon,

Far from dry theological treatises or mere statements of official doctrine, many sermons were lively, rhetorical endeavors, artfully constructed and, presumably, energetically delivered. Attending a sermon by a good preacher was often an event, even a form of entertainment, as Chaucer's *Wife of Bath* implies when she includes sermons, along with vigils, processions, pilgrimages, plays, and weddings, as occasions on which she has "bette leyser for to pleye / And for

to se, and eek for to be seye” (“better leisure to play / And to see and also to be seen”).¹

Sermonists composed their texts with multiple purposes in mind: they were of course intended to educate audiences about Scripture and doctrine as well as to exhort audiences to repentance, but they also were intended to express God’s love and to model practices of veneration.

I first became interested in what lay medieval people thought of numbers and mathematical operations when I was involved with a local adult literacy program in Logan, Utah. I remember a particular volunteer meeting when one of my fellow volunteers, a math teacher, argued that for adult learners, gaining skills in numeracy was just as important as (or even more important than) gaining literacy skills. That conversation, coupled with my interest in the history of mathematics and technology (which has been fostered by my teaching at a science- and technology-rich campus, Utah State University), led to this project. That same year, my older child was in preschool and struggling with some basic numerical concepts, which eventually led me to volunteer in a local public elementary school to help children with their math skills. A sabbatical spent attending university math classes such as the “History of Mathematics and Number Theory” by Carnegie award-winning professor Jim Cangelosi and a course on math pedagogy for elementary schoolteachers helped to awaken some of my long-dormant quantitative skills, as well as to familiarize myself with many concepts in math education. I began to notice evidence of numeracy and mathematical engagement in the medieval literature I was reading at the time, in particular *The Book of Margery Kempe*, which provides many examples of Kempe’s quantitative thinking.

I recognize of course that there are many ways to approach the question of medieval quantitative reasoning and numeracy. One could look at merchant account books or churchwarden records to understand medieval methods of calculation; one could also look at building technologies to explore geometrical understanding, or even agricultural and farming practices to appreciate what calculations were involved, a suggestion made by Alexander Murray in 1978: “The primitive exigencies of land-division, sheep rearing, and the measurement of arable produce may have coaxed even peasants into elementary arithmetic earlier than records show.”² Murray’s study *Reason and Society in the Middle Ages* was the seminal text on medieval numeracy for many years, and it argued that the development of commerce created an “arithmetical mentality” by the end of the Middle Ages because “the spread of money through a society is a direct invitation to it to calculate with numbers.”³ This

idea of the “arithmetical mentality” of the late Middle Ages has proved greatly influential to several generations of scholars (me included),⁴ and I will return to this question of the role of currency and spirituality in chapter 4. It seems only fitting to begin this book with a nod to Murray and his argument about the influence of the spread of money on late medieval cultures, and then to draw chapter 4 to a close with a discussion of counting money as a spiritual exercise in a sermon by Robert Rypon. In addition, the conclusion to *Spiritual Calculations* picks up on this question of how attention to money may have affected memory and text in *The Book of Margery Kempe*.

Although cultural artifacts and farming practices will be mentioned in my study, they are not the focus. As a scholar of literature, I approach the question of the role of quantitative reasoning in medieval popular religious culture by exploring the literature produced by that culture in order to uncover lay and clerical understandings of number. Because sermons reached a wide lay audience, an audience that is both reflected in and educated by those sermons, they are at the center of my study and form the base of my evidence. Hence, it is my belief that the sermons discussed in this book both reflect medieval audiences’ understanding of numerate practice and helped to shape that understanding and practice.

In reviewing the scholarly literature on this topic of medieval number and numeracy, I have found several broad areas of study to be particularly useful. First and foremost is the scholarship on the history of mathematics in the Middle Ages. There are many such history texts, most notably Carl Boyer and Uta Merzback’s *A History of Mathematics*, which cover the history of mathematics from the ancient world to the present, and their chapters on how ancient Greek and Roman mathematics passed to medieval Europe, often through the mediation and development of Arabic sources, have proved particularly useful.⁵ Other specific studies focus on individual authors or texts, including, for instance, the work of Menso Folkerts, which traces the transmission of texts by Euclid through the centuries.⁶ Other scholarly texts discuss the development of algebra, as well as the introduction of other concepts and arithmetical tools in the Middle Ages, including the abacus.⁷ Much scholarship on the history of European mathematics looks at specific contributions by mathematicians such as Robert Grosseteste and Thomas Bradwardine and the “Oxford Calculators,” as well as studies on Leonardo di Pisa (Fibonacci) or the development of accounting systems for banking in Italy in the thirteenth and fourteenth centuries. Although these studies are not directly discussed in my book, they are important to recognize as they do inform some of the background underlying the concepts that sermons explore. All in all,

these many studies on the history of medieval mathematics demonstrate that medieval mathematical thinking was complex, ingenious, and productive.

Another branch of scholarship that has been particularly useful in shaping my project is those studies that examine how number was used symbolically or allegorically in medieval texts. Although there are many modern popular books on numerology and arithmology that I would recommend avoiding, there are some excellent studies of medieval numerological practices. The first place to turn is to the German encyclopedia on numbers by Heinz Meyer and Rudolf Suntrup, *Lexikon der mittelalterlichen Zahlenbedeutungen*, which describes twelve ways that numbers were assigned symbolic meanings in medieval religious commentaries and other writings.⁸ Discussions of the symbolic value of numbers in medieval culture also appear in a wide variety of studies where one would not necessarily expect them; for instance, a particularly good source is Elizabeth Sears, *The Ages of Man: Medieval Interpretations of the Life Cycle*, which describes how writers developed symbolic meanings behind various numbered entities, such as the four seasons or the three ages of man.⁹

Equally useful in conceptualizing my project were those studies that focus on how quantitative reasoning was used in medieval religious practice. An excellent starting place is the essay collection by Teun Koetsier and Luc Bergmans titled *Mathematics and the Divine: A Historical Study*; this book contained the first essay I encountered by Faith Wallis, whose writings on what she terms “philosophical numerology” and “allegorical numerology” have been particularly influential on my thinking of what I refer to as “hybrid numerate practice.”¹⁰ Perhaps the most fascinating essay I have read on quantitative reasoning in religious practice is Thomas Lenten’s “Counting Piety in the Late Middle Ages,” in which Lenten explores what he terms the “arithmetic of salvation” that “appeared as an essential component of the practice of piety.”¹¹ As part of this study, he includes examples of medieval texts that advocated enumeration and arithmetic for the purpose of pious practice. More recently, Albrecht Classen’s *Handbook of Medieval Culture* includes a lengthy section on “number” by Moritz Wedell that describes medieval engagement with a variety of mathematical concepts.¹² Many studies on number, enumeration, measurement, and quantitative reasoning in specific religious, pastoral, devotional, and visionary texts have also been published, many of which have helped to shape my argument and conclusions. These include M. Teresa Tavormina’s early essay on perfect numbers in *Dives and Pauper*,¹³ and more recently, essays emphasizing the role of enumeration and quantitative reasoning, including Nicholas Watson’s “The Making of *The Book*

of *Margery Kempe*,” Martha Rust’s “The *Arma Christi* and the Ethics of Reckoning,” Rachel Fulton’s “Praying by Numbers,” and Margaret Connolly’s “Preaching by Numbers” and “Practical Reading for Body and Soul.”¹⁴ When it comes to the extent that quantitative reasoning appears in late medieval religious texts, these essays have not come close to exhausting the topic. Whereas these studies emphasize that number and quantitative reasoning are important for particular texts, my book demonstrates how widespread the phenomenon was—it occurred at a remarkable rate in sermon literature and reached wide lay and clerical audiences. Ultimately, because of the popularity of spiritually enhanced quantitative reasoning in sermons, I am able to assert that it fundamentally shaped the way medieval people thought about number. I therefore go beyond the specific studies already published to make a wider argument about a genre and a culture as a whole.

In setting out to study how texts capture assumptions about numbers and quantitative reasoning, I found another broad area of scholarship, on numeracy, particularly influential. Whereas “litteratus/a” was a Latin term used in the Middle Ages indicating somebody with an ability to read Latin or with a familiarity with Latin grammar, “numeracy” was coined in 1959 by an English education committee.¹⁵ Originally intended to serve as a mirror of literacy, the term was expanded in 1982 by the Cockcroft Committee report titled “Mathematics Counts,” which argued that “a numerate person should . . . understand some of the ways in which mathematics can be used as a means of communication,” and this required “the possession of two attributes”: first, “‘at-homeness’ with numbers and an ability to make use of mathematical skills which enables an individual to cope with the practical mathematical demands of his everyday life,” and second, “an ability to have some appreciation and understanding of information which is presented in mathematical terms.”¹⁶ As it has been defined more recently by the New South Wales Department of Education and Communities and employed in many contexts, “numeracy involves using mathematical ideas efficiently to make sense of the world. . . . Each individual’s interpretation of the world draws on understandings of number, measurement, probability, data and spatial sense combined with critical mathematical thinking.”¹⁷

Scholarly studies on numeracy have emerged from a variety of fields, notably education, anthropology, and sociology. Their focus on exploring “vernacular numeracy” or nonformally acquired numeracy led me to question how popular medieval religious texts advocated numeracy. An early and influential anthropological study is Thomas Crump’s *Anthropology of Numbers*, which examines how numbers are learned and articulated across cultures.¹⁸

Specific studies on numeracy that have shaped my thinking on calculation include those that examine informants' vernacular practices.¹⁹ Although of course I cannot interview medieval people about what they thought about mathematical concepts and how they performed them, I can argue that these sermons present for us a new way of looking at medieval numeracy—we can now appreciate how sermons build on and combine the audiences' practical idea of counting, arithmetic, measurement, and so on with a spiritual understanding of number. Medieval sermons demonstrate that people could work simultaneously in both realms of number, the practical and the spiritual. I assert that certain participatory elements in these sermons created and invited practices of devotional math and that we can see evidence of quantitative reasoning being promoted as a mode of veneration.²⁰

Last but not least, the scholarly literature on medieval sermons has been of the utmost importance to my study. The literature on this topic is vast, and my book would not have been possible without the dedicated work of Veronica O'Mara and Suzanne Paul, whose multivolume *A Repertorium of Middle English Prose Sermons* offers the incipits, explicits, and summaries of hundreds of Middle English sermons, many of which only appear in manuscript form and are currently unedited. When I started this project, I planned only one chapter on sermons, and the *Repertorium* guided my way to finding the richness of these texts, as well as numerous side projects along the way. Two sermon scholars of note have been of particular importance to my study, Siegfried Wenzel and Holly Johnson, without whose editions, translations, and analyses I could not have written chapter 1 and chapter 4. As more editions of previously unedited sermons are produced, scholarly attention to medieval sermons will certainly only increase.²¹

The specific texts addressed in my study—namely, a number of individual sermons from a range of English manuscripts, as well as the sermon cycles of *Jacob's Well* (Salisbury Cathedral MS 103), Warminster, Longleat House MS 4, and Robert Rypon's collection found in London, British Library, MS Harley 4894—all share something in common: they employ number and quantitative reasoning to express something important about God or humankind's relationship to God, or what drives them from God—sin. They also share something else in common: they have attracted relatively little sustained scholarly attention. Scholarly access to the majority of medieval English sermons has been limited by the relatively few editions available. Moreover, late medieval sermons are not usually included in the readings for literature and history classes, so they have a relatively limited modern scholarly audience. If

my book can do one thing, I hope it convinces readers of the value of studying sermons.

This book weaves together two strands of medieval understanding of numbers: the practical sense of number used in a medieval person's daily life and activities, and the spiritual sense of number that appears in numerological discussions. The book demonstrates how medieval sermons draw on and combine both the practical and the spiritual understanding of number. More specifically, I argue that sermonists present their audiences with numerical and mathematical ways of understanding or approaching God that are different from, and at times more efficacious than, literary or sensorial paths. Medieval sermons modeled for their audiences a numerate practice shaped by both pragmatic and spiritual associations, which formed a significant part of their devotional practice. My study also suggests that in some situations, because of numbers' spiritual associations, medieval people could apply a different sense of "accuracy" when it came to calculating numbers. A sum or calculation might not be numerically accurate or fully calculable, but it could still be valuable and therefore "accurate" because it reveals a significant spiritual truth.

A lack of attention to medieval numeracy in current scholarship on sermons has caused us to miss something fundamentally important about this period—that the medieval laity would have been far more numerate, and in ways that we have not appreciated, than we might otherwise imagine. Those of us who focus on literacy must not forget its mathematical sibling.

Chapter 1, "Encountering the Divine Through Number in Middle English Sermons: An Overview," explores the ways in which preachers used number in vernacular sermons to engage and educate their audiences—namely, through sermon division and enumeration, number theory, numerology, and arithmetical examples. Late medieval sermonists relied on their audiences' pragmatic sense of number and expanded that with a spiritual understanding of number. Sermonists, therefore, encouraged in their audiences a hybrid numerate practice that was both pragmatic and spiritual, formed by practical experiences of number infused with numerological meanings. Sermonists capitalized on this hybrid understanding as a way to teach audiences how to live more Christian lives, to improve their Christian practice, and to understand more deeply God's universe.

Chapter 2, "Numbers in *Dives and Pauper* and the Sermons of Warminster, Longleat House MS 4: Models for Spiritual Understanding and Practice," examines two early fifteenth-century pastoral texts by an anonymous

Franciscan author that use numbers to represent divine truth and offer a way for audiences to approach God. I argue that the sermon is a particularly ripe and welcoming place for vernacular discussions of number and that the quantitative reasoning modeled in these sermons is both performative and collaborative. For this author, the goal of the pastoral tradition—with his use of number and math—is to offer an alternative model for thinking about one’s relationship to God and the world. The author drew on this audience’s practical, numerate understandings to show how one could apply that knowledge to abstract religious ideas like “forgiveness” to create a new, deeper understanding of the divine. The math in these texts offers a framework for making the unfathomable fathomable.

Chapter 3, “‘Knowing Thyself’ and God Through Number in *Jacob’s Well*,” addresses scholarly arguments that this sermon cycle trusted its lay audience to be involved in sophisticated choice-making and decisions in their education as they learned to “know themselves.”²² I argue that these sermons’ extended discussion of number, arithmetic, measure, and geometry is intended to contribute to the audience’s religious education. The sermonist sees discussions of mathematical concepts as a useful way for audiences to learn to “know themselves” spiritually and to understand better what God expects from them. Ultimately, numbers and numerate acts allow the sermon audience to approach God more closely, because contemplation and engagement with quantitative thinking impel the audience to become more obedient and virtuous. However, in contrast to the sermons of Warminster, Longleat MS 4 discussed in chapter 2, in *Jacob’s Well* God can be approached through number but not fully comprehended. In this case, the unfathomable remains unfathomable.

Chapter 4, “Quantitative Reasoning in the Latin Sermons of Robert Rypon in London, British Library, MS Harley 4894,” examines the Latin sermons of an English master sermonist, the Benedictine Robert Rypon of Durham. I argue that Rypon’s sermons offer several intense, extended allegories of number that demonstrate how important spiritual calculation had become in the early fifteenth century. In Rypon’s example, the number used to describe God, as well as God’s expectations for human behavior, is fully fathomable but quite complex. Of particular note is how he allegorizes the act of counting money to explain difficult theological concepts. Other sermons addressed in this book discuss proper tithing practices and basic monetary problems; Rypon’s money allegory directs his audience’s focus toward accounting—what scholars have argued fueled the late medieval arithmetical mentality—as he delights in demonstrating exactly how counting money can be used as a model of spiritual improvement. In Rypon’s deft hand, counting

money models exactly what God expects of Christians. For Rypon, even the most mercantile enterprise can be put to good use for devotional and spiritual contemplation.

The conclusion, “Practical and Spiritual Numeracy in *The Book of Margery Kempe*,” argues that despite scholarly efforts to label Kempe’s attention to number in her book as wholly mercantile in nature, her memory and discussion of number and arithmetical acts are shaped in large part by the hybrid numerate practices that sermons like those of Robert Rypon promote. Kempe of course was an avid sermon attendee, as well as a reader/listener of other religious works and a practitioner of late medieval piety, much of which focused on calculation. Her text shows this hybrid sense of numeracy at work, which I link to her consumption of sermons as well as other religious literature.

Because I argue that medieval people were encouraged to count and calculate during sermons and that sermons were participatory on many levels, I include an appendix outlining the ways in which medieval people counted and performed acts of arithmetic, as well as other mathematical practices. In all, *Spiritual Calculations* offers a reconsideration of what Alexander Murray and others characterize as the “arithmetical mentality” of the later Middle Ages, as my study argues that discussions of number, numerology, and mathematical concepts offer sermonists a way to explore and express fundamental doctrinal and theological concepts. Thus, this “arithmetic of salvation” can be expanded to include many more related concepts, including the quantitative reasoning of devotion and veneration, as well as that of blessedness and of sin and repentance.