

Diagram and Dimension:
Visualising Time in the Drawings of Opicinus de Canistris
(1296-c. 1352)



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Short Abstract

This thesis focuses on the representation of time within the diagrams of Opicinus de Canistris, a cleric working in the scriptorium of the Avignon Papacy from 1329, who created a collection of fifty-two large, highly complex, unbound drawings (BAV, MS Pal. Lat. 1993). The intimidating volume and variety of information which each image displays, amalgamating amongst other elements maps, calendars, astrological tables and theological hierarchies, led their twentieth-century interpreters to conclude that Opicinus was insane. This has been to the detriment of a properly historicised interpretation of his drawings. The dissertation shows that the calendrical and cartographic features of these pictures are neither ornamental nor vague allegories of temporality and geography, but methodically constructed and meticulously measured instruments. By focusing on the calendars of the Palatinus, it demonstrates how Opicinus incorporated and creatively configured new sources, temporal and theological, derived principally from the Avignon papal court, into representations of time in order to create unique cosmologies which sought to visualise, and so better to comprehend, the metaphysical themes of time, space and God.

In addition to elucidating a selection of Opicinus's neglected drawings, they are contextualised here in order to illustrate their value to the study of medieval visual culture. Their comparison to other sources made in Avignon shows how a particular type of diagram, which used technological renderings of time and space for an essentially theological purpose, was characteristic of the Avignon court. This indicates that Opicinus's drawings, in their form and content, were made in response to a discussion at the court concerning the shape of the cosmos and the place of the Church within it. Their interpretation also contributes to larger questions concerning the changing perception of time and function of diagrams in the fourteenth century, whilst demonstrating how the history of technology can inform the study of visual culture.

Long Abstract

This thesis focuses on the representation of time within the diagrams of Opicinus de Canistris, a cleric working in the scriptorium of the Avignon Papacy from 1329, who created a collection of fifty-two large, highly complex, unbound drawings, preserved in the Vatican Library as MS Pal. Lat. 1993 (referred to hereafter, collectively, as the Palatinus). The intimidating volume and variety of information which each image displays, amalgamating amongst other elements maps, calendars, astrological tables and theological hierarchies, led their twentieth-century interpreters to conclude that Opicinus was insane. This has been to the detriment of a properly historicised interpretation of his drawings. This thesis shows that the calendrical and cartographic features of these pictures are neither ornamental nor vague allegories of temporality and geography, but methodically constructed and meticulously measured instruments. By focusing on the calendars of the Palatinus, the dissertation demonstrates how Opicinus incorporated and creatively configured new sources, temporal and theological, derived principally from the Avignon papal court, into representations of time in order to create unique cosmologies which sought to visualise, and so better to comprehend, the metaphysical themes of time, space and God.

In addition to elucidating a selection of Opicinus's neglected drawings, they are contextualised here in order to illustrate their value to the study of medieval visual culture. Their comparison with other sources made in Avignon shows how a particular type of diagram, which used technological renderings of time and space for an essentially theological purpose, was characteristic of the Avignon court. Contemporary technology is used as a comparative source to demonstrate how these diagrams were not simplified schematisations or organisations of knowledge but could be powerful tools which, activated by the user, were employed to deduce new information. In addition to informing larger questions within medieval studies concerning the intellectual culture of the Avignon court, medieval diagrams, and the changing perception of

time in the fourteenth century, the project is an investigation into how the history of technology can inform the study of visual culture.

Secondary Literature

Since Franz Ehrle brought the Palatinus drawings to the attention of Fritz Saxl in 1913, many have puzzled over their surreal nature, mostly focusing on their geographical aspects. This has generated two main schools of interpretation. The majority of his twentieth-century analysts framed them as expressions of Opicinus's personality, most often pathologising them, whereas his more recent interpreters have recognised their more conventional features. The first and still to date the most extensive work to look at the entire set of Palatinus drawings was the *Weltbild und Bekenntnisse eines avignonesischen Klerikers* (1936) of Richard Salomon, which provides a discussion of the recurring themes and a description of each drawing. Although Salomon's work is a valuable resource and, until now, contained the most comprehensive study of Opicinus's calendar systems, it serves more as a presentation than an interpretation and is limited by the author's assumption that Opicinus was mentally ill.

Focus on Opicinus's mental state continued to dominate the secondary literature, most recently in Sylvain Piron's *Dialectique du monstre* (2015). Piron offered a more nuanced approach by incorporating the earlier emphasis with a Warburgian sociological theory, which argued the psychological state of the maker to be crystallised in what they produce. In doing so he interpreted certain features of Opicinus's drawings to be caused by the psychological effect of anxieties resulting from his fraught personal situation in relation to his duties in the Avignon penitentiary. Although this is another version of the psychoanalytic interpretation of the diagrams, Piron suggested that Opicinus was not driven by madness but by natural anxiety

concerning his position. According to this, he was caught in a bind between his spiritual responsibilities and his self-perceived human inadequacy.

Piron's study aside, the last two decades of secondary literature have begun to acknowledge the logical elements of the drawings. Most recently, Karl Whittington focused on what he called the 'body worlds' of Opicinus's journal (BAV, MS Vat. Lat. 6435) and considered various potential sources of influence from medieval visual culture. He began to bridge the gap between art and science in the drawings through his analysis of their portolan charts. In addition to his consideration of diagrams as a visual category, Whittington's focus on the representation of space in relation to contemporary cartography, which is (as this thesis shows) inextricably bound to the visualisation of time, makes his work an invaluable precedent to this project.

Whittington did not, however, offer a detailed investigation into the origins of the content, nor the visual culture which would have informed Opicinus in Avignon, and so his analysis lacks a contextualised understanding of the drawings. This is symptomatic of a larger issue in the study of Opicinus. In the small number of instances in which the features of the drawings have been considered in relation to medieval visual culture, the specific contexts of fourteenth-century northern Italy and Avignon in which Opicinus was active have rarely been taken into account. In addition, Opicinus's interpreters have, historically, tried to comprehend his drawings as an entire set, but their sheer volume means that it is probably impossible for a single scholar to undertake a detailed analysis of every drawing.

Methodology

In order to study Opicinus's representation of time, this thesis begins by considering how he

drew his calendars. Thirty-four of the Palatinus drawings contain at least one calendar but for the reasons outlined above, just one of the drawings is here considered in detail, before it is contextualised within the visual and intellectual culture upon which it drew. This drawing is fol. 14^r, Opicinus's first calendar. Of all fifty-two drawings, it is the most conventional in relation to medieval calendars and is also heavily emended. It therefore reveals the choices Opicinus made in his representation of the calendar and can be used as a key by which to understand how calendars were used in his later drawings. The aim of the thesis is not to analyse the accuracy of the Palatinus calendars, but to understand Opicinus's method of scientific enquiry through his drawing process, whilst considering how it was informed by contemporary images and technology concerning time keeping.

The study is twofold: it serves both as an interpretation of Opicinus's calendars and as a study of the visual culture of time in fourteenth-century Avignon and northern Italy. The methodology is principally object-based as it works outwards from the drawing, yet its contextualisation within the history of time visualisation, which has been lacking thus far in interpretations of Opicinus, is crucial to its understanding. To determine the ideas and visualisations of time with which Opicinus was familiar, this thesis contextualises his drawings within two circles of culture immediate to him: the visual culture of the Avignon court and horology at the turn of the thirteenth and fourteenth centuries. This means that in addition to artistic production (primarily book illumination) at Avignon, the calendrical content demands a wider review of the sources which were available to Opicinus. The thesis therefore considers sources more often treated in the history of science, such as *computus* manuscripts, calendar reform texts, astronomical calendars, atlases, technological treatises and astronomical clocks.

Scholarship from the various disciplines of the history of art, science and technology are crucial to this study, and they are treated here together. This reflects Opicinus's experience within the

visual and intellectual culture of fourteenth-century Avignon, where *scientia* was not 'science' but implied all knowledge, without the secular connotations of the term in more recent usage. This approach is considerably assisted by fast-accumulating research on the papal court at Avignon, which is often conducted in separate silos because of disciplinary divisions. Philipp Nothaft has recently revealed new insights into the calendar reform project at Avignon during Opicinus's time. Meanwhile, new perspectives on Avignonese book production and illumination have been published by Francesca Manzari, Alison Stones and Maria Alessandra Bilotta. In addition to benefiting from these sources, which were unavailable to Opicinus's previous interpreters, the thesis constitutes the first English study which offers an accessible edition of Opicinus's drawings together with a detailed analysis of the calendars.

Structure of the Thesis

The introduction first explores Opicinus's identity, drawings, and historiography more generally, before detailing the place of this thesis within it. This includes a justification and description of the sources focused upon. Chapter one continues to introduce the project through a contextual study, presenting the main issues and figures central to the intellectual and visual culture of the Avignon court leading up to and during Opicinus's time there. In doing so, it builds a picture of a theological project, organised by Pope John XXII, for which he commissioned the diverse intellectuals who visited the court to make particular types of diagrams. These are referred to throughout the thesis as 'image-instruments'. The chapter presents the sources which heavily influenced Opicinus's making process and which are treated in more detail in the following chapters. The rest of the thesis builds an understanding of *Palatinus A* through an interpretation of its individual components, layer by layer, in the order in which Opicinus drew them, before

analysing how they fit together.

Chapters two and three identify and interpret how Opicinus drew his calendars, first looking at the fixed calendar and then at the movable calendar. Chapter two, 'The Construction of the *Sanctorale*', places the calendar rings within the visual context of circular calendars in fourteenth-century Avignon and northern Italy. The material ranges from ubiquitous items such as liturgical books and *computus* manuscripts, to unique objects known to have been available at the papal court and northern Italy: specifically the astronomical calendars of Pietro Vesconte and the calendars of astronomical clocks. The comparison demonstrates that the Palatinus calendars are in fact unique artefacts which demand exhaustive evaluation in their own right.

Chapter three, 'The Movement of Time', isolates, transcribes and compares the calendar rings in the Palatinus drawings which contain detailed movable calendars. An analysis of how they were made and how they functioned demonstrates the role of visualised movement in their activation. This is illustrated through a comparison with contemporary time-keeping technologies, the earliest astronomical clocks and the *astrarium*. Whilst building on previous literature concerning the role of movement within medieval diagrams, chapter three suggests that Opicinus's representation of time was informed by the latest horological developments in northern Italy.

Chapter four, 'Biblical Time', studies how Opicinus integrated scriptural content into his calendars by referencing Ezekiel's vision (as described in Ezekiel 1) and its commentators. By demonstrating how features of the drawings are clearly influenced by another known set of manuscript diagrams to have been made in Avignon, the illuminations of Henricus de Carreto's *De Rotis Ezechielis*, one can see how Opicinus drew upon the rich theological culture at the court. This discovery offers a solid basis for Opicinus's biblical cosmology whilst also introducing

many new questions concerning the strategies of diagrammatic visualisation which both Opicinus and Henricus used to represent the invisible. This is not only novel in the context of the study of Opicinus, but significant as the first interpretative investigation of the illuminations of the *De Rotis*.

Following the consideration of the different categories of time which Opicinus incorporated into a select few of his drawings, chapter five, 'The Harmony of Time', evaluates how he aligned the various measures of time in the rest of the Palatinus calendars. In addition to the liturgical calendar, they depict the hours, the days of the week, the life span of man, the history of mankind and Christian salvation, and the ages of the world. The alignment of these temporal systems depict a Christian conception of history, as outlined in *computus* manuscripts, which combine scripture with the most accurate forms of time-reckoning. Whilst the methods Opicinus used to order these systems within one structure can be recognised in the twelfth-century tradition of visualising history, chapter five considers how he integrated new ideas about time, including 'clock time' and papal chronology, into his drawings.

Having looked at each layer of *Palatinus A*, the final chapter, 'The Measurement of Christ's Body in Time', evaluates precisely how Opicinus aligned these components. It shows how he used the calendar as a physical scale by which to measure Christian history. Contextualised within contemporary discourse of the relationship between natural philosophy and theology, Opicinus's drawings reveal their author's endeavour to quantify metaphysical content through scaled schematisations. This shows how contemporary devotional images, particularly 'metric relics' and the image-instruments at Avignon, were informed by intellectual currents concerning measurement and the relationship between the physical and spiritual worlds.

Palatinus A, through Opicinus's alignment of all available information concerning the physical and spiritual worlds, was made to demonstrate the divine order of the cosmos. Although the drawings are exceptional, Opicinus did not work in a vacuum. *Palatinus A* is a conglomerate of medieval visual sources which were available to him: ranging from the patristic commentaries and *computus* texts which had maintained their significance throughout Europe since the early Middle Ages; to the large-scale diagrams of the cosmos from twelfth- and thirteenth-century France and Italy; to the mechanical clocks and portolan charts which were developed in southern France and northern Italy contemporaneously to his drawings; to the manuscripts, calendars and maps made in the Avignon penitentiary less than a decade before he arrived there. The contextualisation of *Palatinus A* within these distinct circles of culture shows that whilst they were the natural result of multiple understandings of various aspects of the universe, Opicinus was driven by the questions being presented at the Avignon papal court to find the unknown truths of God's universe, and the visual tools which could facilitate that quest. The discussion at the court thus informed his objective, to further man's understanding of the shape of the cosmos and the Church's place within it, and his method, the creation of image-instruments.

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Introduction

Time is not solely a fundamental entity of physical existence; it is also a cultural construct. Multiple systems of time co-existed in medieval Europe, where it was calculated by astronomical observation, ordered through liturgical routine, and interpreted through scripture. This thesis focuses on the representation of time within the diagrams of Opicinus de Canistris, a cleric working in the scriptorium of the Avignon Papacy from 1329, who created a collection of fifty-two large, highly complex, unbound drawings, preserved in the Vatican Library as MS Pal. Lat. 1993 (referred to hereafter, collectively, as the Palatinus). The intimidating volume and variety of information which each image displays, amalgamating amongst other elements maps, calendars, astrological tables and theological hierarchies, led their twentieth-century interpreters to conclude that Opicinus was insane. This has been to the detriment of a properly historicised interpretation of his drawings. This thesis shows that the calendrical and cartographic features of these pictures are neither ornamental nor vague allegories of temporality and geography, but methodically constructed and meticulously measured instruments. By focusing on the calendars of the Palatinus, such as fol. 14^r (fig. 1), this dissertation shows how Opicinus incorporated and creatively configured new sources, temporal and theological, derived principally from the Avignon papal court, into representations of time, in order to create unique cosmologies which sought to visualise, and so better to comprehend, the metaphysical themes of time, space and God.

In addition to elucidating a selection of Opicinus's neglected drawings, they are contextualised here in order to illustrate their value to the study of medieval visual culture. Their comparison with other sources made in Avignon shows how a particular type of diagram, which used technological renderings of time and space for an essentially theological purpose, was characteristic of the Avignon court. Contemporary technology is used as a comparative source to

demonstrate how these diagrams were not simplified schematisations or organisations of knowledge but could be powerful tools which, activated by the user, were employed to deduce new information. In addition to informing larger questions within medieval studies concerning the Avignon court, medieval diagrams and the changing perception of time in the fourteenth century, the project is an investigation into how the history of technology can inform the study of visual culture.

Opicinus de Canistris (1296-c. 1352)

Since Franz Ehrle, one of the great librarians of the Vatican Library, brought the Palatinus drawings to the attention of Fritz Saxl in 1913, many have puzzled over their surreal nature, mostly focusing on their geographical aspects.¹ These drawings are not the only works of Opicinus to have survived. By this time two of Opicinus's treatises were already known, the *De preeminencia spiritualis imperii* (1329) and the *De laudibus Papiae* (1330).² The interpretation of the Palatinus drawings was furthered upon the discovery in the 1940s of Opicinus's journal (1337-c. 1341), referred to in this thesis as the Vaticanus.³ Opicinus marked the date of each entry in the Vaticanus, which consisted of 176 pages, from which more have clearly been lost. These ranged from commonplace events of his day, to complex theological meditations, to guilt-filled

¹ A. van de Put, 'Review: *Opicinus de Canistris. Weltbild und Bekenntnisse eines avignonesischen Klerikers des 14. Jahrhunderts* by Richard Salomon,' *The Burlington Magazine*, Vol. 70, No. 408 (1937), pp.147-48, p.147.

² Richard Scholz discovered the *De preeminencia spiritualis imperii*. R. Scholz, *Unbekannte politische Streitschriften aus der Zeit Ludwigs des Bayern (1327-1354): Analysen und Texte* (Rome, 1911), Vol. 1: pp.37-43; Vol. 2: pp.89-104. Faustino Gianani was the first to identify Opicinus as the author of the description of Pavia published by Ludovico Antonio Muratori in 1727, which had previously been attributed to the Anonymus Ticinensis. F. Gianani, *Opicino de Canistris, l' 'Anonimo Ticinese': (Cod. Vaticano Palatino lat. 1993)* (Pavia, 1927); L. A. Muratori, 'Commentarius de laudibus Papiae,' *Rerum italicarum scriptores*, Vol. 11 (1727), pp.1-18. Opicinus later referred to this text as his *Libellus de descriptione Papiae*. R. Salomon, 'A Newly Discovered Manuscript of Opicinus de Canistris: A Preliminary Report,' *Journal of the Warburg and Courtauld Institutes*, Vol. 16, No. 1/2 (1953), pp.45-57, p.45, n.1.

³ The Vaticanus (BAV, MS Vat. Lat. 6435) was discovered by Roberto Almagià, who gave a brief description of it in R. Almagià, *Monumenta cartographica Vaticana*, Vol. 1: *Planisferi, carte nautiche e affini dal secoli XIV al XVII esistenti nella Biblioteca Apostolica Vaticana* (Vatican City, 1944), pp.95-98. The journal was transcribed and translated into French by Muriel Laharie in 2008. M. Laharie, *Le journal singulier d'Opicinus de Canistris (1337- vers 1341): Vaticanus Latinus 6435*, 2 vols. (Vatican City, 2008).

admissions of sin. Richard Salomon, the first scholar to publish a monograph on the Palatinus, accurately described the images of the journal as a ‘continuation of the pictures collection; different in form but related in contents’.⁴

Apart from the occasional administrative record, Opicinus’s presence in Avignon is not well documented, but thanks to the volume and specificity of the biographical information he presented in both the Palatinus and Vaticanus, the literature concerning his autobiography is far from negligible.⁵ Fol. 11^r of the Palatinus (fig. 2), which is referred to here as his autobiographical calendar, is the most substantial source for reconstructing his life story. It comprises forty concentric circles, each tier containing a year, into which he inserted various life events. In the corners are pictorial representations of the four ages of man which, considering the content of the *rota* which they frame, have been assumed to be self-portraits.⁶ From this calendar and his journal, the following is known.

Born in Pavia in 1296, Opicinus stated on many occasions that he saw Pavia as the physical focus of his family’s existence.⁷ He was well educated, having studied writing, grammar, logic and music in Pavia, before he became a tutor for two noble families from 1314-15.⁸ In 1316, at the age of twenty, the political upheaval between the Guelphs and Ghibellines drove him and his family (who were Guelph supporters of the pope) out of Pavia to Genoa, where he learnt book illumination as his profession. When he returned to Pavia in 1318 he was recruited as a minor

⁴ Salomon, ‘A Newly Discovered Manuscript,’ p.49.

⁵ The papal registers of Clement VI confirm that Opicinus worked in the penitentiary as a *scriptor*. E. Göller, *Die päpstliche Pönitentiare von ihrem Ursprung bis zu ihrer Umgestaltung unter Pius V* (Rome, 1907), p.170; B. Guillemain, *La cour pontificale d’Avignon 1309-1376* (Paris, 1966), pp.343-44. Opicinus is documented twice outside of the Curia, showing that he was in Pavia in 1323 and that he was a witness to an agreement between the Bishop of Vercelli and the commune of Biella which was redacted in Avignon in 1346. V. Morse, *A Complex Terrain: Church, Society and the Individual in the Works of Opicino de Canistris (1296-ca.1354)* (UC Berkeley Ph.D. dissertation, 1996), p.38.

⁶ Salomon, ‘A Newly Discovered Manuscript,’ p.45.

⁷ Morse, *A Complex Terrain*, p.56.

⁸ *Ibid.*, p.67.

cleric at the cathedral there, before he was ordained in 1320.⁹ By the time he took over the humble parish of Santa Maria Capella in 1323 he had begun writing theological treatises, such as the *Liber metricus de parabolis Christi* and the *Tractatus de decalogo mandatorum*, both now lost.¹⁰ Political and financial difficulties drove Opicinus to Avignon in 1329, where he first met Pope John XXII (1249-1334). After receiving Opicinus's treatise, the *De paupertate Christi*, John appointed him in 1330 as a *scriptor* in the apostolic penitentiary: a tribunal, delegated by the pope, chiefly related to the forgiveness of sins. Opicinus's job in the penitentiary was to grant absolutions, dispensations and indulgences.¹¹ Here he wrote multiple theological treatises (such as the *Libellus de septiloquio virginis Marie* (1332) and *Libellus de promotionibus virginis Marie* (1333)) before he began his drawings.¹² It is not certain exactly when he drew the Palatinus. The majority of his drawings seem to have been made between February 1335 and June 1336, but he began drawing prior to 1334 and continued to emend the Palatinus until 1350.¹³ Although there is no documentation of his later whereabouts apart from his drawings, their subsequent emendation implies that he stayed in Avignon until his death in c. 1352.¹⁴

Despite the volume and detail of the biographical information available, the majority of previous scholarship has focused to an excessive degree on a single entry in his autobiographical calendar, in which he recounts falling ill in 1334.¹⁵ He tells the reader how he was given the last rites a few

⁹ Salomon, 'A Newly Discovered Manuscript,' p.46.

¹⁰ Morse, *A Complex Terrain*, pp.83-85.

¹¹ Vaticanus, fol. 74r: *Cum adhuc essem cecus, ante quam haberem presens officium, dominus Iohannes papa XXII^{us} dixit me esse philosophum, sicut mihi relatum fuit; et hoc post receptionem libelli "De paupertate Christi", ante quam recepisset librum "De preeminencia spiritualis imperii"*. Laharie, *Le journal singulier*, 2, p.760.

¹² H. J. Becker, 'Canistris, Opicino de,' *Dizionario Biografico degli Italiani*, http://www.treccani.it/enciclopedia/opicino-de-canistris_%28Dizionario-Biografico%29/ (consulted 02/04/2015)

¹³ Morse offered the most extensive and convincing justification for these dates in *A Complex Terrain*, pp.161-67.

¹⁴ K. Whittington, *Body-Worlds: Opicinus de Canistris and the Medieval Cartographic Imagination* (Toronto, 2014), p.8. There is no documentation which firmly states the date of Opicinus's death, but Hans Jürgen Becker suggested that he died in 1352, as this is the year in which Giorgio de Canistris, a relative of Opicinus, took over as pastor at the parish of Santa Maria Capella. Becker, 'Canistris, Opicino de,' *Dizionario Biografico degli Italiani*.

¹⁵ The autobiographical calendar has been translated into multiple languages: into German in R. Salomon, *Opicinus de Canistris: Weltbild und Bekenntnisse eines arignonnesischen Klerikers des 14. Jahrhunderts* (Leipzig, 1936), pp.205-15; into English in V. Morse, 'Opicino de Canistris: Confessions of a Parish Priest (1336),' in *Medieval Italy: Texts in Translation*, ed. K. L. Jansen, J. Drell and F. Andrews (Pennsylvania, 2009), pp.411-20; and into French in S. Piron and P. Nuss, *Dialectique du monstre: enquête sur Opicino de Canistris* (Paris, 2015), pp.37-44.

days later, became temporarily paralysed and had hallucinations of being in Venice (where he also stated that he had never been). There he was approached by the Virgin and Child, before awakening physically weakened although spiritually strengthened.¹⁶ He added that he believed this experience, which had happened over two years before he described it, gave him a new perception of the world, which had greatly informed his drawings.¹⁷

The State of Scholarship

There are two main branches of interpretation concerning Opicinus's drawings. The majority of his twentieth-century analysts framed them as expressions of his personality, most often pathologising them, whereas his more recent interpreters have recognised their more conventional features. Opicinus's description of what has often been diagnosed as a stroke has elicited a body of scholarship focusing on him as an individual and also, to a lesser extent, on his drawings as exceptional documents of artistic self-expression.¹⁸ The drawings have also been read as symptomatic of self-obsession. For example, the first work which studied the entire set of Palatinus drawings, Salomon's *Weltbild und Bekenntnisse eines avignonensischen Klerikers* (1936), provided a discussion of their recurring themes and a description of each drawing. Although Salomon's work is a valuable resource and, until now, contained the most comprehensive study of Opicinus's calendar systems, it serves more as a presentation than an interpretation and is

¹⁶ For a translation of this passage, see Salomon, 'A Newly Discovered Manuscript,' pp.46-47.

¹⁷ His autobiographical calendar includes dated entries up to 3 June 1336, giving a firm *terminus post quem* for the calendar. As the text of the calendar was written at the same time, Opicinus could have not recounted his experience of 1334 before June 1336.

¹⁸ M. Camille, 'The Image and the Self: Unwriting Late Medieval Bodies,' in *Framing Medieval Bodies*, ed. S. Kay and M. Rubin (Manchester, 1994), pp.62-99; A. Y. Gurevich, 'L'individualité au Moyen Âge: le cas d'Opicinus de Canistris,' *Annales ESC: économies, sociétés, civilisations*, Vol. 48, No. 5 (1993), pp.1263-80.

limited by the author's assumption that Opicinus was mentally ill. Salomon argued that 'If this unorganised agglomeration of pictures has a general theme, it is Opicinus himself'.¹⁹

Related to, although not necessarily in concordance with, studies of Opicinus's character are analyses of the drawings as products of mental illness. Particularly following Jung's *Eranos* seminar on Opicinus (1943), they became the subject of various psychoanalytic interpretations.²⁰ One of the first studies on Opicinus after Salomon was Ernst Kris's *Psychoanalytic Explorations in Art* (1952), in which he asserted that Opicinus was certainly insane and called him 'a psychotic artist of the Middle Ages'.²¹ Neither Salomon nor Kris were aware of the Vaticanus when they published their first studies on Opicinus.²² Almost half a century later, Guy Roux and Muriel Laharie, a neuropsychiatrist and medieval historian respectively, collaborated on a joint publication, *Art et folie au Moyen Âge* (1997), which looked at signs of Opicinus's delusions in the Vaticanus and Palatinus. Whilst their intention was not to prove that Opicinus was mentally ill, they interpreted his drawings on the assumption that he was.²³

Opicinus's mental state has continued to dominate the secondary literature, most recently in Sylvain Piron's *Dialectique du monstre* (2015). Piron offered a more nuanced approach by incorporating the earlier emphasis with a Warburgian sociological theory, which argued the psychological state of the maker to be crystallised in what they produce.²⁴ In doing so he interpreted the features of Opicinus's drawings, which Roux and Laharie had identified as

¹⁹ Salomon, 'A Newly Discovered Manuscript,' p.47.

²⁰ G. P. Quaglino, A. Romano and R. Bernardini, 'Opicinus de Canistris: Some Notes from Jung's Unpublished Eranos Seminar on the Medieval Codex Palatinus Latinus 1993,' *Journal of Analytical Psychology*, Vol. 55, No. 3 (2010), pp.398-422.

²¹ E. Kris, *Psychoanalytic Explorations in Art* (New York, 1952), pp.118-27.

²² Morse, *A Complex Terrain*, p.107, n.10.

²³ G. Roux and M. Laharie, *Art et folie au Moyen Âge: aventures et énigmes d'Opicinus de Canistris (1296-vers 1351)* (Paris, 1997). For more on Opicinus's 'delusions', see G. Roux, *Opicinus de Canistris (1296-1352?): prêtre, pape et Christ ressuscité* (Paris, 2005).

²⁴ Piron's study is named after Aby Warburg's notes, 'Dialektik des Monstrums' (1927). Piron and Nuss, *Dialectique du monstre*, pp.26, 165.

symptoms of Opicinus's psychosis, to be caused by the psychological effect of anxieties resulting from his fraught personal situation in relation to his duties in the Avignon penitentiary:

Appelé à administrer les sacrements, le prêtre demeure pourtant un homme charnel; à ce titre, il demeure par principe infiniment pécheur, invité, comme tout chrétien, à scruter sans relâche sa conscience... Comme je l'ai suggéré, les troubles d'Opicino sont en grande partie liés à une sensibilité exacerbée face à l'hypocrisie inscrite dans l'institution ecclésiale, qui se déclare au service du peuple chrétien alors qu'elle procure d'abondants avantages matériels aux titulaires des charges qu'elle distribue.²⁵

Although this is another version of the psychoanalytic interpretation of the diagrams, Piron suggested that Opicinus was not driven by madness but by natural anxiety concerning his position. Paid to give absolutions in the name of the pope whilst himself accused of simony,²⁶ and grappling with the contradiction of the poverty of Christ and the material resources of the pope, Opicinus was deemed by Piron to have 'schizophrénie de l'Église'.²⁷ According to this, he was caught in a bind between his spiritual responsibilities and his self-perceived human inadequacy.

Whilst this thesis does not contradict Piron's overall argument that Opicinus was affected by anxiety and guilt, which was aggravated by his role in the penitentiary, his hypothesis does not suffice to explain Opicinus's obsessive attempts to map the cosmos, which took him well beyond his basic duties as a *scriptor*. Even if Opicinus was exceptional in the degree of his anxiety,

²⁵ S. Piron, 'Les exils d'Opicino de Canistris,' in *Images and Words in Exile: Avignon and Italy during the First Half of the 14th Century*, ed. E. Brilli, L. Fenelli and G. Wolf (Florence, 2015), pp.193-207, pp.198, 206.

²⁶ It is not entirely certain whether this was Opicinus's only crime. He alluded to more in his autobiographical calendar, but never fully revealed the cause of his guilt.

²⁷ Piron and Nuss, *Dialectique du monstre*, p.29.

many if not all the priests in the Curia would have been subject to similar pressures. Instead of reducing the drawings to the individual characteristics and ‘schizophrénie’ of their maker, an ideology applied to the interpretation of Opicinus since the discovery of the Palatinus, this thesis contextualises them to show that they made sense within their cultural environment.

Piron's study aside, the last two decades of secondary literature have begun to acknowledge the coherent elements of the drawings. Victoria Morse, in her doctoral dissertation of 1996, interpreted the Vaticanus and Palatinus in relation to Opicinus's personality in order to show that they are symptomatic of an intensification of faith (or what she calls his ‘conversion’), which brought about a change in his understanding of human perception.²⁸ Opicinus's mental state was central to Morse's argument, but her work provided a turning point by arguing that the ‘paradigm of mental illness provides [n]either a complete [n]or a particularly helpful framework within which to understand Opicinus's later manuscripts’.²⁹ Even if one were to accept that Opicinus was mentally ill, this neither informs one as to his motivation nor how he used the sources around him for his own creations. Catherine Harding, although she only produced two short studies on Opicinus, further developed this approach by demonstrating the logic of his drawings and their potential cosmological sources.³⁰ Like Morse and Harding, this thesis does not engage with the bibliography concerning Opicinus's madness but neither does it reject it, as even to accept it would not diminish the value of the drawings to the study of the Middle Ages. This has been illustrated by the study of later figures who used diagrams in a similar way, such as Paul Lautensack, whose career and influence problematizes the artificial division between

²⁸ Morse, *A Complex Terrain*, p.108-09.

²⁹ Ibid., p.107. Morse referred to him as ‘Opicino’. This thesis has changed the references to him in her English quotations to ‘Opicinus’ for the sake of clarity.

³⁰ C. Harding, ‘Opening to God: The Cosmographical Diagrams of Opicinus de Canistris,’ *Zeitschrift für Kunstgeschichte*, Vol. 61 (1998), pp.18-39; eadem, ‘Madness, Reason, Vision and the Cosmos: Evaluating the Drawings of Opicinus de Canistris (1296-c. 1351),’ in *Revaluing Renaissance Art*, ed. G. Neher and R. Shepherd (Farnham, 2000), pp.201-07.

'madness' and 'genius'.³¹

Karl Whittington focused on what he called the 'body worlds' of the Vaticanus and considered various potential sources of influence from medieval visual culture. Studying the use of maps and optics within the construction of the body worlds, Whittington began to bridge the gap between art and science in the drawings through his analysis of their portolan charts.³² His art-historical study was the first monograph to consider how Opicinus's drawings could further understanding of medieval diagrams. By evaluating the method by which Opicinus created his drawings, as distinct from their argument, Whittington showed how Opicinus did not use his drawings to argue a certain point, but rather to experiment with their content in order to organise his thoughts.³³ It was through the process of drawing that Opicinus came to his own conclusions. In addition to his consideration of diagrams as a visual category, Whittington's focus on the representation of space in relation to contemporary cartography, which is (as this thesis shows) inextricably bound to the visualisation of time, makes his work an invaluable precedent to the present project.

Although this dissertation agrees with Whittington's general conclusion, that Opicinus used certain diagrammatic structures to compile and connect different bodies of information, there are problems with his study. First, Whittington did not consider how Opicinus's working environment in Avignon affected his procedure, and which sources would have been available to him there. This also meant that instead of considering specific sources which may have informed Opicinus, he often invoked generalised image types and their broadly-associated concepts, such

³¹ Berthold Kress's study of Paul Lautensack, for example, opened with an argument for the relevance of Lautensack's drawings, despite his probable mental illness: 'He is relevant for the modern scholar both because he was typical and because he was highly eccentric... Lautensack's treatises which happily juxtapose biblical quotations with images from astrological broadsheets therefore provide a rare glimpse into a culture that otherwise remains mute'. B. Kress, *Divine Diagrams: The Manuscripts and Drawings of Paul Lautensack (1477/78-1558)* (Leiden, 2014), p.3.

³² Whittington, *Body-Worlds*, p.5.

³³ *Ibid.*, p.7.

as the zodiac man.³⁴ His analysis thus lacks a contextualised understanding of the drawings. In his entire study, for example, the Avignon popes are mentioned only briefly and in passing, despite their crucial relevance to Opicinus's artistic motivation.³⁵ Whittington justified his approach by arguing that, as so little was known of Opicinus's intended audience, his drawings were instead 'a unique chance to focus on production, creation, creativity and process'.³⁶ However, this detracts from the viewer's ability to contextualise the drawings and to gauge what they can tell us about the Middle Ages. This is symptomatic of a larger issue in the study of Opicinus. In the small number of instances in which the features of the drawings have been considered in relation to medieval visual culture, the specific contexts of fourteenth-century northern Italy and Avignon in which Opicinus was active have rarely been taken into account. Salomon cited many medieval sources, but his objective to describe the entire set of the Palatinus manuscripts meant that he could not be specific in his analysis, limiting the detail with which he could evaluate the relationship between Opicinus and each source.

This leads to the second methodological issue one must face when working with Opicinus's drawings and writings. Their sheer volume (comprising the fifty-two diagrams of the Palatinus, and the Vaticanus manuscript, together with his theological works and the treatise on Pavia) means that it is probably impossible for a single scholar to undertake a detailed analysis of every drawing, whilst the common features of the Palatinus constantly tempt their interpreters to jump from drawing to drawing in the attempt to crack the code of Opicinus's complex visual language, with the result that no one drawing is fully understood.³⁷ In Whittington's case, his focus on the Vaticanus meant that when he did refer to the Palatinus drawings his interpretation

³⁴ Ibid., p.104.

³⁵ Pope John XXII, who was central to Opicinus's project, and Pope Benedict XII are each mentioned once. Whittington, *Body-Worlds*, pp.7, 65.

³⁶ Ibid., p.19.

³⁷ An English translation of the Pavia treatise is forthcoming: *Opicino de Canistris. In Praise of Pavia (1330)*, transl. W. L. North and V. Morse (New York, forthcoming).

was often superficial. Each interpreter has endeavoured to understand Opicinus's drawings (the Palatinus, the Vaticanus or both) as a set, leaving undiscovered the nuances buried in their detail. For the interpretation of the Palatinus to move forward, this approach needs to change.

Methodology

In order to study Opicinus's representation of time, this thesis begins by considering how he drew his calendars. Thirty-four of the Palatinus drawings contain at least one calendar but for the reasons outlined above, just one of the drawings is here considered in detail, before it is contextualised within the visual and intellectual culture upon which it drew.³⁸ This drawing is fol. 14^r, Opicinus's first calendar. From a close analysis of this diagram, one can then approach the other drawings with a more informed understanding of Opicinus's methods of visual expression and, specifically, of how he used calendars within his representations of time.³⁹ The aim of the thesis is not to analyse the accuracy of the Palatinus calendars nor their contribution to calendar reform, but to understand Opicinus's method of scientific enquiry through his drawing process, whilst considering how it was informed by contemporary images and technology concerning time-keeping. The study is twofold: it serves both as an interpretation of Opicinus's calendars and as a study of the visual culture of time in fourteenth-century Avignon and northern Italy.

³⁸ Whittington, *Body-Worlds*, p.17, table 2.

³⁹ This has been greatly helped by the digitisation of both the Palatinus and the Vaticanus, from which high-quality images of the manuscripts have been made fully accessible online. 'Pal. Lat. 1993,' *DIGIVATLIB*, https://digi.vatlib.it/view/MSS_Pal.lat.1993 (consulted 2/1/2016); 'Vat. Lat. 6435,' *DIGIVATLIB*, https://digi.vatlib.it/view/MSS_Vat.lat.6435 (consulted 2/1/2016).

1. The Identification of Fol. 14^r: *Palatinus A*

The thesis is primarily structured around one drawing, fol. 14^r, which is not only shown to be Opicinus's first calendar, but is suggested to be his first *rota*. It is thus referred to throughout the thesis as *Palatinus A*. That *Palatinus A* is Opicinus's first calendar is shown through its multiple emendations. Half of the inner calendar ring is erased and then re-written and many of the feast days clumsily overlap, whereas in the other calendar rings within the Palatinus the same content is displayed neatly. This gives the impression that Opicinus, in *Palatinus A*, was still figuring out how to draw the calendar. Through the comparison of this drawing with his other calendars, one can see how Opicinus constructed his own visual language. First he learnt how to draw the calendar before he abstracted and experimented with the form in his later drawings. *Palatinus A* has the most potential to reveal the process by which Opicinus digested the sources available to him before reconfiguring them for the purposes of his own project.

The visual analysis of *Palatinus A* also supports the hypothesis that it is his first calendar. Of the set, it is the most conventional in relation to medieval calendars. Unlike the majority of the other images, which are most often structured by giant bodies or maps, *Palatinus A* is founded on a circular calendar. The figural elements are simpler and more recognisable than those found elsewhere in the Palatinus. The schema also contains many elements which are repeated throughout the Palatinus: most notably the double calendar rings of the zodiac and months, which are distorted and multiplied in the other images.

That it is the earliest surviving *rota* from the Palatinus is suggested by one of Opicinus's journal entries. Although he wrote that his first drawing (*tabula*) was a 'description of the ecclesiastical hierarchy' (*ad descriptionem ecclesiastice ierarchie*) which he had made shortly after finishing his *De preeminencia spiritualis imperii* (around 1330), he stated that he began to renew his work on the

drawing in 1334.⁴⁰ He then went on to describe how he made his first *rotae*.

In the same year of expectation (1335), when I was comparing the properties of the Gospels with the above mentioned table in my conscience, I collected and wrote down, amidst the assiduous labours of the penitentiary's scribal work, and despite the weakness of my right hand, many passages (although they seem really wild) *on small pieces of paper and parchment* because great and truly terrible temptations within my breast were urging me on. I tested my knowledge of the truth with a variety of different *rotae* which were drawn only on sheets of paper, until I completed the first *rota* of this work on the martyrology of the entire year (*martirologio totius anni*) on parchment. Concerning the subject of this [*rota*] and all the other things mentioned above, I hastily and furtively filled innumerable pieces of paper and parchment with my own opinions (*sententialium*).⁴¹

This passage will be important in the next chapter in defining what exactly Opicinus was trying to achieve and why, but here it is significant in revealing that his first *rota* was a martyrology: 'a list of the feasts of saints and other fixed celebrations organized in calendrical order'.⁴² There has been speculation as to whether this martyrology has survived. Roux and Laharie suggested it was

⁴⁰ Opicinus described how, at the time of the renewal of his work, he was 'beginning to be born'. Vaticanus, fol. 53r: *Incipiens ergo nasci anno domini .mcccxxxiiij. iterum renouavi tabulam ierarchie super qua paulatim correxi declarationis libellum...* Translated and transcribed by Morse, *A Complex Terrain*, pp.294-95. Note that 1335 is labelled as *annus expectationis* in his autobiographical calendar.

⁴¹ Vaticanus, fol. 53r: *Eodem anno expectationis conferens in conscientia mea proprietates evangeliorum cum tabula supradicta inter labores assiduos scriptorie penitentie infirmitate manus dextere non obstante per minutas pecias papyri et carte plura testimonia licet valde silvestria videantur urgentibus me magnis et valde terribilibus temptationibus intra pectus adduci et scripsi experiendo per quemlibet modum notitiam veritatis descriptis diversis et variis rotis in foliis tantum papyri donec perfecero huius operis primam rotam in carta de martirologio totius anni. Super cuius materia et omnibus aliis supradictis innumerabiles peciolas tam papyri quam carte testimoniorum valde silvestrium sententialium.* Ibid., pp.294-95. The italicised words in English in the main body of the text are my own additions to Morse's translation, in which it appears she has omitted the initial mention of *per minutas pecias papyri et carte*. Whilst my addition purposely conforms to Morse's translation, in which she translated *pecias papyri* and *carte* as 'small pieces of paper' and 'parchment', it is more likely that Opicinus was differentiating here between small pieces of parchment and the entire sheets, upon which he later drew the Palatinus.

⁴² J. R. Strayer, *Dictionary of the Middle Ages*, Vol. 8 (New York, 1982), p.161. Jacques Dubois described martyrologies as very similar to calendars but much longer. J. Dubois, *Les martyrologes du Moyen Âge latin* (Turnhout, 1978), pp.16-17.

his autobiographical calendar, but as that drawing does not include any saints' days their theory is unconvincing. Morse, in a brief footnote, corroborated the hypothesis of this thesis: 'Fol. 14^r seems to be the most likely candidate [for Opicinus's first *martirologio totius anni*], because the calendar of saints' days is more central to this drawing than to the others'.⁴³ This is supported by the calendrical content of *Palatinus A*. The date of Easter (*Resurrectio domini*) is inserted in the fixed calendar of saints' days (the outer calendar ring) on the date upon which Easter fell in 1334 (27 March).⁴⁴ This shows that the calendar was either drawn in 1334 or copied from a calendar made then. In either case, the calendar prototype was made around the time that Opicinus began to make the Palatinus drawings.

Despite its wealth of information, *Palatinus A* has been relatively ignored.⁴⁵ If it had been discovered independently its treatment would have been entirely different; it would have received the attention it deserves as a valuable artefact for the study of the history of the calendar. Considered within the set, however, *Palatinus A* has been neglected because it shows far less evidence of Opicinus's eccentricity than others of his drawings have been thought to do. Its figural representation, in comparison to the other drawings, is seemingly limited and traditional. For example, the *Majestas Domini* was common throughout the Middle Ages and the zodiac symbols were typical. The majority of Opicinus's other diagrams, on the other hand, contain large sprawled-out figures constituting maps, some explicitly sexual, which have drawn attention away from the details which are more conducive to the comprehension of Opicinus's cosmological outlook.

⁴³ Morse, *A Complex Terrain*, p.165, n.150.

⁴⁴ Of the years Opicinus was in Avignon, Easter was also celebrated on 27 March in 1345. As shown in the Vaticanus, however, Opicinus began to make his drawings before 1334, had made most of them by 1337 and added subsequent drawings and comments later (Morse, *A Complex Terrain*, p.163). *Palatinus A* was thus extremely unlikely to have been drawn in 1345. Easter was also marked as 27 March in his other calendars (such as folios 5^r and 6^r) but as chapter three shows, these calendars were clearly copied from *Palatinus A*.

⁴⁵ *Palatinus A* has only ever been discussed once, in Salomon, *Weltbild und Bekenntnisse*, pp.176-81. He paired *Palatinus A* with fol. 6^r, which he believed to be almost identical in function: the key difference being that the outer ring of fol. 6^r is oval rather than circular.

2. The Contextualisation of *Palatinus A*

The thesis has two foci: Opicinus, and the representation of time. The methodology is principally object-based, as it works outwards from the drawing, yet its contextualisation within the history of time visualisation, which has been lacking thus far in interpretations of Opicinus, is crucial to its understanding. To determine the ideas and visualisations of time with which Opicinus was familiar, this thesis contextualises his drawings within two circles of culture immediate to him: the visual culture of the Avignon court and horology at the turn of the thirteenth and fourteenth centuries. This means that in addition to artistic production (primarily book illumination) at Avignon, the calendrical content demands a wider review of the sources which were available to Opicinus. A study of calendars from a variety of contexts with which he was familiar, from liturgical manuscripts to astronomical clocks, illustrates how his diagrams were affected by changing ideas of time and its representation. The thesis therefore considers sources more often treated in the history of science, such as *computus* manuscripts, calendar reform texts, astronomical calendars, atlases, technological treatises and astronomical clocks. Meanwhile, by integrating the Palatinus calendars with images and objects more often associated with sacred art, such as biblical illustrations, liturgical books, and drawings of Christian salvation history, the thesis deciphers both how and why Opicinus aligned all of the temporal resources available to him.

Scholarship from the various disciplines of the history of art, science and technology are crucial to this study, and they are treated here together. This reflects Opicinus's experience within the visual and intellectual culture of fourteenth-century Avignon, where *scientia* was not 'science' but implied all knowledge, without the secular connotations of the term in more recent usage. This approach is considerably assisted by fast-accumulating research on the papal court at Avignon, which is often conducted in separate silos because of disciplinary divisions. Philipp Nothaft has

recently revealed new insights into the calendar reform project at Avignon during Opicinus's time.⁴⁶ Meanwhile, new perspectives on Avignonese book production and illumination have been published by Francesca Manzari, Alison Stones and Maria Alessandra Bilotta.⁴⁷ In addition to benefiting from these sources, which were unavailable to Opicinus's previous interpreters, the thesis constitutes the first English study which offers an accessible edition of Opicinus's drawings together with a detailed analysis of the calendars.

In addition to furthering scholarship on Opicinus's drawings, this thesis aims to contribute new insights into the form and function of diagrams in the fourteenth century. The Palatinus diagrams were not simplified schematisations, whose content could be more succinctly described in a text, but accurately-measured instruments whose form was integral to their meaning. The significance of their visual features makes their art-historical analysis crucial. These were not mere symbols or re-presentations of the cosmos, but novel apparatuses which sought to embody the true shape of the universe. In other words, their form was their content.

This phrase 'form is content' has become loaded, particularly in the study of medieval diagrams. Originally introduced by Adolf Katzenellenbogen to describe sculptures of the Virtues and Vices, Madeleine Caviness applied the phrase to what she defined as 'images of divine order', in which abstract structures were used to express theological concepts as they were believed to directly reflect the harmony of the universe.⁴⁸ Caviness used Opicinus's drawings as the fourteenth-century bookend of this tradition, and believed that they functioned as 'an important

⁴⁶ For Nothaft's most recent publication concerning the Avignon calendar reform, see C. P. E. Nothaft, 'Astronomy and Calendar Reform at the Curia of Pope Clement VI: A New Source,' *Annals of Science*, Vol. 74, No. 1 (2017), pp.1-24.

⁴⁷ F. Manzari, *La miniatura ad Avignone al tempo dei papi, 1310-1410* (Modena, 2006); A. Stones, *Gothic Manuscripts 1260-1320 Part 1*, Vol. 1 (London, 2013), pp.74-75 (which lists manuscripts illuminated in Avignon); M. A. Bilotta, 'Un inedito manoscritto giuridico miniato dalla bottega del 'Liber Visionis Ezechielis', attiva ad Avignone nella prima metà del XIV secolo: L'Urb. Lat. 157,' in *Images and Words in Exile*, pp.345-57.

⁴⁸ A. Katzenellenbogen, *The Sculptural Programs of Chartres Cathedral: Christ, Mary Ecclesia* (Baltimore, 1959); idem., 'The Central Tympanum at Vézelay: Its Encyclopedic Meaning and its Relationship to the First Crusade,' *The Art Bulletin*, Vol. 26 (1966), pp.141-51.

indication of the survival of this mode of depiction to the end of the Middle Ages'.⁴⁹ The Palatinus diagrams clearly fall within the category of 'images of divine order', yet the complexity of their detail and thus of their function demands a more specific definition. This thesis shows how the Palatinus consisted of a particular type of diagram which was popular at the Avignon court and that partook of both images and instruments. They are thus referred to in this thesis as 'image-instruments'.

Their affinity to instruments is revealed upon their contextualisation within the history of technology, by which it is revealed that Opicinus incorporated the latest forms of maps and calendars into his drawings. Through his interpretive reconfiguration of these forms with theological content, Opicinus sought to gain a new understanding of the cosmos and of how God and the Church featured within it. This both complements and confirms Whittington's tentative suggestion that the diagrams were 'tools for thinking', as the process of their making was itself an act of interpretation.⁵⁰ Whittington did not, however, contextualise this type of diagram within the visual and intellectual culture of Avignon or the history of technology. By doing so, it becomes clear that Opicinus was drawing upon other diagrams which were made at Avignon and that incorporated the most accurate forms of time- and space-measuring technologies in order to inform the theological questions which had been posed at the court.

⁴⁹ M. Caviness, 'Images of Divine Order and the Third Mode of Seeing,' *Gesta*, Vol. 22, No. 2 (1983), pp.99-120, p.110. Caviness drew particular attention to fol. 10^r (fig. 55), which is discussed in chapter five.

⁵⁰ The concept of 'thinking tools' originally comes from S. Bogen and F. Thürlemann, 'Jenseits der Opposition von Text und Bild,' in *Die Bildwelt der Diagramme Joachims von Fiore: Zur Medialität religiöspolitischer Programme im Mittelalter*, ed. A. Patschovsky (Stuttgart, 2003), pp.1-22, p.2. Whittington translated 'thinking tools' from their term *Denkfigur* in *Body-Worlds*, p.53.

Structure of the Thesis

Chapter one continues to introduce the project through a contextual study, presenting the main issues and figures central to the intellectual and visual culture of the Avignon papal court leading up to and during Opicinus's time there. It builds a picture of a theological project, organised by Pope John XXII, for which he commissioned the diverse intellectuals who visited the court to make particular types of diagrams, or image-instruments. The chapter introduces the sources which heavily influenced Opicinus's making process and which are treated in more detail in the following chapters. The following chapters construct an understanding of *Palatinus A* through an interpretation of its individual components, layer by layer, in the order in which Opicinus drew them (see figures 4, 31, 61), before analysing how they fit together.

Chapters two and three identify and interpret how Opicinus drew his calendars, first looking at the fixed calendar and then at the movable calendar. The analysis of the calendrical foundations of his drawings allows an evaluation of how other content was incorporated within his drawings, which is undertaken in the following chapters. Chapter two, 'The Construction of the *Sanctorale*', places the calendar rings within the visual context of circular calendars in fourteenth-century Avignon and northern Italy. The material ranges from ubiquitous items such as liturgical books and *computus* manuscripts, to unique objects known to have been available at the papal court: specifically the astronomical calendars of Pietro Vesconte and the calendars of astronomical clocks. The comparison demonstrates that the Palatinus calendars are in fact unique artefacts which demand exhaustive evaluation in their own right.

Chapter three, 'The Movement of Time', isolates, transcribes and compares the calendar rings of the Palatinus drawings which contain detailed movable calendars (*Palatinus A*, folios 6^r and 25^v). An analysis of how they were made and how they functioned demonstrates the role of visualised

movement in their activation. This is illustrated through a comparison with contemporary time-keeping technologies, the earliest astronomical clocks and the *astrarium*, in which the movable feasts of the calendar were represented by the physical movement of the mechanical apparatus with which they were expressed. This also builds on previous literature concerning the role of movement within medieval diagrams, which has not yet been considered in relation to medieval technology. The integration of this new understanding of time in *Palatinus A*, like the inclusion of portolan charts in the other Palatinus drawings, demonstrates how a diagram can be categorised as an image-instrument.

Chapter four, ‘Biblical Time’, studies how Opicinus integrated scriptural content into his calendars by referencing Ezekiel’s vision (as described in Ezekiel 1) and its commentators.⁵¹ By demonstrating how features of the drawings are clearly influenced by another known set of manuscript diagrams to have been made in Avignon, the illuminations of Henricus de Carreto's *De Rotis Ezechielis*, one can see how Opicinus drew upon the rich theological culture at the court. This treatise of six books and twenty-seven diagrams portrays the wheels of the vision of Ezekiel as symbols of the entirety of scripture. This discovery offers a solid basis for Opicinus’s biblical cosmology whilst also introducing many new questions concerning the strategies of diagrammatic visualisation that both Opicinus and Henricus used to represent the invisible. This is not only novel in the context of the study of Opicinus, but is also significant as the first interpretative investigation of the illuminations of the *De Rotis*.

Following the consideration of the different categories of time which Opicinus incorporated into a select few of his drawings, chapter five, ‘The Harmony of Time’, evaluates how he aligned the various measures of time in the rest of the Palatinus calendars. In addition to the annual cycle

⁵¹ All English translations of scripture in this thesis are taken from the Douay-Rheims bible.

(including the liturgical calendar and zodiac) they depict the hours, the days of the week, the life span of man, the history of mankind and Christian salvation, and the ages of the world. The alignment of these temporal systems constructs a holistic perception of time which conforms to a Christian conception of history as outlined in *computus* manuscripts, which combine scripture with the most accurate forms of time-reckoning. Whilst the methods he used to order these systems within one structure can be recognised in the twelfth-century tradition of visualising history, chapter five considers how Opicinus integrated new ideas about time, including 'clock time' and the chronologies of the Avignon popes, into his drawings. The latter further supports the hypothesis that he made them in response to a discussion at the court concerning the position of the Roman Church in cosmos.

Having studied each layer of *Palatinus A* individually, the final chapter, 'The Measurement of Christ's Body in Time', evaluates precisely how Opicinus aligned these components to make pictures of the cosmos. It shows how Opicinus visualised sacred concepts by using the calendar as a physical scale by which to measure Christian history. Contextualised within contemporary discourse of the relationship between natural philosophy and theology, Opicinus's drawings reveal their author's endeavour to quantify metaphysical content through scaled schematisations. This shows how contemporary devotional images, particularly 'metric relics', were informed by their intellectual culture, and also significantly contributes to the understanding of medieval diagrams as a visual category.⁵² Considered in relation to the other diagrams made at Avignon, chapter six demonstrates how this conception of the universe crystallised at the court in the form of image-instruments.

⁵² For a definition of 'metric relics' see K. M. Rudy, 'Kissing Images, Unfurling Rolls, Measuring Wounds, Sewing Badges and Carrying Talismans: Considering Some Harley Manuscripts through the Physical Rituals They Reveal,' *Electronic British Library Journal* (2011), art. 5, pp.1-56, p.45.

Palatinus A, through Opicinus's alignment of all available information concerning the physical and spiritual worlds, demonstrated the divine order of the cosmos. Whilst the drawings are exceptional, Opicinus did not work in a vacuum. *Palatinus A* is a conglomeration of medieval visual sources which were available to him: ranging from the patristic commentaries and *computus* texts which had maintained their significance throughout Europe since the early Middle Ages; to the large-scale diagrams of the cosmos from twelfth- and thirteenth-century France and Italy; to the mechanical clocks and portolan charts which were developed in southern France and northern Italy contemporaneously to his drawings; to the manuscripts, calendars and maps made in the Avignon penitentiary less than a decade before he arrived there. The contextualisation of *Palatinus A* within these distinct circles of culture shows that whilst they were the natural result of multiple understandings of various aspects of the universe, Opicinus was driven by the questions being presented at the Avignon papal court to find the unknown truths of God's universe, and the visual tools which could facilitate that quest. The discussion at the court thus informed his objective, to further man's understanding of the shape of the cosmos and the Church's place within it, and his method, the process of interpretive configuration by which he created his image-instruments.

Chapter One: *Scientia* at the Papal Court of Avignon

Between Rome and Paris: Avignon in the Early-Fourteenth Century

The first half of the fourteenth century was a crucial moment for calendars and maps, during which there was a shift towards the quantification of time and space. From the late-thirteenth to the fifteenth centuries, Genoa, Venice and Palma de Majorca were the main centres of cartographic production. Genoa was one of the first cities, if not the first, to produce portolan charts: the first representations of space which accurately mapped coastlines by a mathematical process, and which are therefore often heralded as the first maps as we understand them.⁵³ Meanwhile, the earliest mechanical clocks were being constructed from the late-thirteenth century, before spreading throughout Western Europe in the fourteenth and fifteenth centuries.⁵⁴ By the mid-fourteenth century these had evolved into astronomical clocks: large, complex cosmological instruments which were not intended solely as practical time keepers, but as moving models of the cosmos.⁵⁵ For example, the *astrarium* of Giovanni de' Dondi of Padua (c. 1330-88), although only surviving in textual description, shows the complexity of horological-astronomical devices invented in northern Italy at this time. It was from the cities of northern Italy that the use of public clocks and the modern system of hour reckoning would originate in the mid-fourteenth century, and where astronomical clocks would be promoted from within particular circles of power, including those of the Visconti, the Carrara, the Este and the pope.⁵⁶

⁵³ T. Campbell, 'Portolan Charts from the Late Thirteenth Century to 1500,' in *The History of Cartography*, Vol. 1: *Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*, ed. J. B. Harley and D. Woodward (Chicago, 1987), pp.371-463, pp.388-90.

⁵⁴ The definition and development of the 'mechanical clock' is explored at length in chapter two.

⁵⁵ Derek de Solla Price convincingly argued that the timekeeper was a byproduct of astronomical clockwork, which was primarily intended as a model of the universe. D. de Solla Price, 'On the Origin of Clockwork, Perpetual Motion Devices and the Compass,' *Contributions from the Museum of History and Technology*, Paper 6 (Washington DC, 1950), pp.81-112.

⁵⁶ G. Dohrn-van Rossum, *History of the Hour: Clocks and Modern Temporal Orders*, transl. T. Dunlap (Chicago, 1996), p.134.

This surge of technological invention was not confined to horology, but also extended to images of logic, as exemplified in the *figurae* of Ramon Llull (c. 1232-1316), who is often considered a pioneer of computation theory and devices of warfare. The phenomenon is best documented in the treatise, *Texaurus regis Francie* (1335), by Guido da Vigevano (c. 1280-c. 1349).⁵⁷ Born in Pavia, the same town as Opicinus, Guido drew diagrams of military engineering such as chariots and siege engines.⁵⁸ As physician to the king and queen of France, Philip VI (1293-1350) and Joan of Burgundy (1293-1349), Guido travelled between northern Italy and Paris. Within the process of technological change which was taking place between Rome and Paris, images played a crucial role.

It was precisely during this period that the papacy moved from Rome to Avignon. The quarrel between Philip IV of France (1268-1314) and Pope Boniface VIII (c. 1230-1303), compounded by the death of Boniface's successor after just eight months in office, led to the selection of a new pope in 1305: the Frenchman Clement V (c. 1264-1314). Clement made a decision which split the papacy for almost seventy years. He declined to move to Rome, instead insisting on remaining in France. In 1309 he moved his court to Avignon, just outside the border of the French kingdom, which became the home of the papacy until 1377.

Yves Renouard presented early-fourteenth-century Avignon as a new centre of scholarship. Located in the Rhône valley it became the principal stopping-off point and a natural mediator of communication between the Mediterranean and northern Europe, linking the two great

⁵⁷ A. Bonner, *Selected Works of Ramon Llull*, Vol. 1 (Princeton, 1985), pp.574-75.

⁵⁸ Guido was also physician to Henry VII from 1310-13 and to his daughter, Mary of Luxembourg. B. S. Hall, 'Guido da Vigevano's *Texaurus Regis Franciae* (1335)', in *Studies on Medieval Fachliteratur: Proceedings of the Special Session on Medieval Fachliteratur of the Sixteenth International Congress on Medieval Studies, Kalamazoo, Michigan (U.S.A), May 10, 1981* (Belgium, 1982), pp.33-44, p.33; 'Guido da Vigevano,' *Dizionario Biografico degli Italiani*, [http://www.treccani.it/enciclopedia/guido-da-vigevano_\(Dizionario-Biografico\)/](http://www.treccani.it/enciclopedia/guido-da-vigevano_(Dizionario-Biografico)/) (consulted 15/06/2016).

economic centres of Christendom of central/northern Italy and Flanders, in addition to connecting London and Paris to Rome and Naples.⁵⁹ Avignon became a nexus of knowledge. Between Paris and Rome, both geographically and intellectually, the Italian heritage of the papacy was enriched by a succession of French popes, many of whom were theologically trained at the University of Paris.

The amalgamation of French and Italian visual culture is reflected in the extant material produced at the Avignon court. One can immediately recognise the presence of both influences in the traces of its fourteenth-century visual culture. The architecture of the Palais des Papes is a model example of the International Gothic style, while many of the wall and panel paintings (still in situ or now in the Musée du Petit Palais next door) are by Italian artists.⁶⁰ A collection of goldsmiths, tapestry makers, and sculptors came to the court from Italy, including Simone Martini, who was there from approximately 1335 until his death in 1344,⁶¹ and Matteo Giovannetti of Viterbo, who held the title of 'painter of the pope' at the Avignon court from 1342-67.⁶² Much can be and has been said of the art and architecture of fourteenth-century Avignon, but for the sake of this project, which looks at the diagrammatic visualisation of cosmological content, this chapter focuses on the images being made within the penitentiary in which Opicinus was working.⁶³ There is no documentation concerning how ateliers of

⁵⁹ Y. Renouard, *The Avignon Papacy (1305-1403)* (London, 1970), p.34.

⁶⁰ Much of the current edifice was built under Benedict XII and Clement VI. Renouard, *The Avignon Papacy*, p.41.

⁶¹ A. Girard, *L'Aventure gothique entre Pont-Saint-Esprit et Avignon du XIII^e au XV^e siècle: genèse des formes et du sens de l'art gothique dans la basse vallée du Rhône* (Aix-en-Provence, 1996), p.79. For more on Simone Martini's activity at the Avignon court, see M. Laclotte, *L'école d'Avignon: la peinture en Provence aux XIV^e et XV^e siècles* (Paris, 1983), pp.15-23. For more on Simone as a 'court painter,' see C. J. Campbell, "'Symoni nostro senensi nuper iocundissima': The Court Artist: Heart, Mind, and Hand," in *Artists at Court: Image-Making and Identity 1300-1550*, ed. S. J. Campbell (Boston, 2004), pp.33-45.

⁶² Matteo Giovannetti produced the wall paintings of the Chapels of St Martial (c. 1344-46) and St John the Baptist (c. 1346-48), which are the largest artistic programmes of the papal court to survive. For the most extensive treatment of Matteo Giovannetti, see E. Castelnuovo, *Un pittore italiano alla corte di Avignone: Matteo Giovannetti e la pittura in Provenza nel secolo XIV* (Turin, 1962).

⁶³ For a brief bibliography on the art of Avignon in addition to the sources cited above, see C. A. Fleck, 'Seeking Legitimacy: Art and Manuscripts for the Popes in Avignon from 1378 to 1417,' in *A Companion to the Great Western Schism (1378-1417)*, ed. J. Rollo-Koster and T. M. Izbicki (Boston, 2009), pp.239-302; J. Gardner, *The Tomb and the Tiara: Curial Tomb Sculpture in Rome and Avignon in the Later Middle Ages* (Oxford, 1992); and A. Luyster, 'Christ's

illuminated manuscripts functioned in Avignon, yet it has been deduced from their commission that illuminators were drawn from a variety of workshops to form a new, multicultural environment.⁶⁴

The Avignon court brought together the most up-to-date forms of knowledge: from Italian cartography to Parisian theology. The intellectual centralization at Avignon has often been linked to the administrative and bureaucratic achievements of the papacy. In the words of John Weakland, it 'required more efficient financial, secretarial, judicial, and disciplinary departments within the Curia, the organization charged with the administration of the Church'.⁶⁵ This was not only a practical necessity in order to govern the immense and growing court, but also to legitimise the new home of the papacy.⁶⁶ This centralization is surely significant to understanding the intellectual history of the court, and is thus considered here in relation to the process of image making at Avignon.

This chapter shows that the purpose of gathering various groups and projects was not to form a conglomerate of impressive materials, but to process the latest information and technological findings in order to manufacture new resources, many of which included diagrams.⁶⁷ It first shows that Opicinus made diagrams with the pope in mind, before considering his relationship with each in order to evaluate which pope(s) he made them for. It then illustrates how the measurement of time was of particular interest at the court as Opicinus was making the

Golden Voice: The Chapels of St. Martial and St. John in the Palace of the Popes, Avignon,' *Word & Image*, Vol. 27, No. 3 (2011), pp.334-46.

⁶⁴ F. Manzari, 'Le opportunità offerte dall'esilio: componenti multiculturali e libertà di innovazione nella miniatura avignonese del Trecento,' in *Images and Words in Exile*, pp.325-44, p.344.

⁶⁵ J. E. Weakland, 'Administrative and Fiscal Centralization under Pope John XXII, 1316-1334,' *The Catholic Historical Review*, Vol. 54, No. 1 (1968), pp.39-54, p.43.

⁶⁶ For more on the administration of the Avignon papacy, see Guillemain, *La cour pontificale d'Avignon*.

⁶⁷ This is reflected in the most recent discussion concerning the art of Avignon. In the context of Simone Martini's wall paintings in the cathedral, Beth Williamson argued that Avignon should no longer be perceived as 'an Italian artistic outpost north of the Alps', but instead that each painting should be understood 'as a highly specific, Avignonese monument'. B. Williamson, 'Site, Seeing and Salvation in Fourteenth-Century Avignon,' *Art History*, Vol. 30, No. 1 (2007), pp.1-25, p.20.

Palatinus, as shown through the study of calendar reform and chronological calculation and the presence of mechanical clocks at the court. This is of particular significance to the later Palatinus drawings.

The second part of the chapter concentrates on the patronage of the pope who influenced Opicinus the most: John XXII. From a review of manuscripts produced in Avignon under his pontificate, it is apparent that particular types of images, or more specifically, diagrams of a particular function, were being manufactured which could combine all of man's knowledge in order to bring light to theological truths. Because these are found in a range of manuscripts - maps, calendars, and illuminated scriptural treatises - they have until now been treated separately. By looking at them together, chapter one hypothesises that Pope John XXII was the architect of a programme of research for which he formed a network of intellectuals in the Avignon penitentiary in the early 1320s. He commissioned them to create diagrammatic representations of the Christian cosmos, which integrated the latest findings of diverse subjects, including new scriptural commentaries and the latest technological developments. Opicinus, who was placed in the penitentiary by John in 1330, seems to have been recruited for the project.

Opicinus's drawings fit into this classification of diagrams. In his journal, he told the viewer how he began to make 'a variety of different kinds of images and *rotae* concerning the description of the world and other figures of mystery' with which he 'tested' his 'knowledge of the truth'.⁶⁸ He was clearly describing the Palatinus drawings. The passage shows that he shared the same objective as the other intellectuals at the court, to find truth, and the same method, to make diagrams. This thesis thus situates Opicinus's drawings within their visual and intellectual context by comparing their content and intended function to that of the available sources at Avignon.

⁶⁸ Vaticanus, fol. 53r: *Variis modis ymaginum et rotarum super descriptione orbis terrarum et aliarum figurarum misterii... scripsi experiendo per quemlibet modum notitiam veritatis descriptis diversis et variis rotis*. Transcribed and translated by Morse in *A Complex Terrain*, pp.294-95. For the full passage and its translation, see n.41 above.

Before considering the content of each of these sources, this chapter studies the context of their commission. In order to do so one must not only identify the images physically accessible to Opicinus at the penitentiary, but also ask what types of images these were, how they worked, and how they related to one another. In turn, this illustrates how they were united by Pope John's intellectual project, and the place of the Palatinus within it.

The novel aspects of Opicinus's drawings should therefore be considered as offering new insights into the intellectual culture of Avignon, rather than disregarded or marginalised as traces of individual psychosis as they have been previously, most recently by Piron. This is not to reduce Opicinus's drawings to a deposit of their cultural environment, and one should not deny the relevance of his personality to the drawings. In fact, his personal relationships with the popes reveal much about why he was first compelled to make his cosmological drawings. The assessment of Opicinus's personality *vis-à-vis* the Avignon papal court in this study is fundamentally different from that in Piron's, which focuses on the effect of the papal court on Opicinus's mental state. His personality can instead be more constructively used to evaluate who he made his diagrams for and why. A consideration of the intended purpose of Opicinus's drawings is elucidated by his writing as well as by the interests of the patrons for whom he made the drawings.

Diagrams for the Pope

The best surviving indication of Opicinus's source of inspiration is found in an entry on fol. 53^r of his journal, which suggests that his first drawings were made, or at least begun, with the pope in mind. He wrote of his descriptions of the ecclesiastical hierarchy made before 1334, 'I wanted many times to hand it over to the lord pope, [and would have] if the Lord had not decided to

dispose my thoughts otherwise'.⁶⁹ Opicinus made it explicit that his drawings were related to a papal agenda. Moreover, throughout the *Palatinus* and his journal, papal doctrine is represented in a variety of formats: textually, geographically and symbolically. *Palatinus A* provides an example in which text concerning the pope is inserted into a drawing. The calendar is surrounded by quotations from *Unam sanctam* (1302), the papal bull of Pope Boniface VIII which declared the pope to be the sole and absolute head of the Church. This concept was most often referred to as *plenitudo potestatis*, a term which came to be used regularly by medieval canonists to refer to the jurisdiction of papal power.⁷⁰

Above each Gospel in the diagonal corners of *Palatinus A* are the inscriptions (in red, clockwise from the top left corner):

Explicatio clavium superiarum ecclesiae,

Executio gladii spiritualis in paritate materie.

Implicitas gladii utriusque in defensionem ecclesiae.

*Executio gladii materialis sine prohibitione*⁷¹

These are direct references to the bull, which states the spiritual supremacy of the pope: 'We are informed by the texts of the Gospels that in this Church and in its power are two swords; namely, the spiritual and the temporal'.⁷² As the Gospels are claimed to be the source of this

⁶⁹ ... sed propter festinationem nascendi ante terminum partus pluries volui illud tradere domino pape nisi dominus aliter cogitationes meas disponere decrevisset. Translated by Morse, *A Complex Terrain*, pp.294-95.

⁷⁰ William McCready noted that this referred to the delegated power of papal legates opposed to the pope himself. W. D. McCready, 'Papal *Plenitudo Potestatis* and the Source of Temporal Authority in Late Medieval Papal Hierocratic Theory,' *Speculum*, Vol. 48, No. 4 (Oct., 1973), pp.654-74, p.654. For more on the political thought surrounding the Avignon papacy, see J. A Watt, 'Spiritual and Temporal Powers,' in *The Cambridge History of Medieval Political Thought c. 350-c. 1450*, ed. J. H. Burns (Cambridge, 1991), pp.367-423.

⁷¹ 'Explanation of the superior keys of the Church/ The use of the spiritual sword in order to spare matter/The involvement of both swords in the defence of the Church/ The use of the material sword without prohibition'. The transcription is the author's.

⁷² *Unam sanctam* is translated in *Reading the Middle Ages: Sources from Europe, Byzantium, and the Islamic World*, ed. B. H. Rosenwein (Toronto, 2014), pp.425-26.

statement, it is clear why Opicinus placed each line above the symbols of the Gospels' four beasts. These statements also echo the sentiments of the bull, which concludes 'that it is absolutely necessary for salvation that every human creature be subject to the Roman Pontiff'.

Unam Sanctam was certainly still consulted at the Avignon court during Opicinus's active period. Jacopo Caetani Stefaneschi (c. 1270-1343), a prominent Italian cardinal and patron of the arts, was present at the court from 1309 to 1341, and was himself a student of Giles of Rome (c. 1243-1316), whose treatises contain similar themes and ideas to those of *Unam sanctam*, to the extent that he has been supposed to have been its author.⁷³ Opicinus was not only aware of the papal politics of this time, but also incorporated into his drawings concepts currently under discussion at the court.

Geopolitical Symbolism in Opicinus's Maps

Opicinus's use of papal symbolism was considered by Agostino Paravicini-Bagliani, who argued that Opicinus exhibited an extensive knowledge of pontifical ecclesiological theology.⁷⁴ In numerous cases, the geopolitical implications of this pontifical theology are clearly conveyed in his maps. In one of his imperial constitutions, Louis of Bavaria argued that John XXII's absence from the Holy See, especially following requests from the Roman clergy for his return, meant that he was deprived of his office *ipso iure*. To counter this, the German scholar who called himself Conrad of Megenberg famously argued *ubi papa, ibi Roma*: where the pope is, there is

⁷³ L. Kanter, *Painting and Illumination in Early Renaissance Florence, 1300-1450* (New York, 1994), p.84; M. Dykmans, 'Jacques Stefaneschi, élève de Gilles de Rome et Cardinal de Saint-Georges (vers 1261-1341),' *Rivista di Storia della Chiesa in Italia*, Vol. 29 (1975), pp.536-74, pp.537-39. Giles's *De ecclesiastica potestate* (likely 1302) was also composed in defence of Boniface VIII and includes a systematic evaluation of the relationship between *regnum* and *sacerdotium*.

⁷⁴ A. Paravicini-Bagliani, 'Opicinus de Canistris et la symbolique pontificale,' in *Medievalia et Vaticana. Études offertes à Louis Duval-Arnould, réunies par Jean-Marie Martin, Bernadette Martin-Hisard et Agostino Paravicini Bagliani* (Florence, 2008), pp.427-35.

Rome.⁷⁵ In accordance with this, Opicinus referred to Avignon as the *Nova Roma* (Vaticanus, fol. 71^v), thereby contributing his defence to the papacy's move to Avignon.⁷⁶

Examples of established papal iconography are found in many of the drawings. Paravicini-Bagliani discussed an example (fol. 6^r of the Palatinus, fig. 47) in which the papal tiara is labelled as the Ark of Noah, demonstrating the interpretation of Cardinal Stefaneschi. Writing under Boniface VIII, Stefaneschi identified the pope as the incarnation of the Roman Church, which was sometimes allegorised as Noah's Ark.⁷⁷ There is still much to say of Stefaneschi's papal writings in relation to Opicinus's calendars as he used chronology, and thus the calculation of time, to establish the authority of the pope.⁷⁸ For now, it can be concluded that the papal politics of the mid-fourteenth century undoubtedly had a direct impact on the conception of the Palatinus, both in motivation and content.

The 'Avignon Popes'

Before moving forward, one must rectify the obscurity of the term repeatedly used above: the 'Avignon court'. This scholarly discourse cannot be defined under the unitary umbrella of 'the Avignon papacy', as each pope brought his own priorities and projects. Historians have differentiated the three popes under whom Opicinus was active: from the theological interests of John XXII (r. 1316-34), to the architectural patronage of Benedict XII (r. 1334-42),⁷⁹ to astrology

⁷⁵ D. Wood, *Clement VI: The Pontificate and Ideas of an Avignon Pope* (Cambridge, 1989), p.46.

⁷⁶ Salomon, 'A Newly Discovered Manuscript,' p.57.

⁷⁷ Paravicini-Bagliani, 'Opicinus de Canistris et la symbolique pontificale,' p.432.

⁷⁸ This is given more attention in chapter five.

⁷⁹ Benedict XII, probably upon the realisation that the move to Avignon was likely to be permanent, began a reconstruction of the Avignon episcopal residence in 1336 in order to transform it into a new palace. Renouard, *The Avignon Papacy*, p.41.

and medicine under Clement VI (r. 1342-52).⁸⁰ A more detailed analysis of this period necessitates a reconsideration of these generalisations. In so doing, it draws attention to significant features of their patronage whilst maintaining a focus on their varied attitudes towards manuscript acquisition and production.⁸¹

Most important in deciphering the influence of the popes on Opicinus is an evaluation of his relationship to each of them. This has been surprisingly undervalued in recent studies of the Palatinus drawings, and is mentioned only once in Whittington's interpretation. To move through each pope chronologically would, in truth, be anticlimactic. The only mention of Clement VI in Opicinus's works is his later correction of a list of popes at the beginning of his journal, no doubt added when Clement became pope and shortly before Opicinus's death.⁸² His references to John and Benedict are not only more frequent, but more charged with personal emotion, leading him to equate each figure with sin and salvation. However, despite Opicinus's lack of personal feelings concerning Clement, certain elements of Clement's patronage are key to understanding components of Opicinus's later drawings, and are returned to below.

⁸⁰ Étienne Anheim and Jean-Patrice Boudet's analyses of the contents of Clement's personal library (which was added to the general Avignon papal library after his death) showed the profane sciences to have become more dominant than in previous generations. In addition to the texts on calendar reform and astrolabes, the library included 14th-century copies of Bede, a medical text of the work of Rhazes and Albucasis (with two fragments of Peter John Olivi's commentary on the Apocalypse (highly disputed at the Avignon court) and a commentary of the Sentences and Ezekiel), various astronomical and astrological treatises by Al-Farghani, Al-Zarqali, Messahala, Ptolemy, Alcabitus and Albumasar (made before 1316 but with annotations by Clement VI), a commentary by Albertus Magnus on Aristotle's *De motu animalium*, and a miscellany of personal notes on a variety of subjects (theology, philosophy and science) made by Clement between 1314-23 (thus before his papacy). E. Anheim, 'La bibliothèque personnelle de Pierre Roger/Clement VI' in *La vie culturelle, intellectuelle et scientifique à la cour des papes d'Avignon*, ed. J. Hamesse (Turnhout, 2006), pp.1-48, pp.1, 11, 33-34, 39. Boudet argued that the library showed a strong scientific interest. J. P. Boudet, 'La papauté d'Avignon et l'astrologie,' in *Fin du monde et signes des temps: visionnaires et prophètes en France méridionale (fin XIIIe-début XVe siècle)*, *Cahiers de Fanjeaux*, Vol. 27 (1995), pp.257-93, p.263. For the most recent summary of each of the Avignon popes' distinct interests, see J. Rollo-Koster, *Avignon and Its Papacy, 1309-1417: Popes, Institutions, and Society* (Maryland, 2015).

⁸¹ The necessity to differentiate between the patronage of each pope is reflected in the structure of Manzari's monograph on illumination at Avignon (*La miniatura ad Avignone*), in which she treated each pope individually.

⁸² Vaticanus, fol. 4^r.

Opicinus showed great fondness for and allegiance to John XXII. Despite not being present at John's coronation, he described it in his journal: 'On this day in the year of the Lord 1316, the holy father of happy memory, the lord Pope John XXII was crowned and truly established by God as gatekeeper of human hearts; And he who does not obey him cannot reach the kingdom of heaven of the present church, let alone that of the next country'.⁸³ In a later entry, Opicinus wrote with great pride of how John called him a philosopher (*philosophum*) after he presented to the pope his treatise *De paupertate Christi* in 1329.⁸⁴ His gratitude towards John is not surprising. John was not only his patron, receiving and commenting on Opicinus's written works, but also lent him financial support: he provided Opicinus with two expectative benefices in Pavia, supported his sister, and gave him his position within the penitentiary.⁸⁵

This period of prosperity for Opicinus ended with the death of John on 4 December 1334. In his place, Jacques Fournier was elected as Pope Benedict XII and immediately intimated a series of impending reforms. On 8 January 1335, Benedict personally examined Opicinus's case and cancelled the benefices bestowed to him under John.⁸⁶ This left Opicinus in panic and debt and so, in Laharie's words, 'il commence à développer vis-à-vis de Benoît XII une forte animosité rancunière délirante'.⁸⁷ This animosity towards Benedict features in Opicinus's images as well as in his writings. Whittington illustrated how the forms of his body worlds in his journal (often the outlines of Europe and Africa) provided a template for these binary oppositions. In the case of fol. 69^r of his journal, 'Europe versus Africa' became Opicinus versus Benedict.⁸⁸

⁸³ Vaticanus, fol. 38^r: *Hac die, anno Domini MCCCXVI, fuit coronatus sanctissimus pater felix recordationis dominus Iohannes papa XXII^{us}, uere a Deo constitutus ostiarius pectorum humanorum, sine cuius obediencia nemo potest regnum celorum presentis Ecclesie multo fortius nec future patrie adipisci.* Transcribed and translated into French by Laharie, *Le journal singulier*, 1, pp.364-65.

⁸⁴ See n.11 above.

⁸⁵ Morse, *A Complex Terrain*, p.119; Laharie, *Le journal singulier*, 1, p.l. Opicinus's autobiographical calendar details his interaction with John between his arrival in Avignon in April 1329 and John's death on 4 December 1334. Morse, 'Opicino de Canistris: Confessions,' pp.417-19.

⁸⁶ This is described in the autobiographical calendar ('Opicino de Canistris: Confessions,' p.419) and is also referred to in his journal (Vaticanus, fol. 72^v, Laharie, *Le journal singulier*, 2, p.743).

⁸⁷ Laharie, *Le journal singulier*, 2, p.li.

⁸⁸ Whittington, *Body-Worlds*, p.65.

With such personal animosity for Benedict, it is clear that Opicinus did not originally make these for the eyes of the popes collectively, but specifically for John XXII. After all, it was to John that he submitted his treatises and, as early as 1331, his lost drawing of the ecclesiastical hierarchy. Still, one cannot be certain what Opicinus intended these diagrams to be used for after their submission. Morse suggested that he hoped that following the pope's approval, the drawings might be reworked into 'more valuable books by wiser men than he'.⁸⁹ She elsewhere argued that his motivations could have been financial, as winning John's favour was a means of being appointed to a position which could support him in the later years of his life.⁹⁰

Yet the drawings, at least later on, show too personal a motivation to be solely motivated by material considerations. Considering John's reputation to have had a high level of personal involvement in his projects, it is instead more likely that Opicinus initially saw a chance to involve himself in the higher intellectual activities happening under John's guidance and patronage but that later, after John's death, the *Palatinus* became a more intimate project but still considered issues of significance to the court. Weakland's study of John's centralization argued that even within the administration of dry regulations, he had a high personal involvement: 'Power was to be concentrated not in the officials of the Curia, but rather in the pontiff himself. It was to the pope that each official had to swear allegiance, honesty, fidelity, and loyalty even unto death. It was through him that all important matters had to pass... Everywhere the hand of John XXII was visible'.⁹¹ This feature is seen in much of John's work: from his theological consultations to the annotations he made in the manuscripts he commissioned.⁹²

⁸⁹ Morse, *A Complex Terrain*, p.232.

⁹⁰ Morse, 'Opicino de Canistris: Confessions,' p.412.

⁹¹ Weakland, 'Administrative and Fiscal Centralization,' pp.48, 54.

⁹² For the most recent analysis of John's annotations, see P. Nold, 'New Annotations of Pope John XXII and the Process against Peter of John Olivi's *Lectura super Apocalipsim*: The Marginalia of MS Paris BnF lat. 3381A,' *Oliviana: mouvements et dissidences spirituels XIII^e-XIV^e siècles*, Vol. 4 (2012), pp.1-48; idem., 'Pope John XXII's Annotations on the Franciscan Rule: Content and Contexts,' *Franciscan Studies*, Vol. 65 (2007), pp.295-354. Using John's annotations

John's process of patronage is verified through other projects and sources which were created under his authority. This also reveals which manuscript sources were available to Opicinus at the penitentiary, and how they could inform Opicinus about John's intellectual tastes and agenda. But before looking at these manuscripts specifically, an intellectual project highly relevant to the calendar rings central to this thesis must be acknowledged: the calendar reform of Clement VI. Although this was officially instigated after Opicinus began his drawings, Nothaft's recent research has shown that the beginnings of the reform can be traced back further and that it was integral to the intellectual culture of Avignon long before Opicinus's arrival. This section considers the study of time in Avignon and the extent to which Opicinus would have been aware of this.

Time at the Avignon Court: Calendar Reform, Chronology and Clocks

No official calendar reform was established during the fourteenth century, but Nothaft's translation and interpretation of a group of texts reveals that Clement commissioned a project to reform the calendar in order to correct the movable feast dates. The feasts were meant to emulate past events which were not recorded by their fixed date but by their place within the lunar calendar. By the fourteenth century the predicted dates of the new moon, which were calculated using the golden number, were three days behind their actual conjunctions, with the

of BAV, MS Borgehese 242, Patrick Nold analysed the comments on the Franciscan rule and considered their possible historical context to argue that John annotated the manuscript in 1331. Nold categorised John's annotations into two groups: 'First, there are occasions where the Pope actively engages a text or author by supplying either external references or counterarguments, or by summarizing a passage in his own words. At other times, John XXII passively copies a line from a text, more or less verbatim, into the manuscript's margin. Similarly, a brace (}) is sometimes drawn in the margin next to certain lines of interest in the text' (see p.304). For more on John's annotations, see n.94 below. The two copies of the *De Rotis*, unfortunately, do not include annotations from John. I would like to thank Maria Alessandra Bilotta for clarifying this.

result that the movable feasts were deviating further from their correct place each year.⁹³ This affected the liturgical calendar, the temporal backbone of the Church, in ways that became increasingly difficult to ignore. Before Nothaft's recent studies, the project had been neglected in the historiography of time reckoning, probably because the proposals for reform were not implemented and the situation remained unchanged until the Gregorian calendar reform in 1582. Yet such a teleological presentation of the 'progress' of the calendar is not of interest to this project as it is concerned not with the astronomical calculation itself, but with the papal incentive for calendar reform at Avignon. This should not be perceived as an intellectual curiosity of Clement, but rather as what he perceived to be his duty: to lead the Church to redemption by ensuring that it adhered to the true liturgical calendar. This depended upon the correct alignment of Christian salvation history with its celebration in the present.

The Calendar: The Calculation of the Present

On 25 September 1344, the papal chancery in Avignon dispatched written invitations to Firmin de Beauval, a cleric from Amiens who was then best known for his treatise on weather prognostication, and Jean de Murs,⁹⁴ an astronomer and music theorist formerly based at the Sorbonne, stating there were 'certain doubts or defects concerning the golden number' which were in urgent need of correction.⁹⁵ Since the golden number was vital to the calculation of

⁹³ C. P. E. Nothaft, 'Science at the Papal Palace: Clement VI and the Calendar Reform Project of 1344/45,' *Viator*, Vol. 46, No. 2 (2015), pp.277-302, p.283.

⁹⁴ Nold noted that there are existing copies of the bulls of Jean de Murs, *Cum inter nonnullos* and *Ad conditorem*, which contain John's annotations. Nold argued that 'On the whole, John's annotations should be viewed less as indicators of his opinion than as markers where important concepts or ideas are discussed: a sort of tabular index'. P. Nold, *Pope John XXII and his Franciscan Cardinal: Bertrand de la Tour and the Apostolic Poverty Controversy* (Oxford, 2003), pp.166-67, 169.

⁹⁵ E. Déprez, *Clément VI (1342–1352): lettres closes, patentes et curiales*, Vol. 1.2 (Paris 1925), p.209, n.1134: *Cum super quibusdam dubiis seu defectibus aureum numerum tangentibus, ad utilitatem universalis ecclesie declarandis, seu corrigendis, tu, tanquam peritus, ut intelleximus, in talibus dicaris existere multipliciter oportunus, discretioni tue per apostolica scripta mandamus quatinus una*

Easter, this meant that there were concerns over whether Easter (and related to this, the entire movable calendar) was being celebrated on the correct day. As the calendar diverged further from the correct phases of the moon, the vernal equinox regressed to the beginning of the year,⁹⁶ so that by 1318, the official date for Easter (23 April) fell thirty-five days late according to the solar and lunar tables.⁹⁷ Such inaccuracy would mean the incorrect worship of God, which not only had negative spiritual ramifications, but also made the Church vulnerable to criticism of its authority.

The two astronomers soon responded with the *Epistola super reformatione antiqui kalendarii* addressed to Clement VI in 1345, which included a four-part treatise with a series of recommendations as to how the golden number might be better defined.⁹⁸ The significance of the calendar was surely a priority of the court by the mid-1340s, by which time Opicinus had created many of his drawings which included complex and detailed calendar rings. Yet it is more difficult to define when such astronomical activity had begun at Avignon. This question of timing is crucial to our understanding of the motivation and content of Opicinus's calendars.

The official project under Clement VI is documented from 1344, but the recognition of the necessity for the calendar's refinement had been present long before. By the fourteenth century, highly accurate astronomical tables highlighted the defects of the ecclesiastical lunar calendar, with the effect that the new moons predicted by the golden numbers had fallen roughly three

cum dilecto filio Firmino de Bellavalle, alias dicto de Ambianis, perito similiter in arte hujusmodi, sicut fertur, venire ad Sedem Apostolicam quantocius non postponas.

⁹⁶ For more on the 'calendar problem', see Nothaft, 'Astronomy and Calendar Reform,' pp.3-4.

⁹⁷ This provoked a Dominican friar, Pierre Vidal, to offer John XXII an astronomically advanced calendar for Montpellier, applicable for the period 1311-67. Nothaft, 'Science at the Papal Palace,' p.284.

⁹⁸ Nothaft has recently translated another previously unknown 14th-century treatise, the *Expositio kalendarii novi (et correctio veteris edita anno domini 1340)*. According to the verbal parallels to contemporary treatises, especially that of Johannes de T(h)ermis, who presented the *Tractatus de tempore celebrationis paschalis* to Pope Innocent VI in 1354, Nothaft argued that it was produced as part of the calendar reform initiative of 1344/45. See Nothaft, 'Astronomy and Calendar Reform,' pp.1-24.

days behind the actual conjunctions.⁹⁹ Many attempts had been made to fix the calendar in the thirteenth century, most notably by Robert Grosseteste (1175-1253) and John of Sacrobosco (c. 1195-c. 1256) and, in relation to the papal court, Campanus of Novara (c. 1220-96) and Roger Bacon (1214-92) at Viterbo. Bacon's involvement was centred on the papal mandate sent in 1266, which closely followed Clement IV's (r. 1265-68) demand in 1265, shortly before his election as pope, for Bacon's philosophical work, the *Opus maius*. Bacon closely followed the work of Campanus of Novara, who set himself apart from contemporary computists by his astronomical expertise and awareness of Islamic astronomy and therefore insisted on the use of astronomical instruments and tables.¹⁰⁰ From this, Bacon proposed to remove a day every 125 years to reform the calendar, but this was never instigated. The attempt to reform the calendar therefore continued in the following century at Avignon.

As the calendar tracts of the early-fourteenth century were further refined, the quality of the astronomical data was key to their improvement. A variety of tables were used: Jean de Murs used the Toulouse tables in the *Autores kalendarii* (1317), whereas Geoffrey of Meaux stated a preference for the Toledan tables over the Alfonsine in his calendar for 1320-40 (compiled c. 1319/20).¹⁰¹ This also shows that Jean de Murs was active long before the reform of 1344/5, the *Autores kalendarii* being the earliest surviving example of his work. In addition to using the Toulouse tables,¹⁰² he created his own tables, the earliest of which is documented in the

⁹⁹ Nothaft, 'Science at the Papal Palace,' p.283.

¹⁰⁰ J. North, 'The Western Calendar – "Intolerabilis, Horribilis, et Derisibilis": Four Centuries of Discontent,' in *Gregorian Reform of the Calendar*, ed. G. V. Coyne, M. A. Hoskin, and O. Pedersen (Vatican City, 1983), pp.75-113, pp.81-83.

¹⁰¹ The Toledan tables were originally commissioned by King Alfonso X of Castile and León in the mid-13th century, but were not known in Paris until 1320. They soon after became a standard source of astronomical calculation. See Nothaft, 'Science at the Papal Palace,' p.285. Jean de Murs correctly inferred that the Alfonsine Tables implied a mean tropical year which was 1/134 of a day shorter than the Julian year of 365.25 days, which meant that the dates of the equinoxes and solstices were bound to recede at a rate of one day every 134 years. E. Poule, 'Jean de Murs et les tables Alphonsines,' *Archives d'histoire doctrinale et littéraire du Moyen Âge*, Vol. 47 (1980), pp.241-71, p.251.

¹⁰² The Toulouse tables are a variant of the Toledan Tables which preceded the Alfonsine Tables. E. Poule, 'Un témoin de l'astronomie du XIII^e siècle, les tables de Toulouse,' in *Comprendre et maîtriser la nature au Moyen Âge: mélanges d'histoire des sciences offerts à Guy Beaujouan* (Paris, 1994), pp.55-81.

Kalendarium solis et lune (1321) and reworked in the *Patefit*.¹⁰³ Whilst the exact date of the *Patefit* is unknown, Nothaft interpreted the colophon of a deluxe copy (BL, MS Royal 12 C XVII) to show that it was probably composed after 29 November 1329, when John XXII bestowed a benefice upon Jean de Murs from the abbey of Le Bec-Hellouin. This showed him to be in contact with the papacy long before the 1344/5 project.

Accompanying three known copies of the *Patefit* is his criticism on the ecclesiastical calendar in *Sermo de regulis computistarum* (1332), in which he differentiates between computists and astronomers, arguing that the latter are more careful not to be bound by the imprecise rules of the traditional calendar.¹⁰⁴ In addition to these works, Joël Plassard argued that the incipit of the *Ad correctionem calendarii*, which considers ten arguments for and against reforming the calendar and the potential outcomes, was also written by Jean de Murs and Firmin de Beauval as a type of pre-calendar reform report.¹⁰⁵ Even if this were not the case, as Chris Schabel argued, it still demonstrates an interest in calendar reform before the papacy of Clement VI.

Yet more astronomical work was achieved at Avignon outside the calendar project of Jean de Murs and Firmin de Beauval. Astrolabes were certainly used at the court under John XXII,¹⁰⁶ and

¹⁰³ The title of the *Patefit* comes from the first three lines of the *Patefit ex Ptolomei disciplinis*..., most recently discussed in R. L. Kremer, 'John of Murs, Wenzel Faber and the Computation of True Syzygy in the Fourteenth and Fifteenth Centuries,' in *Mathematics Celestial and Terrestrial*, ed. J. W. Dauben et al. (Stuttgart, 2008), pp.147-60.

¹⁰⁴ Nothaft, 'Science at the Papal Palace,' pp.286-87.

¹⁰⁵ The treatise considered the possible outcomes to be: to do nothing, to adjust the calendar year, or to periodically adjust the calendar year by means of the removal of bissextiles and then remove enough days for the equinox to fall on the conventional dates. It is on the basis of the similarity between a few paragraphs in each text (a large section of the *Epistola* (ll. 135-49) contained verbatim in *Ad correctinem* (part 1a)) that Plassard argued it to be related. C. Schabel, 'Ad correctionem calendarii... The Background to Clement VI's Initiative? Text and Introduction,' *Cahiers de l'Institut du Moyen-Âge Grec et Latin*, Vol. 68 (1998), pp.13-34, p.14.

¹⁰⁶ For example, the use of an astrolabe for divination was documented in a case between John and Robert Mauvoisin, who solicited the services of an astrologer, Johannes de Luna, who 'after taking an astrolabe to the sky in day light, he shared information that went well beyond the request'. J. P. Boudet and J. Théry, 'The Trial of John XXII against Archbishop of Aix Robert of Mauvoisin (1317-18): Astrology, Forbidden Arts, and Politics,' in *Jean XXII et le Midi* (2012), pp.159-235, p.165. There are also numerous astrolabes recorded in the papal inventories: the treasury of Clement VI (taken in 1342-43) records two astrolabes and their cases, as well as another in the papal palace inventory of 1369, and a further two in 1371 under the governance of Gregory XI: *Item in 2 repositoriis de corio 2 astralaba de latone*. (fol. 48r, Collect. 289); H. Hoberg, *Die Inventare des päpstlichen Schatzes in Avignon 1314-76* (Vatican City, 1944), p.83.

Levi ben Gerson (1288-1344, often referred to by his Latinised name, Gersonides) was also in communication with the court. Clement VI possessed two copies of Levi ben Gerson's works, including a copy of the astrolabe manual, *De instrumento secretorum revelatore*, which includes a dedication to Clement from 1342.¹⁰⁷ Thorndike believed the second work by Levi ben Gerson in the papal library, the *Prognosticon de coniunctione saturni et iouis et martis* for the year 1345, to have also been made for Clement.¹⁰⁸ Evidence of Levi ben Gerson's communication with the court is apparent as early as 1339, according to an astrological prediction for a comet seen in that year and discussed in a work addressed to Benedict XII.¹⁰⁹ Between 1336 and 1344, he began to create the philosophical work, 'Wars of the Lord' (which later became part of 'On Sines, Chords and Arcs').¹¹⁰ Nothaft contemplated whether the presence of such a distinguished astronomer encouraged Clement to commission a reform project, especially considering that Levi ben Gerson had computed a set of lunar and solar tables shortly before (1335-37).¹¹¹

For these reasons, Clement has often been depicted as the 'scientific pope' in the historical narrative of the Avignon popes, but the astronomical and computational activity at the court can be traced before the reform project of 1344/5, as far back as the papacy of Benedict XII and even under John XXII. Unlike the projects below, the reckoning of the calendar was not an

¹⁰⁷ A fragment is conserved in BnF, MS Lat. 7392, in which the dedication reads: *Explicit tractatus instrumenti astronomie magistri Leonis Judei de Balneolis, habitatoris Aurayce, ad summum pontificem dominum clementem VI, translatum de hebreo in latinum, anno incarnationis christi 1342 et pontificatus dicti domini clementis anno primo* (fol. 17^v). Anheim, 'La bibliothèque personnelle de Pierre Roger/Clement VI,' pp.12, 43. Anheim also noted that this could be a copy with only part of the dedication preserved. For a discussion of this, he redirected the reader to E. Renan and A. Neubauer, 'Lévi ben Gerson,' *Histoire littéraire de la France*, Vol. 31 (1893), pp.586-644, p.621; G. Dahan, 'Les traductions latines médiévales des œuvres de Gersonide', in *Gersonide en son temps: science et philosophie médiévales*, ed. G. Dahan (Paris, 1991), pp.329-68, p.365.

¹⁰⁸ Thorndike based this assumption on Levi ben Gerson's allusion to a former prediction he made for the late pope, Benedict, from signs seen in 1339. See L. Thorndike, *A History of Magic and Experimental Science*, Vol. 3 (Columbia, 1934), p.310. Boudet argued that this showed the toleration, or even attractiveness, of astrological prediction under Benedict and Clement. J. P. Boudet, 'La papauté d'Avignon et l'astrologie,' p.263. There are many later copies of the *Prognosticon*, such as BnF, MS Lat. 7378A. Anheim, 'La bibliothèque personnelle de Pierre Roger/Clément VI,' pp.43-44.

¹⁰⁹ Nothaft, 'Science at the Papal Palace,' p.282.

¹¹⁰ J. Suzuki, *Mathematics in Historical Context* (Washington DC, 2009), p.147.

¹¹¹ Nothaft, 'Science at the Papal Palace,' p.283.

intellectual interest during a specific moment or for a single pope, but it was their duty, as the rulers of the temporal realm, to order the Christian world with the liturgical calendar.

As John Heilbron boldly stated, ‘the Roman Catholic Church gave more financial and social support to the study of astronomy for over six centuries, from the recovery of ancient learning during the late Middle Ages into the Enlightenment, than any other, and, probably, all other institutions’.¹¹² Having established the significance that the papacy placed upon the exactness of the calendar, one must question why it might have been of particular importance for the Avignon popes. Pedersen noted that the establishment of the calendar was vital for the liturgical unity of the Church, its administration and its independence, and allowed for the generation of new Christian feasts and festivals in order to forge Avignon as a new intellectual centre of Christendom.¹¹³ It is no surprise that the Avignon court, which sought its authentication through an impressive administrative and bureaucratic system, would prioritise this issue.

Chronology: The Calculation of the Past

The reckoning of the liturgical calendar not only allowed the calculation of the present, but also of the Christian past. The calculation of the date upon which Easter is celebrated was the same as that of the original Easter and, thus, Christ’s Resurrection. By identifying the dates of Christ’s life, Christian history was placed within a solid temporal frame of the same physical reality in which the worshipper existed. This was an entirely conscious endeavour at Avignon: Jean de Murs’s *Sermo de regulis computistarum* stated the intrinsic connection between calendrical accuracy and Christian chronology, ‘for if the computists cannot find the [astronomically correct] date of

¹¹² J. L. Heilbron, *The Sun in the Church: Cathedrals as Solar Observatories* (Massachusetts, 1999), p.3.

¹¹³ O. Pedersen, ‘The Ecclesiastical Calendar and the Life of the Church,’ in *Gregorian Reform of the Calendar*, ed. G. V. Coyne, M. A. Hoskin and O. Pedersen (Vatican City, 1983), pp.17-74, p.29.

the first Easter with their rules, how can they ever arrive at the truth?¹¹⁴ Astronomy was, to some medieval theologians, a means by which to find truth.

The study of chronology is documented at Viterbo, where, in pre-Avignon days, the Roman Curia periodically adjourned. While Robert Grosseteste and John of Sacrobosco did not venture into the chronological implications of their calendar reform, Bacon stated that the newly accurate information made it necessary to rethink the doctrine of the Crucifixion.¹¹⁵ He focused on the date of Easter in his *De temporibus a Christo* (now lost), *De termino paschali*, and the most astronomical of his works, the *Compotus* (1263-65). Jean de Murs never directly cited Bacon, yet the first four chapters of the *Autores kalendarii* are almost identical with Bacon's *Compotus*, ultimately agreeing that the first Easter took place on 3 April AD 33.¹¹⁶ Jean then differentiated his work by inserting elaborate astronomical discussions of the dates of Christ's life into his *Autores kalendarii*.

Time, in the form of calendar reform and chronology, had always been central to the papal agenda as it legitimised the papacy's authority over the temporal Church. The papacy's concern with the accuracy of time was not limited to the annual calendar. The most recent instruments for keeping time, mechanical clocks, were present in Avignon from the early-fourteenth century. The court employed a clock keeper from 1336, and there is documentation concerning the repair of a clock in the papal palace as early as August 1343.¹¹⁷ Another record from 5 May 1363 states that Brother Jean de Venise was paid twenty florins for the construction of a clock for the

¹¹⁴ C. P. E. Nothaft, *Dating the Passion: The Life of Jesus and the Emergence of Scientific Chronology (200-1600)* (Leiden, 2012), p.199. Nothaft cited Brussels, Bibliothèque Royale, MS 1022-1047, 203^r: *Quero quoque quid inveniant per suas regulas quot anno sue etatis passus est christus, mensem insuper et diem in qua a mortuis resurrexit, quoniam tunc fuit primum pascha, hoc autem non debet ignorari. Si igitur compotiste primum pascha nesciunt per eorum regulas invenire quomodo revera reperirent.*

¹¹⁵ Ibid., p.157.

¹¹⁶ Ibid., p.198.

¹¹⁷ Dohrn-van Rossum, *History of the Hour*, p.131.

pope's bedroom.¹¹⁸ In addition, John North deduced that the astronomical clock of Richard of Wallingford (1292-1336) would have been known in Avignonese circles before then. Richard described the clock in his *Tractatus horologii astronomici* in 1327, shortly before he visited John XXII in Avignon from 4 January to 12 April 1328.¹¹⁹ It is not surprising that the representation of time is central to drawings produced in papal Avignon, including the drawings of Opicinus. The later chapters of the thesis consider the extent to which Opicinus's drawings were affected by these temporal changes.

Opicinus and the Calendar Reform

There is no concrete evidence that Opicinus had read and understood the calendar reform texts. None of their suggestions, such as the alternative dates of Christ's life as stated in the *Autores kalendarii*, feature in his calendars.¹²⁰ Yet one of his latest drawings suggests that Opicinus was at least aware of the calendar reform project during Clement VI's pontificate. Salomon described how fol. 1^r (c. 1350, fig. 3) shows Opicinus's uninformed attempt to fix the cycle of the year.¹²¹ Opicinus's method was to alter the number of days for each month so that the months were alternately long (thirty-one days) and short (thirty days). In the semi-circles which weave in and out of the circular calendar ring, Opicinus displayed two systems of the twelve months. In the inner half of semi-circles, he depicted the lengths of the months according to the accepted system (they read: *Ianuarius XXXI*, *Februarius XXVIII*, *tempore bissexti XXVIII*, etc.).¹²² In the

¹¹⁸ R. André-Michel, 'Les premières horloges du Palais Pontifical d'Avignon,' *Mélanges d'archéologie et d'histoire de l'école française de Rome*, Vol. 29 (1909), pp.213-24, p.215.

¹¹⁹ Richard set out for Avignon on 23 November 1327, in order to receive the title of Abbot of St Albans from Pope John. J. North, *God's Clockmaker: Richard of Wallingford and the Invention of Time* (London, 2005), pp.79-90, 80.

¹²⁰ Ibid., p.159.

¹²¹ Salomon, *Weltbild und Bekenntnisse*, pp.145-52. Salomon noted that the date of fol. 1^r is missing but he dated it to c. 1350 based on its visual similarity to fol. 26^r, which was made in 1350 at the earliest. Ibid., p.145. Roux and Laharie believed this and fol. 26^r to be the last drawings Opicinus made before his death. Roux and Laharie, *Art et folie*, p.301.

¹²² The last part of this note states that during the leap year, February lasts twenty-nine days.

outer half of semi-circles, he presented his corrected version of the year, in which February lasts thirty days, March: thirty-one, April: thirty, May: thirty-one, and so on.¹²³

Opicinus's attempt to fix the calendar by equalling out the months demonstrated his lack of understanding of the real problems of the calendar and the astronomical calculation with which it was computed. He instead followed his own internal system of logic by visually aligning what he knew about the structure of the year into a neat and symmetrical form. Salomon succinctly described this attempt: 'Das Ganze ist also ein Kalenderreformvorschlag ebenso naiver wie eigenwilliger Art...die typische Leistung eines einsamen Spintisierers, der sich auf seine Art mit Fragen beschäftigt, von deren Existenz er nur eben gehört hat'.¹²⁴ Before beginning an analysis of Opicinus's calendars, one must be aware that despite the exceptional detail with which he drew them, he was neither an astronomer nor a computist. He must have copied his calendars from other sources, as will be shown in chapter two.

The significance of these texts is not, however, solely dependent on whether Opicinus had read and understood them. They show, instead, that the accuracy of the calendar and its astronomical underpinning were at the forefront of the papal quest for knowledge, and that the images and texts made as the by-products of this interest may have informed Opicinus, or maybe even inspired him. In North's study of the Avignon calendar reform, for example, he wrote of how the two astronomers created a volvelle 'of a general type well known to most students of the computus'.¹²⁵ This implies that a calendrical or computistical *rota* of some sort, perhaps similar to *Palatinus A*, existed in Avignon by the mid-fourteenth century.¹²⁶ The circularity of this form is intriguing. Could there have existed, perhaps during John's papacy, a collection of circular

¹²³ Salomon, *Weltbild und Bekenntnisse*, pp.84-85.

¹²⁴ Ibid., p.85.

¹²⁵ North, 'The Western Calendar,' p.85.

¹²⁶ Subsequent copies of the text (such as Oxford, Bodleian, MS Canon. Misc. 248) contain small *rotas*, indicating that the original was unlikely to have been a volvelle. My thanks to Philipp Nothaft for his advice on this matter.

calendrical images at the Avignon court which were concerned with the correction of the astronomical, and by extension liturgical, calendar? Sadly, no such image survives from Avignon, but the possible existence of larger circular liturgical calendars should be kept in mind. In any case, new sources were being crafted at the court throughout the time that Opicinus was there, and continued to influence the content of his drawings.

Manuscript Images made under John XXII

In 1329, Opicinus arrived in Avignon in great financial trouble. After begging with other poor clerics, he was provided for by Pope John after illuminating the book of 'a certain protonotary'. He first met John on 10 October. Two weeks later (24 October), Opicinus presented to him his corrected and transcribed treatise (*De preeminentia spiritualis imperii*).¹²⁷ Soon after this, Opicinus was given an official post in Avignon, which will have granted him access to areas of the court previously restricted to him. His new patron was building a new library of ground-breaking content. Its manuscripts provided Opicinus with insight into how to capture the intellectual curiosity of John: his temporal ruler, wealthy patron, financial saviour, and spiritual lord on earth.

The complexity of these images and their incorporation of the latest time and space reckoning technologies (maps and calendars) means that their commission could not be solely dependant on papal patronage, but required scholarly collaboration. The manuscripts are therefore not only witnesses to an individual patron, but also to an intellectual moment in which a specific type of image was being made and for a particular purpose. John, by fostering this environment, remains central to this discourse. The remainder of this chapter looks at the intellectual culture of the

¹²⁷ 'Opicino de Canistris: Confessions,' pp.417-18. This also provides a useful indication of the impressive speed with which Opicinus produced his works.

Avignon court under John. By considering how and why John built a library of encyclopaedic texts and images, and what his method of forging theological doctrine reveals about his process of intellectual exploration (or *disputatio*), one can ascertain the nature of his project.

The Avignon Papal Libraries

An overview of the manuscript collections at the Avignon court is vastly complicated as there was not one single papal library but a variety of libraries in different locations. This is partially because the papal complex was under a great deal of construction and re-organisation, with the old palace built under Benedict and the new under Clement, but also because the collections were divided amongst multiple libraries for different users and purposes. For example, each of the popes had his own private library, or *studium*, where his books were conserved. For Clement's successors, there is even an inventory for the books of the *studium* separate from those of the grand papal library.¹²⁸ In addition, and as suggested above, the papal registers imply that each pope had his own unique process of commissioning manuscripts. In general, John XXII bought books which had already been made, whereas Benedict XII commissioned new books to be made in Avignon, and Clement VI purchased manuscripts from outside the city.¹²⁹

Despite these obstacles, the inventory of 1369 provides useful information concerning the overall composition and use of the papal manuscript collections. The library included what one would expect to find in a traditional ecclesiastical collection, over three-quarters of the holdings being theological and liturgical texts.¹³⁰ Numbering approximately 2,000 volumes in 1368, the

¹²⁸ Anheim, 'La bibliothèque personnelle de Pierre Roger/Clement VI,' p.15. For more on the various libraries, see Fleck, 'Seeking Legitimacy,' pp.272-73.

¹²⁹ Fleck, 'Seeking Legitimacy,' p.279.

¹³⁰ Ibid., p.272.

collection was enormous in comparison to those of contemporary ecclesiastics and much larger than other major institutions.¹³¹ This offers a clearer picture as to the constitution of the Avignon libraries in the latter half of the fourteenth century; but this study is more concerned with the library as it appeared to Opicinus when he arrived in Avignon in 1329.

Unfortunately, documentation of the earlier state of the Avignon libraries is scarcer. The formal thirteenth-century papal library did not arrive in Avignon from Assisi intact and none of the inventories of that collection is considered to be a complete account.¹³² Because the library never arrived, John XXII began to construct a new library, the content of which was contrived to legitimise Avignon as the home of the papacy.¹³³ As Fleck stated, "The very act of collecting, commissioning, and appropriating manuscripts was a way for the popes to prove their political, intellectual, religious, and cultural superiority. They acquired manuscripts to authenticate their location in Avignon and to express the full knowledge and history of the Church and its teachings, doctrines, and ritual".¹³⁴ In an evaluation of the expenditures of the papal chamber and libraries as documented in 1369 and 1375, Degenhart and Schmitt identified it as a library which had been growing significantly through the fourteenth century.¹³⁵

Although there is no way to know the full contents of John's growing library, the identification of a select group of sources shows certain revealing points of overlap. First, all of their authors

¹³¹ The Sorbonne university library in Paris, for example, had 1,722 books according to their 1338 inventory. The average size of the libraries of contemporary ecclesiastics was approximately thirty-five volumes. Ibid., p.272.

¹³² Fleck, 'Seeking Legitimacy,' p.270-71. Whilst we do not have a complete and detailed record, the partial inventories (currently in the Vatican's Secret archives) taken in 1295, 1311, 1327 and 1339 give an idea of what was held and by whom it was commissioned.

¹³³ C. A. Fleck, 'The Cultural Politics of the Papal Library at Avignon: The Meaning and Movement of the Bible of Anti-Pope Clement VII,' in *La vie culturelle, intellectuelle et scientifique*, pp.65-85, p.68. For more on this, Fleck directs the reader to C. A. Fleck, *Papal Politics of a Trecento Bible: The Bible of Anti-pope Clement VII* (London, British Library, MS Add. 47672) (PhD diss., Johns Hopkins University, 1999). In general regarding the entry of books, see M-H. Julien de Pommerol and J. Monfrin, *La bibliothèque pontificale à Avignon et à Peñíscola pendant le Grand Schisme d'Occident et sa dispersion. Inventaires et concordances*, Vol. 1 (Rome, 1991), pp.56-61.

¹³⁴ Fleck, 'The Cultural Politics of the Papal Library,' p.85.

¹³⁵ B. Degenhart and A. Schmitt, 'Marino Sanudo und Paolino Veneto: Zwei Literaten des 14. Jahrhunderts in ihrer Wirkung auf Buchillustrierung und Kartographie in Venedig, Avignon und Neapel,' *Römisches Jahrbuch für Kunstgeschichte*, Vol. 14 (1973), pp.1-137, p.92; Julien-de-Pommerol, 'Les papes d'Avignon et leurs manuscrits,' p.136.

were active in the apostolic penitentiary during the 1320s, the place where Opicinus was given his post. Second, the similarity between the manuscripts made in the penitentiary in the 1320s reveals that John built his library with a specific and coherent purpose in mind. He endeavoured to fill his library with new resources concerning scripture, God and the cosmos, many of which utilised the latest methods of measuring time and space. Before treating the Avignon sources together to see how they were connected within the Avignon court, they are first introduced individually and in the same order in which they appear in the thesis.

Schemata Conceived under John XXII

i) The Maps of the *Secreta*

Opicinus's portolan charts have previously been connected to those of Pietro Vesconte (active c. 1311-21), the master cartographer who worked in two of the three leading cartographic centres of the Middle Ages.¹³⁶ Pietro, like Opicinus, was trained in Genoa to make portolan charts, which were accompanied by detailed, circular calendars, not unlike those in the Palatinus. There is no documentation of Pietro in Avignon, but it is certain that a group of his maps was present in the apostolic penitentiary under John XXII's papacy. The maps were attached to the manuscripts of the Venetian statesman, Marino Sanudo, best known for his two major works: the *Secreta fidelium crucis* (1307-21),¹³⁷ referred to below as the *Secreta*, and the *Istoria di Romania* (c. 1326-33).¹³⁸ In the *Secreta*, Sanudo discussed medieval trade routes and political history and

¹³⁶ Whittington was the most recent to draw a connection between the maps of Pietro and Opicinus in *Body-Worlds*, p.30.

¹³⁷ The full title is in fact much longer: *Liber secretorum fidelium Crucis qui est tam pro conservatione fidelium, quam pro conversione et consumptione infidelium: quamquam etiam propter acquirendum et tenendum Terram Sanctam et alias multas terras in bona statu pacific e et quieto.*

¹³⁸ Marino Sanudo, *The Book of the Secrets of the Faithful of the Cross*, transl. P. Lock (Farnham, 2011), p.3.

offered a practical guide to crusading. The text was made to be read by the pope. Its earliest form (written in 1306-07) was offered to Pope Clement V, before being significantly added to between December 1312 and September 1321. In a later edition Sanudo told the reader that he travelled to the Avignon papal court to present two copies of the *Secreta* to John in 1321, then stayed in Avignon until May 1323 before returning to Venice. Some copies still contain maps which have been shown to have been executed by Pietro.

Pietro's maps in the *Secreta* are particularly resonant with Opicinus's drawings as they combine the *mappamundi* with the portolan chart. The Mediterranean world was depicted in impressively accurate proportions which could only be obtained by the aid of a portolan chart, yet it also contained the circular format of the *mappamundi*, with Jerusalem at its centre. Evelyn Edson argued that Sanudo and Pietro amalgamated the two map types to illustrate Sanudo's message about the declining strength of Christianity. This is again tied with Opicinus's use of portolan charts, which he experimented with in order to make hypotheses about the Christian cosmos and the place of papal politics within it. The comparison, however, focuses on the relationship between Opicinus's calendars and the astronomical calendars which accompany Pietro's atlases. The forms of both Pietro's maps and his calendars are highly significant, as they were constructed in a crucial moment in the history of cartography, when portolan charts were the most accurate and up-to-date technologies. The incorporation of the maps of Pietro Vesconte shows the importance of this technology to John's library.

Another manuscript containing maps and diagrams can be categorised with the *Secreta*, the *Satirica Historia* of Paolino Veneto (d. 1344), composed in the penitentiary between 1321 and 1324.¹³⁹ In addition to the maps and diagrams, it includes more than 1600 small busts and sixteen

¹³⁹ Paolino was an apostolic penitentiary in Avignon in 1321. Manzari, *La miniatura ad Avignone*, p.74; Degenhart and Schmitt, 'Zwei Literaten des 14. Jahrhunderts,' p.95; F. Cecchini, 'Paolino Veneto,' *Dizionario Biografico degli Italiani*,

miniatures of the Crusades. The images and texts are connected to form a complex matrix showing all of history from the Creation to the primacies of Pope Clement V (1305-14) and the Henry VII, Holy Roman Emperor (1308-13).¹⁴⁰ Paolino was certainly concerned with how images could be used in conjunction with text to become, in the words of Tanja Michalski, ‘an epistemological instrument of the historiographer’.¹⁴¹ Michalski noted how in Paolino’s prologues he described the values of the *grata pictura*, in which information is gathered and organised in a way which gives the viewer an overview of history ‘at a glance’ and *prompte ac clare*.¹⁴²

The *Secreta* and *Satirica Historia* were directly connected as not only did Paolino work in the penitentiary from 1321 to 1326 and so must have worked alongside Sanudo, but John also appointed him to examine Sanudo’s *Secreta* in 1321.¹⁴³ Although the lack of visual similarity between the *Satirica Historia* and the Palatinus means it is not extensively treated in this thesis, an awareness of its existence is important for two reasons. It shows that there was an interest at the penitentiary in visualising the history of the world through chronologies and maps, an important feature of Opicinus’s depiction of history (studied in chapter five). Most significant here, it reinforces this chapter’s hypothesis: John gathered a network of intellectuals in the penitentiary

http://www.treccani.it/enciclopedia/paolino-veneto_%28Enciclopedia-dell%27-Arte-Medievale%29/ (consulted 21/12/2017).

¹⁴⁰ F. Botana, ‘The Making of “L’Abreujamen de las estorias”: British Library Egerton MS 1500,’ *Electronic British Library Journal* (2013), art. 16, pp.1-32, p.1. Federico Botana focused on BL, MS Egerton 1500, but earlier copies exist, such as Venice, Biblioteca Nazionale Marciana, MS Zanetti Lat. 399 (= 1610), which was produced under the supervision of Paolino c. 1320-23. Ibid., p.3. This manuscript will be discussed in Catherine Léglu, *Histories and Genealogies in Late Medieval Avignon: ‘L’Abreujemens de las Estorias’* (forthcoming).

¹⁴¹ T. Michalski, ‘Grata pictura and mapa duplex: Paolino Minorita’s Late Medieval Map of Rome as an Epistemological Instrument of a Historiographer,’ *Convivium*, Vol. 2, No. 1 (2015), pp.38-59, pp.38, 49.

¹⁴² Ibid., p.49, n.31. Michalski cited Paolino’s prologue: *Quemadmodum organici corporis, puta hominis, pulcritudinem, ite et totius universi decursus, una parte conspecta, nullus capit obtutus, percipit autem si parcium singularem in se conexione in toto ac proportionem adinvicem comprehendat. Hunc universi decorem monstrare agrediar brevi compendio (...) grata pictura deducens cum glosarum seu explicacionum brevi adiectione ut que ipse in Epithomate ystoriarum seu ceteri diffuse scriptitare conati sunt prompte ac clare intueri quisque valeat, quasi in semine segetem et arborem radicale.*

¹⁴³ C. Léglu, ‘A Genealogy of the Kings of England in Papal Avignon: British Library, Egerton MS 1500,’ *Electronic British Library Journal* (2013), art. 18, pp.1-22, p.2. Paolino’s involvement is recorded in the prologue of the second redaction of the *Secreta*. John also employed him as a papal diplomat. Botana, ‘The Making of “L’Abreujamen de las estorias”,’ p.5.

to create elaborate pictures which sought to encapsulate the Christian cosmos and the position of the Roman Church within it. This is corroborated by the next set of images.

ii) Henricus de Carreto's *De Rotis Ezechielis*

Least studied of these sources is a presentation copy of a theological treatise illustrated with multiple diagrams, which was made for John and was present in the Avignon penitentiary in the 1320s: the *De Rotis Ezechielis* (referred to here as the *De Rotis*) of Henricus de Carreto. The illustrations of the *De Rotis* comprise the most comprehensive medieval treatise and series of diagrams concerning the wheels of Ezekiel, as described in his vision (Ezekiel 1). Henricus attempted to visualise the paradoxical description of the four wheels whilst explicating their theological and cosmological significance. Two manuscripts of the *De Rotis* survive. The first (BN 12018) is smaller and, thanks to the colophon, we have a precise date of 1313 to August 1315 (then corrected in 1320-21) for its composition.¹⁴⁴ It is the original copy of the manuscript and still contains the full set of diagrams.

The second manuscript (BN 503) is of more interest in relation to the production of the Avignon court, and its dedication clearly states that it was made for John. Originally a larger and more ornate presentation copy, most of the diagrams have since been cut from this manuscript and dispersed. It was illuminated at the Avignon court in 1320-21, probably during the same time that the first copy was corrected, and was therefore made less than a decade before Opicinus's arrival in 1329. The remaining documentation suggests that Henricus had a close relationship with John. Henricus moved to Avignon in December 1316 and stayed in the

¹⁴⁴ Both copies of the *De Rotis* (BN 12018 and BN 503) are in the BnF.

penitentiary until his death in 1323; he would have also known Sanudo and Paolino.¹⁴⁵ During this time, Henricus was a consultant at the court for theological matters, including in 1320 the nature of magic and images. In addition to the dedication, the style and content of these complex theological structures indicates that these were diagrams made for John, corroborating the hypothesis that John was building a library of diagrammatic materials to elevate Avignon as a new centre of theological knowledge.

The *De Rotis* schemata are not built upon technological representations of time and space, like the other diagrams considered, but are instead constructed on the basis of complex scriptural descriptions of space. In the depictions of the wheels of Ezekiel from multiple perspectives, their sophisticated rendering of three-dimensional space is unprecedented. This can be attributed to the overall cosmological conception of the wheels during this period, as illustrated by the medieval commentaries on Ezekiel (explored in chapter four). The exegetical potential of Ezekiel 1 was clearly of interest to the court at this time, as many fourteenth-century copies of patristic commentaries on the vision are listed in the 1369 papal inventory.

These manuscripts and their makers illustrate the variety of French and Italian workshops and individuals active in Avignon: maps from Venice and Genoa, illuminators from Paris, Italy and southern France, and theologians and astronomers from Paris and northern Italy. When considered together, however, we see that whilst their content is varied, the process of their commission and making is linked, and yet they have not hitherto been treated as a group. For instance, the *Secreta* and *Satirica Historia* are not only connected by the familiarity of their authors. Degenhart and Schmitt showed that the drawing and illumination of their figures is also linked.¹⁴⁶

¹⁴⁵ C. E. Meek, 'Del Carretto, Enrico,' *Dizionario Biografico degli Italiani*, [http://www.treccani.it/enciclopedia/enrico-del-carretto_res-162c5dbc-87ec-11dc-8e9d-0016357eee51_\(Dizionario-Biografico\)/](http://www.treccani.it/enciclopedia/enrico-del-carretto_res-162c5dbc-87ec-11dc-8e9d-0016357eee51_(Dizionario-Biografico)/) (consulted 09/01/2017). This thesis refers to him as 'Henricus de Carreto', which is how he is named in the Latin texts consulted.

¹⁴⁶ Degenhart and Schmitt, 'Zwei Literaten des 14. Jahrhunderts,' pp.1-137.

In addition, Manzari noted that the illustrated squares depicting battle scenes in the *Satirica Historia* are very similar to the miniatures of the *De Rotis*, suggesting that the same miniaturist executed these figures.¹⁴⁷ Such shared features in the making process support the idea that these manuscripts were being created in the same environment and with the same illustrators.¹⁴⁸ This indicates that there must have been a space in Avignon in which cartographers, theologians and miniaturists were brought together. Considering what is known of their authors, this was almost certainly the penitentiary. From 1321 to 1323, Henricus, Sanudo and Paolino produced their manuscripts there. The apostolic penitentiary most often consisted of only twelve scribes, so it is reasonable to infer that they were familiar with one another.¹⁴⁹ This probably explains how Opicinus, working in the penitentiary less than a decade later, had access to these manuscripts.

By 1334 Opicinus had already submitted multiple treatises to John. It cannot be a coincidence that the *Secreta* and the *De Rotis*, which were also offered to John and which remained in the penitentiary until at least 1369, bear certain similarities to Opicinus's own *mappamundi*-portolan chart models of the cosmos. This thesis argues that Opicinus, with John's encouragement, engaged with the works available to him in the Avignon penitentiary to make his own pictures of the cosmos. Considered together, these sources and their authors build a picture of a linked project, organised by John, to picture all of human knowledge.

¹⁴⁷ Manzari, *La miniatura ad Avignone*, p.76.

¹⁴⁸ Manzari argued that the French workshop which illuminated the second copy of the *De Rotis* (BnF, MS 503) also illuminated the title page of a copy of the *Tragedie* of Seneca: BAV, MS Urb. 355, fol. 1^v (featured in the 1369 papal inventory), which depicts a schematisation of a theatre. She also believed this to be the same workshop that illuminated a collection of constellations in BAV, MS Vat. Lat. 1650. Manzari, *La miniatura ad Avignone*, p.62. For more on this workshop, see Bilotta, 'Un inedito manoscritto,' pp.345-57.

¹⁴⁹ Guillemain, *La cour pontificale*, pp.335-45.

iii) Encyclopaedic Images

The images in these manuscripts are similar not only in that they can be categorised as diagrams but also because they shared a specific function. Each endeavoured to combine and organise multiple sets of information into encyclopaedic forms which, as demonstrated in turn below, were intended for the communication and further investigation of knowledge.¹⁵⁰ Isabelle Heullant-Donat argued that the crystallisation of influences from many parts of Europe at the court, as well as its establishment as an intellectual centre, led to an encyclopaedic tendency in Avignon, especially under John XXII.¹⁵¹ This was not only characterised by the development of new editorial techniques for the reorganisation of thirteenth-century encyclopaedic works (such as indexes, tables of contents and new manuscript layouts), but also by the production of new works. In addition to the manuscripts of Paolino Veneto, Heullant-Donat looked at the works of Pierre Bersuire (resident at the court from 1320-45)¹⁵² and Jean Hautfuney.¹⁵³ Both created alphabetical indexes of scriptural information and, like Paolino, were present in Avignon during the 1320s. Before evaluating what was distinct about the manuscripts produced under John's papacy, it is necessary to understand the roots of the intellectual tradition whence they came.

¹⁵⁰ Isabelle Heullant-Donat (following Jacques Le Goff) used the word 'encyclopaedia' with caution, as the word was not introduced until the 16th century. I. Heullant-Donat, 'L'encyclopédisme sous le pontificat de Jean XXII, entre savoir et propagande: L'exemple de Paolino da Venezia,' in *La vie culturelle, intellectuelle et scientifique*, pp.255-76, p.255. Mary Franklin-Brown emphasised the distinction between 'encyclopédisme' and 'encyclopedia', to indicate that she was more interested in the 'specific intellectual and textual practises that shape them' than in the books themselves. M. Franklin-Brown, *Reading the World: Encyclopedic Writing in the Scholastic Age* (Chicago, 2012), pp.9-11. This same interest applies to this present study, which is more concerned with the encyclopaedic tendency at Avignon than with the categorisation of each group of images discussed as 'encyclopaedic'.

¹⁵¹ Heullant-Donat, 'L'encyclopédisme sous le pontificat de Jean XXII,' pp.273-75.

¹⁵² Pierre Bersuire (c. 1290-1362) accompanied his abbot to Avignon in 1320 and remained there for twelve years as the protégé of the papal vice-chancellor Cardinal Pierre Desprez. He is best known for the *Repertorium morale* (first written in Avignon in 1335), in which he ordered principal words of scripture alphabetically, accompanied by his own moral reflections. See 'Bersuire, Pierre,' *Dizionario Biografico degli Italiani*, http://www.treccani.it/enciclopedia/pierre-bersuire_%28Enciclopedia-Italiana%29/ (consulted 27/7/2017).

¹⁵³ Present in Avignon in the 1320s, Jean Hautfuney fabricated an alphabetical index of the works or processed notions in Vincent of Beauvais's *Speculum historiale*. Heullant-Donat, 'L'encyclopédisme sous le pontificat de Jean XXII,' p.264.

The later Middle Ages is often characterised as the golden era of the reorganisation of knowledge, which was founded in the thirteenth century by scholastic activity in Paris and Oxford. This not only constituted the analysis of Aristotelian (and to a lesser degree, Platonic) ideas concerning natural philosophy, but also addressed how they could be incorporated within Christian theology. A rivalry formed between the Platonists of Oxford, Robert Grosseteste, Robert Kilwardby (c. 1215-79), and Roger Bacon, and the Aristotelians of Paris, Albertus Magnus (c. 1200-80) and his student, Thomas Aquinas (1225-74), over exactly how these ideas related to one another.¹⁵⁴ This is not the place to explore this rivalry, but some of the key areas of debate, as delineated most significantly in the scientific works of Roger Bacon, will prove invaluable to understanding Opicinus's enterprise later in the thesis. Significant here is the interest at the Avignon court in gathering and organising knowledge into encyclopaedias.

Malcolm Parkes argued that the revival of Aristotelianism at the University of Paris and its new found utility to theology 'demanded a more precise method of dissecting and defining human knowledge'.¹⁵⁵ The reorganisation has been characterised in the works of Parkes, Alastair Minnis (a student of Parkes) and Richard Rouse in terms of *compilatio* and *ordinatio*.¹⁵⁶ The purpose of these encyclopaedic texts was not only to gather information (*compilare*) but to arrange it in a meaningful way (*ordinare*), which required analysis of the collected content.¹⁵⁷ In this vein,

¹⁵⁴ J. Weisheipl, 'Classification of the Sciences in Medieval Thought,' *Mediaeval Studies*, Vol. 27 (1965), pp.54-90, pp.72-90. For a more detailed exposition on the different scholastic approaches to Aristotelian metaphysics, see R. Wood, 'The Subject of the Aristotelian Science of Metaphysics,' in *The Cambridge History of Medieval Philosophy*, ed. R. Pasnau (Cambridge, 2011), pp.609-21.

¹⁵⁵ M. Parkes, 'The Influence of the Concepts of *Ordinatio* and *Compilatio* on the Development of the Book,' in *Scribes, Scripts and Readers: Studies in the Communication, Presentation and Dissemination of Medieval Texts* (London, 1991), pp.35-70, pp.35, 50.

¹⁵⁶ This is partially taken from Aquinas's often-used phrase *sapientis est ordinare* (it is the role of the wise man to order). A. Minnis, *Medieval Theory of Authorship: Scholastic Literary Attitudes in the Later Middle Ages* (London, 1984), pp.146-47. Franklin-Brown offered a useful overview of this secondary literature in *Reading the World*, p.64.

¹⁵⁷ *Compilatio*, which has been shown by Minnis to have previously carried connotations of thievery, became in the later Middle Ages an interpretive-intellectual act and an 'urgent moral duty' of the theologian. I. Johnson, 'Loose Giblets: Encyclopaedic Sensibilities of *Ordinatio* and *Compilatio* in Later Medieval English Literary Culture and the Sad Case of Reginald Pecock,' in *Encyclopaedism from Antiquity to the Renaissance*, ed. J. König and G. Woolf (Cambridge, 2013), pp.325-42, p.327. On the changing perception of *compilatio* and the distinction between *auctor* and *compilator*, see A. Minnis, '*Nolens auctor sed compilator reputari*: The Late-Medieval Discourse of Compilation,' in *La méthode critique au Moyen Âge*, ed. G. Dahan and M. Chazan (Turnhout, 2006), pp.47-63.

Albertus and Aquinas set out in their *Summae theologiae* to summarise and explain the discourse of theology.

The interest in compiling and ordering information at the court is manifest in the inventory of the papal library of 1369 in two distinct groups of authors: the textual works of encyclopaedists, such as Aquinas, almost one hundred texts by whom are documented in the inventory, and the authors who made large-scale ‘diagrams of everything’ from the twelfth century.¹⁵⁸ The latter authors are Hugh of St Victor (c. 1096-1141), who studied and taught at the Abbey of St Victor in Paris, and Joachim of Fiore (c. 1135-1202), the Calabrian mystic and theologian. Much like the fourteenth-century schemata introduced above, their diagrams combine cartography, chronology, vision, scripture and Christian salvation history into large-scale images. The inclusion of these two authors in the papal library again indicates an interest in Avignon in gathering and meaningfully ordering diverse sets of information in images as well as texts.

iv) Hugh of St Victor and Joachim of Fiore

Copyists under Benedict XII and Clement VI reproduced many texts by Hugh and Richard of St Victor.¹⁵⁹ Around 1125, Hugh gave a series of lectures concerning the Ark of Noah (referred to in this thesis as the *Arca Noe*, c. 1125-30), one of which included a detailed description of a large-scale cosmological diagram (taller than the average person) of the Mystic Ark, which is

¹⁵⁸ Aquinas’s texts were clearly at the forefront of Avignon philosophical thought. Almost 100 texts are recorded in the 1369 inventory, including a summary of the *Summa theologiae* which Pope John commissioned from John the Dominican in 1324. For a list of the manuscripts of Aquinas’s texts in Avignon, see M. Faucon, *La librairie des papes d’Avignon: sa formation, sa composition, ses catalogues (1316-1420)*, Vol. 1 (Rome, 1886), pp.114-22, nos 229-323. John also elevated Aquinas to sainthood in 1323. D. Lindberg, *The Beginnings of Western Science: The European Scientific Tradition in Philosophical, Religious and Institutional Context, 600 B. C. to A. D. 1450* (Chicago, 1992), p.246. The idea of ‘diagrams of everything’ was used in Whittington’s interpretation of Opicinus to allude to Edson’s study of *computus* manuscripts, which she described as presenting a ‘theory of everything’. E. Edson, ‘World Maps and Easter Tables: Medieval Maps in Context,’ *Imago Mundi*, Vol. 48 (1996), pp.25-42, p.35. Whittington cited Edson in *Body-Worlds*, p.103, n.1.

¹⁵⁹ Faucon, *La librairie des papes d’Avignon*, 1, p.54. The books are detailed on pp.112-13.

hypothesised to have been created and referred to during the lectures. In 2014, the text was fully translated by Conrad Rudolph and the diagram of the Ark was reconstructed, showing an image which layered maps, calendars, biblical history, theology and the body of Christ.¹⁶⁰

Joachim of Fiore is best known for his *figurae*, which are undoubtedly related to the drawings of Opicinus in form and in their conception of spiritual vision. Much as Opicinus later intended, a selection of Joachim's *figurae* were originally made for his contemporary papacy. He publicly submitted them for examination by Pope Innocent III in 1200, but died in 1202 before they could be the subject of judgement.¹⁶¹ There are at least six manuscripts which include Joachim of Fiore's texts documented in the papal inventory of 1369.¹⁶² The *figurae* concern many themes which were actively discussed later at Avignon, including the wheels of Ezekiel and eschatology. In addition, Peter John Olivi's commentary on the Apocalypse (*Postilla in apocalypsim*, 1325), which was an issue at the centre of theological disputation at the court, was heavily influenced by Joachimism.¹⁶³

The presence of Hugh and Joachim's works shows a specific interest at Avignon in large-scale cosmological diagrams which used multiple diagrammatic structures with text in order to make visual descriptions of the cosmos. The twelfth-century diagrams also provide comparative sources to the fourteenth-century projects, emphasising the difference in how time and space were incorporated into cosmologies before the developments in mapping time and space in the late-thirteenth to early-fourteenth centuries. The comparison shows that whilst the significance

¹⁶⁰ C. Rudolph, *The Mystic Ark: Hugh of Saint Victor, Art and Thought in the Twelfth Century* (Cambridge, 2014).

¹⁶¹ M. Reeves and B. Hirsch-Reich, *The Figurae of Joachim of Fiore* (Oxford, 1972), p.21.

¹⁶² Faucon, *La librairie des papes d'Avignon*, 1, pp.125-26, nos 360-65. According to Boudet, there were many more manuscripts containing Joachimite or pseudo-Joachimite content in the library. Boudet, 'La papauté d'Avignon et l'astrologie,' p.266.

¹⁶³ S. Piron, 'Avignon sous Jean XXII, l'Eldorado des théologiens,' *Jean XXII et le Midi* (2012), pp.357-91, pp.366-73. John called many of the theologians at court for counsel on the *Postilla in apocalypsim* in 1319, before revisiting the debate in 1325.

of encyclopaedic knowledge of the temporal world was not unique to John's patronage, the types of diagrams being made under John were entirely different from their predecessors in form and complexity. This leads one to question: What particular purposes engendered the distinctive aspects of the diagrams made under John XXII?

Diagrams at Avignon

Petrarch wrote that in John's old age, without enough time to satiate his 'hunger for reading', he demanded *florilegia* of literary works in the forms of excerpts, abridgements, and abstracts to be made, for which Petrarch composed a table of contents.¹⁶⁴ Examples of these summaries still exist, in addition to a record of their acquisition from 30 July 1329, only a matter of months after Opicinus arrived at the papal court.¹⁶⁵ It is unclear whether these summaries were diagrammatic, but tabular summaries were often visually organised in a way which promoted a certain reading, which could range from a list to a more intricate pattern.¹⁶⁶ From this one might jump to the conclusion that the schematisations were used as shortened summaries of content, designed to

¹⁶⁴ For Petrarch's comments, see J. Coleman, 'English Culture in the Fourteenth Century,' in *Chaucer and the Italian Trecento*, ed. P. Boitano (Cambridge, 1983), pp.33-64, pp.52-53. Alexander Ibarz suggested that Paolino de Veneto's *Satirica Historia* may provide an example of what Petrarch referred to. A. Ibarz, 'The Provenance of the "Abreujamen de las estorias" (London, British Library, Egerton MS. 1500) and the Identification of Scribal Hands (c. 1323),' *Electronic British Library Journal* (2013), art. 17, pp.1-14, p.1. The definition of *florilegia* is, however, a contentious one. From the Latin *flos* (flower: a medieval term for extracts) and *legere* (to choose), they were fairly varied in the scope of their content. Franklin-Brown argued that the size and range of many meant they came to function as encyclopaedias, but acknowledged that the literature previous to her study often distinguished between the two. Franklin Brown, *Reading the World*, p.6, n.18. It is not clear which Petrarch referred to, but as this chapter shows, John's patronage speaks for itself.

¹⁶⁵ M-H. Julien-de-Pommerol, 'Les papes d'Avignon et leurs manuscrits,' in *Livres et bibliothèques (XIII^e-XV^e siècle)* (Toulouse, 1996), pp.133-56, p.137. Of the approximately 140 volumes which John bought or commissioned, he bought a copy of the *flores bernardi* in 1329, and commissioned: a table of the *Summa* of Aquinas composed by John the Dominican (see n.158 above); an abridgment of the *Topographies* of Gerald of Wales by Philippe de Slane; and tables of the writings of Augustine, Boethius, pseudo-Dionysius and a dictionary of words of the bible by Georges de Bourgueil. Julien-de-Pommerol cited F. Ehrle, *Historia bibliothecae romanorum pontificum: tum Bonifatianae tum Avenionensis*, Vol. I (Rome 1890), pp.150-53.

¹⁶⁶ For examples of different forms of *tabulae*, see M. Evans, 'The Geometry of the Mind: Scientific Diagrams and Medieval Thought,' *Architectural Association Quarterly*, Vol. 12, No. 4 (1980), pp.32-55.

present information quickly and with clarity. But this is precisely not what the schemata in the works of Sanudo, Henricus and Paolino were doing.

They can instead be understood in relation to the interest in encyclopaedic images and texts in the thirteenth century and their development during the fourteenth century. As in Aquinas's *Summa theologiae*, in which he incorporated the most accurate information at his disposal in the forms of the recently translated natural philosophy of Aristotle, the fourteenth-century images required the integration of the newest findings concerning geography and astronomy (in the forms of portolan charts, calendar reform and new scriptural exegesis) into a Christian understanding of the world. The development of encyclopaedic images from the thirteenth to the fourteenth century was not only a consequence of the inclusion of novel content, but their function had also changed. In Minnis's description of the increasingly intellectual perception of *compilatio* following the thirteenth century, he argued that the fresh challenges of scholarship, thanks to new learning, meant that 'the compilers – or, men who presented themselves as compilers – saw themselves as being in the front ranks of a scholarly task-force which sought strategies of command and control of information which must have seemed intimidating in its sheer quantity'.¹⁶⁷ The aims and strategies of the later encyclopaedic forms therefore had to evolve as the compilers digested this new information. Iolanda Ventura succinctly summarised this change in her comparison of the encyclopaedic forms of the thirteenth and fourteenth centuries, arguing that for the later compilers there was more emphasis on the interpretative process by which they could develop their own opinion.¹⁶⁸

¹⁶⁷ Minnis, *Medieval Theory of Authorship*, p.62.

¹⁶⁸ I. Ventura, 'On Philosophical Encyclopaedism in the Fourteenth Century: The *Catena aurea entium* of Henry of Herford,' in *Une lumière venue d'ailleurs: héritages et ouvertures dans les encyclopédies d'Orient et d'Occident au Moyen Âge: actes du colloque de Louvain-la-Neuve, 19-21 Mai 2005*, ed. B. Abdeele and G. Callataÿ (Turnhout, 2008), pp.199-245, pp.199, 228. Maria Teresa Beonio Brocchieri-Fumagalli called the new 14th-century tendency 'philosophical encyclopaedism', in M. T. Beonio Brocchieri-Fumagalli, 'Le enciclopedie,' in *Lo spazio letterario del Medioevo*, Vol. 1: *Il Medioevo Latino*, ed. G. Cavallo, C. Leonardi, and E. Menestò (Rome, 1995), pp.635-57. Yet as Ventura emphasised in her re-evaluation of this essay, the term is problematic as it implies there was less of an interpretative element in the *compilatio* of the 13th century than there likely was.

The idea that these compilations of content were not intended to be used to look up information, but instead to yield new understanding through their meaningful ordering, perfectly aligns with the types of images in question which were commissioned by John. The diagrams were certainly linked to the scholastic interest in compiling large volumes of information in the thirteenth century, but through their fresh content and increased emphasis on interpretative use became a new genre of encyclopaedic diagram. Understood together they reveal John's urgent project to understand and incorporate the widening comprehension of the natural world into Christian philosophy. The Avignon diagrams are not purely didactic nor summaries made for quick edification, but are unique and complex schemata. In the case of the *Secreta*, *Satirica Historia* and *De Rotis*, they required the viewer to read an entire treatise in order to comprehend them and in the case of Opicinus, a sophisticated understanding of how the visual structures he used (such as portolan charts, astronomical calendars and scriptural iconography) functioned was needed before one could interpret how they were manipulated for Opicinus's objective.

What remains therefore is to situate these erudite images within their intellectual context at the court, particularly in relation to the practice of theology specific to Avignon, where an overarching vision across a range of cultural activities can be recognised. Opicinus drew from the diagrams in the works of Sanudo, Paolino and Henricus, suggesting that he was inspired by the materials made in the 1320s which had been deemed appropriate for John's new library. Their authors certainly knew one another and discussed common concerns. This is not to suggest that they were formally in collaboration, but that together they formed an intellectual network. But if this network and the images produced were tools of John's investigation, what was the higher theological goal of understanding that he was trying to achieve? Through an analysis of the process by which theological doctrine was decided under John, one can observe his method of *compilatio* and *disputatio*. First, he gathered the most accurate information available

(technological and theological). He then considered this within a framework of intellectual disputation with specialists whom he had summoned for consultation. From this, it seems that John recruited experts of map-making, scriptural interpretation and cosmography in order to inform a larger conversation about the history of the cosmos and mankind, revealing his motivation to understand the world and its relationship to eternity.

The Search for Truth: John's Theological *Disputationes*

In an interpretation of the intellectual culture of the Avignon court under John, Richard Southern cited a description of the papal court in a letter from Stephen of Kettleburgh (an Oxford doctor of civil law) at the papal court of Avignon to John Luttrell (a doctor of theology) in Oxford:

Concerning the state of this court, I can tell you that our lord the pope, who formerly lavished all his attention on civil lawyers, has now conceived a great and special affection for theologians, and especially for biblical experts. So much is this the case, that if any master of distinction in theology turns up at the papal Curia he will not let him go, and the pope is very free in providing such men with great dignities and prebends, even to the extent of making them bishops and archbishops.¹⁶⁹

Southern's interpretation of the letter argued that John, in an attempt to strengthen the theological resources and decision-making process of the Curia, differed from his predecessors

¹⁶⁹ R. Southern, 'The Changing Role of Universities in Medieval Europe,' *Historical Research*, Vol. 60, No. 142 (1987), pp.133-46, p.134.

in emphasising the need for order and regularity through fixed procedure. 'In brief, he acted as the master of a school whose professorial *catbedra* was also that of St Peter... The papal court became the central theological school of Europe; and the *sententiae* of its regent master, the pope, became the definitive rulings of the highest court in Christendom'.¹⁷⁰ In theory, the procedure was based on a scholastic theology which used the logical argument of numerous consultations and *disputationes* to reason the highest truth.

Southern's identification of Avignon as 'the central theological school in Europe' has been questioned extensively by scholars (most recently William Courtenay and Isabel Iribarren), many of whom have debated the ambiguous relationship between the University of Paris and the Avignon court.¹⁷¹ Nevertheless, what concerns this study is not Avignon's hierarchical ranking or precise interaction with the University of Paris, but how the theological system at Avignon worked. Theology was not solely learnt here by the copying of scripture and its commentaries, but also by the active criticism of ideas which were contemporaneously contentious. John gathered the most knowledgeable theologians in specialist fields and considered multiple opinions before deciphering doctrine.¹⁷² Ultimate truths were thereby researched through a scholarly process of observation, reason and experimentation. This was also true of Clement VI's

¹⁷⁰ Southern, 'The Changing Role of Universities,' p.140.

¹⁷¹ Courtenay argued that their relationship was adversarial at first. In the first year of John's pontificate, he wrote an open letter to Paris, warning scholars not to study frivolous questions about the arts and theology, and then a year later, summoned Jean de Pouilly (regent master at Paris) for erroneous teaching. Paris also showed disregard for John in the dissemination of the *Defensor pacis* (1324), an anti-papal work. On the other hand, there were other actions which suggest a working relationship between the two. For example, one of John's first papal acts was to set up a system of *rotuli* which benefited both the University and the court. W. J. Courtenay, 'John XXII and the University of Paris,' in *La vie culturelle, intellectuelle et scientifique*, pp.237-54, pp.237, 338. Iribarren disagreed with both Courtenay and Southern, 'The papacy had distanced itself from the magisterium by questioning the very core of their corporate identity: the scholastic tradition. Against this tradition, John had initiated an "evangelical programme", reflected both in his way of practicing theology and in his ecclesiology'. I. Iribarren, 'Theological Authority at the Papal Court in Avignon: The Beatific Vision Controversy,' in *La vie culturelle, intellectuelle et scientifique*, pp.277-302, pp.300-01.

¹⁷² As Patrick Nold recently emphasised, not much is known about John's education, except that he did candidly admit that he was not a Master of theology at Paris. Whilst theological discussion had become a priority at John's court, one could legitimately characterise him as an 'amateur' theologian. Whether his lack of a formal education necessarily indicates that he was a lesser theologian is another issue. Nold, *Pope John XXII and his Franciscan Cardinal*, p.142.

calendar reform project, which although astronomical in content, was driven by a primarily theological concern.

Yet as Piron suggested, the pope's view was not necessarily initially neutral. John's commissions and decisions show a hierarchy caught between the scholastic method of *disputatio* and a conceptual framework in which the pope had the highest authority.¹⁷³ As in the chronologies (Paolino Veneto's *Historia*) and geopolitical maps (the *Secreta* and some of Opicinus's drawings) outlined above, the process of theological reasoning took an empirical approach which considered all that was already known (in the above instances, contemporaneous knowledge of cartography and *computus*) in order to reach a conclusion, but they were all conspicuous in their papal agenda. Each supported the authority of the pope and were tailored with his use in mind. Still, the extent to which the reinforcement of the papacy dominated the drawings should not be overestimated. The projects may have served a hierarchical papal programme of institutional consolidation, but they also entered a more open debate at the court concerning the ways in which God was manifest in the physical world.

In Piron's study, 'Avignon sous Jean XXII' (2012), he compiled a table of the 106 names of individuals for whom there is evidence that Pope John had engaged in theological discussion between 1318-33. John's tendencies as a 'micromanager' are as apparent in his approach to his theological responsibilities as in his administration.¹⁷⁴ The table includes many of the figures already mentioned: Cardinal Stefaneschi, Jacques Fournier (later Pope Benedict XII), Pierre Roger (later Pope Clement VI), Pierre Desprez and, most significantly for theology and image

¹⁷³ Piron used the case of Bérenger Talon, imprisoned on arrival in Avignon and with whom the pope discussed the poverty of Christ, to suggest that these consultations were to deploy all available arguments for the purpose of drafting a conclusion which had effectively already been decided. Piron, 'Avignon sous Jean XXII,' p.381.

¹⁷⁴ Rollo-Koster, *Avignon and Its Papacy*, p.45.

making, Henricus de Carreto.¹⁷⁵ Piron interpreted his table in a hierarchical sense, placing those whom he believed to be the highest ranking at the top. Opicinus can be found at the bottom of this table, and it is noted that his meeting with John was outside the framework of a formal consultation. Piron evidently believed that Opicinus's consultations were of less value than those of some of his colleagues, which is unsurprising considering that Piron's subsequent project was founded on Opicinus's supposed mental illness. Yet the evidence of Opicinus's encounters with the pope suggest that he functioned in the same circle and through the same process of theological consultation as those who were making images for John during the 1320s.

A more thorough inspection of Opicinus's consultation with John in relation to his productivity indicates his desire to be considered as one of John's intellectual entourage. The subjects of his texts directly cater to the interests of John as indicated by his previous theological consultations. Returning to Opicinus's initial meeting with John, Piron's table notes that they discussed the condemnation of Marsilius of Padua's *Defensor pacis* in 1329.¹⁷⁶ In his autobiographical calendar, Opicinus tells us that two weeks later, he corrected and transcribed a treatise to present to John. In addition, Piron's table shows that the majority of the highest-ranking officials (including Stefaneschi, Pierre Desprez, and Henricus de Carreto) discussed the poverty of Christ in 1322, shortly before the issue of the landmark papal bull on the subject, *Cum inter nonnullos*, in 1323.¹⁷⁷ It is perhaps for this reason that Opicinus wrote *De paupertate Christi* in 1329.

¹⁷⁵ Piron, 'Avignon sous Jean XXII,' pp.366-73. The table also shows the issues which these consultations concerned. In order from the highest title: Stefaneschi, the poverty of Christ (1322); Pierre Desprez, the poverty of Christ (1322); Jacques Fournier, the heretical nature of magic (1320), Peter John Olivi's commentary on the Apocalypse (revisited in 1325), the condemnation of William of Ockham (1326), the *Defensor pacis* of Marsilius of Padua (1327/9), and the Beatific Vision (1333); Pierre Roger, The Beatific Vision (1333); and Henricus de Carreto, the first debate on the apocalyptic commentary of Peter John Olivi (1319), magic (1320), and the poverty of Christ (1322).

¹⁷⁶ Piron, 'Avignon sous Jean XXII,' pp.372-73.

¹⁷⁷ Henricus dedicated his treatise on this subject (*Tractatus de statu dispensativo Christi et specialiter de paupertate eius et Apostolorum*) to John. Meek, 'Del Carretto, Enrico'.

The outcome of many of the theological debates instigated by John was textual, but the system of *disputatio* also reveals a significant interest in images at the court. John's enquiry into the nature of magic is particularly revealing in this regard, as it exposes the perception at the court that images had the potential to be powerful instruments. In 1320, John commissioned a group of ten theologians, members of the regular orders, one of whom was Henricus de Carreto, to consider whether the invocation of demons could be regarded as a heretical act. John favoured Henricus's argument, which was founded upon the power of images.¹⁷⁸ He based his argument on the production and function of images by questioning how their 'baptism' for the purpose of magical uses related to notions of heresy and spells. This was done by assessing whether the sorcerer evoked the power of God, the image or Satan.¹⁷⁹ According to this, images were regarded to have powerful potential which could be activated by human agency. Although they were potentially dangerous, they were also recognised to have the potential to activate theological knowledge.

Diagrams at Avignon: Image-Instruments of Interpretation

At the Avignon court, diagrams were used as tools for research. They were used to bring together sets of complex visual information, often including technological drawings, in order to come to new interpretations. By analysing them within their technological and intellectual moment, one can understand them as diagrams which functioned as both images and instruments, and whose activation required the knowledge of the learned viewer. They reflect the process of learning at mid-fourteenth century Avignon, in which the most developed sources

¹⁷⁸ Alain Boureau's analysis of the event showed how Henricus's theory did not (like the others) simply extend the notion of heresy, but 'constituted a true doctrinal turning point'. A. Boureau, *Satan the Heretic: The Birth of Demonology in the Medieval West*, transl. T. L. Fagan (Chicago, 2006), p.54.

¹⁷⁹ Henricus illustrated this by citing biblical instances of the improper use of images (such as Moses and the brazen serpent). Boureau, *Satan the Heretic*, pp.55-57.

were combined to make erudite images that might bring to light further truths.

If one returns to Opicinus's description of his making process, quoted above, the same process of image making is shown in his testing of his 'knowledge of the truth with a variety of different *rotae*'.¹⁸⁰ The passage shows that Opicinus was gathering information from his scribal work and testing the combination of such ideas by drawing *rotae*. As with other intellectual projects which survive in the manuscripts commissioned under John, drawing diagrams was an act of interpretation by which their makers searched for truth. Opicinus's drawings can be firmly situated within the intellectual, artistic and technological milieu of the papal court. The processes of manuscript production and theological consultation under John XXII reveal a holistic impetus to combine sources in such a way as to engage more effectively with challenging questions. Opicinus's eagerness to contribute to John's intellectual project is manifest in his texts and drawings, in which he strove to combine features of John's previously-commissioned sources to make encyclopaedic image-instruments of the cosmos. The following chapters show how.

¹⁸⁰ ...scripsi experiendo per quemlibet modum notitiam veritatis descriptis diversis et variis rotis. Transcribed and translated in Morse, *A Complex Terrain*, pp.294-95.

Chapter Two: The Construction of The *Sanctorale*:

How Opicinus Drew his Calendars

In the Middle Ages, diverse conceptions of time converged in calendars, in which different streams of temporal data were amalgamated within an annual cycle, specifically those calculated by astronomical observation and those ordered through liturgical routine. The functions of medieval calendars were various. Some, such as astrolabes and the calendars which accompanied maps, were more concerned with the quantification of time in relation to space, whereas others were liturgical (and often devotional) objects which ordered the annual Christian cycle. Some attempted to incorporate both. The consequence of this is that their form, medium, content and pictorial imagery can tell us a great deal about their specific function and intended environment.

Despite this, the importance of calendars to the ongoing discussion of the representation of time, the art-historical conversation concerning which is studied in the next chapter, has been neglected. This could be attributed to the methodological challenges which their visual analysis and comparison present to art historians. Unlike visual culture which can more easily be categorised as 'images', there are more dimensions of the calendar to contemplate. In addition to their material and visual composition, one must also consider their content, essentially astronomically-determined sets of data, as this was intrinsic to their function. To complicate their analysis further, the calendar's content was adjusted in relation to changes in the history of science and ideas, requiring that the calendar in question be contextualised within the state of astronomical and computistical learning of its time.

This adjustment was of particular importance in Avignon during the first half of the fourteenth century, as the pope's urgent concern for the reform of the calendar brought its correction to the

forefront of the scientific issues at the court. Within this context, Opicinus made the Palatinus drawings, many of which were built upon circular calendars. As was shown in the previous chapter, Opicinus seems to have been aware of the calendar reform and even presented a suggestion for its correction in fol. 1^r. This only reveals, however, that Opicinus was not well versed in the astronomical and computistical calculation which went into the reckoning of the calendar. It is also unclear whether he was aware of the reform when he made his earlier drawings, such as *Palatinus A*, as none of the suggestions offered in the relevant texts were integrated into his calendars. This chapter therefore does not consider the calendar reform texts. The significance of the calendar and its correction from the pope's perspective is, however, useful in determining Opicinus's intention to contribute to a papal project.

In *Palatinus A*, the calendar is the first component which Opicinus measured and drew; it therefore provides the foundation of the drawing and so governs the composition of the rest of its features. To understand how Opicinus made the drawing one must first observe the calendar in isolation from the image's other features. Its comparison with medieval calendars, however, presents a problem. His calendars are unique, leading one to question how he could have made them. In order to decipher Opicinus's representational choices and therefore how he drew the calendar of *Palatinus A*, this chapter compares his calendars with contemporary models and considers what they reveal about the nature of his project.

The Palatinus calendar rings have previously been the subject of study by Salomon. Although briefly, Salomon drew significant comparisons with a varied collection of potential sources for the *sanctorale*, including ancient Egyptian and Roman calendar discs, tables of the Roman calendar system in medieval liturgical books (most notably Breviaries) and the circular calendars

accompanying the portolan charts of Pietro Vesconte.¹⁸¹ Although his study is still important to the interpretation of the *Palatinus*, it was written long before many of the sources discussed in this chapter had been discovered or introduced into scholarly discussion. As Salomon's study encompassed all fifty-two *Palatinus* drawings it is not surprising that his discussion of each source is limited. His analysis can be more appropriately defined as a list of potential sources of visual comparison than an interpretation of whether, and how, each influenced Opicinus's working process. This meant that Salomon's study excluded an entire dimension of medieval visual culture with which, this thesis argues, Opicinus was engaged: time-keeping instruments made in northern Italy and Avignon during the fourteenth century.

By re-evaluating the role of the sources which informed the making process of *Palatinus A*, including those cited by Salomon, and identifying additional calendars available to Opicinus, the *sanctorale* (fig. 4) is placed within diverse traditions of time visualisation which cross boundaries of both medium (manuscript and instrument) and subject (liturgy and astronomy). The chapter is split into three parts, each of which considers a different group of calendars. Part one distinguishes between the two calendar forms which appear in the *Palatinus*: the 'old' type, which is derived from liturgical manuscripts, and the 'new' type, which is the focus of the rest of the chapter. Part one illustrates how Opicinus used the 'old' version of the calendar as a means by which to situate the urgent political and liturgical issues at the Avignon court within the history of the Church, in order to support the papal agenda.

Part two evaluates how Opicinus learnt to draw his calendars in Genoa and how and why he drew them at the Avignon court. This shows how the pope's dual concern for the correction of the calendar and the coordination of a *summa* of human knowledge motivated Opicinus to

¹⁸¹ Salomon, *Weltbild und Bekenntnisse*, pp.81-86.

include in his drawings the most accurate and recently developed forms for the representation of time and space available to him. Part three emphasises this point by comparing *Palatinus A* with the newest forms of calendars, which are hypothesised to have been components of monumental horological instruments. This further supports the hypothesis that Opicinus incorporated technology into his drawings to make a specific type of diagram, or image instrument, of the cosmos. Considered together, Opicinus's use of the multiple calendar sources expressed his desire to incorporate into his drawings the most recent forms of calendar available, for the purpose of informing the intellectual discussion which was taking place at Avignon.

The primary objective of this study is to elucidate Opicinus's calendars, but its conclusions contribute to the wider study of medieval visual culture. The chronological overview of the calendars available to Opicinus during the early- to mid-fourteenth century reveals a shift in their representation during this time: from the old type to the new. The Palatinus calendars therefore provide a window into the visual culture in which Opicinus was active, meanwhile showing them to be unique and important survivals for the history of the calendar and horology.

Part One: Liturgical Manuscripts and the 'Old' Calendar

The calendars found at the beginning of liturgical manuscripts were the most common forms of calendars during the Middle Ages and, as a *scriptor* and priest, Opicinus was certainly familiar with them. Of the fifty-two Palatinus drawings, thirty-four include at least one calendar, and of these there is only one obvious anomaly.¹⁸² Unlike the circular and oval calendars in the rest of the drawings, fol. 24^r (fig. 5) contains a rectangular calendar, and is thus referred to as the *rectangular calendar*. This was clearly copied from a liturgical manuscript, presenting the question: Were the circular calendars in Opicinus's other drawings also copied from liturgical manuscripts but then rendered into a circular or oval format? The following comparison between Opicinus's *rectangular calendar* and his circular calendars reveals that this is not the case, as their shape is not their only differentiating factor. His circular calendars in fact hail from a different group of sources altogether, showing that Opicinus must have used multiple calendrical sources. By identifying these sources, his calendars can be categorised into two types: the 'old' rectangular calendar from liturgical manuscripts and the 'new' circular format associated with the most recently developed forms of maps and time-keeping instruments. The comparison between the two highlights certain features which explain the role that Opicinus saw his calendars to play within his drawings and hence what he was trying to achieve through them.

Before differentiating between the two forms, an overview of the *rectangular calendar*'s content is necessary. Both the circular and rectangular calendars of the Palatinus are displayed according to the Roman calendar system, as found in contemporary liturgical books. In the *rectangular calendar* the calendrical information is presented in a table in the following order (see fig. 5a):

¹⁸² This statistic is identified by Whittington in *Body-Worlds*, p.17, table 2.

1. Date according to the Roman calendar system: unlike our current system, by which the dates run from the first to the thirtieth or thirty-first of each month, the Roman calendar system is structured around three fixed points: *kalends* (beginning of the month), *ides* (mid-month) and *nonas* (the ninth day before *ides*).¹⁸³
2. Golden number (where relevant) in red Arabic numerals: this specifically indicates the place of the year in the nineteen-year Paschal cycle, and is therefore used to calculate the date of Easter.
3. Dominical letter: a-g repeated, corresponding to the days of the week. Also known as the Sunday letters, they begin with 'a' on 1 January each year.
4. Name of the saint whose feast day it is (if any) and a selection of the movable feast dates.¹⁸⁴ The use of different colours for particular saints' days is typical of medieval liturgical calendars: the majority are in black whilst the most important are highlighted in red, hence our term 'red-letter days'.¹⁸⁵

The content of the *rectangular calendar* is undoubtedly that of a liturgical calendar. Although *Palatinus A* contains the same groups of data, it is organised differently in order to accommodate the separation of the movable and immovable calendars (the *sanctorale* and *temporale*) into two rings. This means that in *Palatinus A* the dominical letters are included twice: in a ring for each calendar. The data relevant to the *sanctorale* (the fixed date and saints' day) is found in the outer ring and that relevant to the *temporale* (the golden number) is in the inner. The calendar of *Palatinus A* is not only different from the *rectangular calendar* in its circularity but also in the organisation of its content, which emphasises a different relationship between the movable and immovable calendars. The reasons for this become clear through the close analysis of *Palatinus*

¹⁸³ For a more comprehensive description of the Roman calendar system, see Roger Wieck's handbook on the medieval calendar: R. Wieck, *The Medieval Calendar: Locating Time in the Middle Ages* (New York, 2017), pp.12-13.

¹⁸⁴ This is explained in the description of *Palatinus A* in Salomon, *Weltbild und Bekenntnisse*, p.82. The representation of the movable feast dates is explained at length in chapter three.

¹⁸⁵ Wieck, *The Medieval Calendar*, pp.2-3.

A's circular calendar below, but for now it suffices to conclude that Opicinus's two calendar types are distinct in their making and hence in their purpose.

Before focusing on Opicinus's circular calendars, which whilst less common in medieval visual culture were generic for the Palatinus, the significance of the *rectangular calendar* must be recognised. Why, in this one case, did Opicinus choose to represent the calendar in this form? The content surrounding the *rectangular calendar* expresses its strong relationship with the texts of the liturgy, a selection of which held political implications during that time. In comparison to the images which include circular calendars, the calendar in this image has a different purpose.

Opicinus's Rectangular Calendar

The *rectangular calendar* is one of Opicinus's most well-known drawings, probably on account of the distracting diversity of its textual and pictorial content and its colouring. It is covered with images of the zodiac, religious iconography and busts of representatives of each of the monastic orders. The large zodiac symbols are washed in earth-tone colours which were more often used for map-making, rendering the pictorial aspects of the image more striking. The drawing is often the first to be recalled in a discussion concerning Opicinus, especially since its exhibition in *Pen and Parchment: Drawing in the Middle Ages* (2009) at the Metropolitan Museum of Art, for which good quality colour images of selected drawings of the Palatinus were published online for the first time.¹⁸⁶ It is also published in the most recent monograph concerning Opicinus, Piron's *Dialectique du monstre*.¹⁸⁷ As the *rectangular calendar* seems to originate from liturgical books, it is

¹⁸⁶ *Pen and Parchment: Drawing in the Middle Ages*, ed. M. Holcomb and L. Bessette (New York, 2009), pp.154-55, cat. no. 46; 'Diagram with Zodiac Symbols,' *Pen and Parchment: Drawing in the Middle Ages*, Metropolitan Museum of Art, http://blog.metmuseum.org/penandparchment/exhibition-images/cat460r7_49f/ (consulted 01/10/2014). The relative popularity of certain drawings may have changed following the upload of high-quality images of the Palatinus drawings onto the Vatican Library's website in 2016.

¹⁸⁷ Piron and Nuss, *Dialectique du monstre*, pp.142-43.

understandable that Opicinus's interpreters would be inclined to believe that his other calendars had come from this same source.

The format of the calendar is similar, if not identical, to the layout one would find in contemporary Italian liturgical books, which also often consist of four columns containing the golden number, the dominical letter, the date according to the Roman calendar system, and the feast day written in Latin. Even more similar are the calendars in non-codex form, such as Wellcome MS 201 (fig. 6), an early-fourteenth-century *computus* manuscript.¹⁸⁸ Written on a single sheet of vellum, there is enough space for the scribe to draw multiple months on each side in a consecutive list in the same format as the *rectangular calendar*. It is unclear whether MS 201 is an unfinished calendar which was later meant to be cut down and collated into a codex or almanac, but in any case, it displays how the calendar appeared to the copyist during the making process.

As a *scriptor* in the penitentiary, where many of these liturgical books were copied, Opicinus would certainly have seen the calendar copied in this form, if he had not done so himself. Kathleen Fleck's study of the inventories of the papal library showed how each pope had his own distinct practice for the commission and acquisition of books, and how illumination flourished under the popes reigning during Opicinus's time in Avignon. Benedict XII especially had a tendency to commission books to be made in Avignon.¹⁸⁹ The library was a traditional ecclesiastical collection and over three-quarters of its contents consisted of theological and liturgical texts, the majority of the latter including calendars.¹⁹⁰ Manzari's study of illumination at

¹⁸⁸ *Computus* is the Latin for 'computation' and refers to the calculation of Easter. The definition of *computus* and its role within the Palatinus is considered further in chapter five.

¹⁸⁹ See n.129 above.

¹⁹⁰ Fleck, 'Seeking Legitimacy,' p.272. She cited P. Gasnault, 'La librairie pontificale à la veille du Grand Schisme,' in *Genèse et débuts du Grand Schisme d'Occident: [colloque tenu à] Avignon, 25-28 septembre 1978*, ed. J. Favier, G. Yves and H. Michel (Paris, 1980), pp.277-89, pp.281-82.

Avignon corroborated Fleck's by indicating the primarily liturgical nature of the books illuminated there.¹⁹¹

The content which surrounds the *rectangular calendar* supports its liturgical source and purpose.¹⁹²

To the left of the drawing's centre is a laudatory verse to the *Virgo beata*, written vertically in large upper-case letters.¹⁹³ Parallel to this verse on the right side (fig. 5b) and read upside down alongside the calendar are five sets of liturgical information. Salomon referred to these as *Glossenlieder*, or gloss-songs, which form what he called a 'cento' made up of the following: the *Ave Maria* (first, *Ave*; second, *Maria*; third, *Gratia*, and so on); the Gradual Psalms, and the Magnificat (the canticle of Mary taken from the Gospel of Luke 1, 46-55). The *Ave Maria* makes up fifteen stanzas, which are used to organise the other texts.¹⁹⁴ To take the first verse as an example: to the left of the *Ave* in red is the Gradual Psalm written vertically and also in red ((119,1) *Ad Dominum, cum tribularer, clamavi*); followed by the canticle (*Ave tu sanctificata/ Maria prius quam nata/ Ut, dum clament tribulati...*); followed by the Magnificat written vertically in red ((Luke 1,46) *Magnificat anima mea Dominum*).¹⁹⁵ Between the canticle and the Magnificat are single words written in red, which Salomon identified as the fifteen mysteries of the rosary.¹⁹⁶

The groups of texts organised here originate from commonplace liturgical books such as the *Divinus officium*, hence simply referred to as the Divine Office, or the Breviary. These include a calendar (including the *sanctorale* and *temporale*), psalms and hymns, all of which are structured by the canonical hours at which they are performed. Yet this content existed in different forms of

¹⁹¹ Manzari, *La miniatura ad Avignone*, p.10.

¹⁹² The image does not have a set orientation and the calendar reads around the image in a rectangular border. For the sake of this description, the face of the largest central figure which coincides with the neck of the folio is referred to as the top.

¹⁹³ PULCHRA ET PULCHRIOR ET PULCHERRIMA VIRGO BEATA./ PINGITUR. HIC VIXIT, NUNC REGNAT GLORIFICATA./ SIC FIT, SIC FUERAT, SIC EST. NOS ERGO PRECEMUR/ HUNC VULTUM STATUAMQUE DEI MATRIS VENEREMUR. Transcribed by Salomon in *Weltbild und Bekenntnisse*, p.280.

¹⁹⁴ *Tecum* is divided into *Te-Cum*.

¹⁹⁵ Salomon, *Weltbild und Bekenntnisse*, p.280-81.

¹⁹⁶ *Ibid.*, p.282.

liturgical books, all of which take their content from the Breviary. The specifically Marian content of these *Glossenlieder* led Salomon to connect this drawing with Opicinus's still unpublished treatise devoted to the Virgin, the *De promotionibus virginis Marie* (1333).¹⁹⁷ The Marian focus could also indicate that Opicinus did not use a Breviary, but instead a Book of Hours, a genre which began to flourish in France and northern Italy at the beginning of the fourteenth century. In Books of Hours each hour had an opening verse to be spoken after a silent *Ave Maria* and a response followed by the Gloria, antiphon, psalms, *capitula* (short extracts from psalms), and hymns divided by verses, responses, prayers or collects. Both the Marian songs and the form of the *rectangular calendar* suggest that the drawing was informed by a Book of Hours.

It is not possible, nor particularly helpful, to define which exact form of liturgical book Opicinus would have drawn from. A comparison of the *rectangular calendar* with Breviaries and Books of Hours is complicated by the overlap of the two genres of liturgical book, as the Book of Hours itself emerged from the text of the Divine Office. After its approval by Pope Urban II (r. 1088-99), the basic text of the Book of Hours (the *Officium parvum beate Marie virginis*) was first appended to the Breviary, but after time became separated to become a book in its own right.¹⁹⁸ In any case, Opicinus's alignment of such texts is, as Salomon pointed out, not uncommon.¹⁹⁹ The various genres of liturgical book vary in their focus and function, but they were all structured around the same basic liturgical routine by which Christian history was celebrated within the medieval present.

The fundamental function of calendars in liturgical books informs a crucial question of this project: What role does the liturgical calendar play within the drawing? Before this can be

¹⁹⁷ Ibid., p.281, n.3.

¹⁹⁸ J. P. Harthan, *Books of Hours and their Owners* (London, 1977), p.13.

¹⁹⁹ Salomon, *Weltbild und Bekenntnisse*, p.281, n.3.

answered one must understand, in the most general terms possible, what Opicinus depicted: an image of the Church.²⁰⁰ The body of Mary, identified by her veil, is labelled the *Ecclesia universalis* and is thus the embodiment of the Church. She holds the monastic orders and Church Fathers at each end of her body, with the calendar year stretched between. The symbolic Church is therefore structured by the liturgical calendar, which also serves as a representation of Church history. The Church Fathers are situated at one end, at the genesis of the Church, and the monastic orders on the other, representing the most dominant orders of the fourteenth century. Amongst these details the *rectangular calendar* becomes a multifaceted symbol of time. It represents both liturgical time, which structured the administration of the fourteenth-century Church and its ecclesiastical routine, and historical time, including the figures and communities involved in its governance.

Opicinus used the calendar as a means by which to situate the present Church within the overall history of the Church. By bringing the two understandings of time together, the following section shows how Opicinus used events from Christian history to construct arguments concerning fourteenth-century liturgical and political practice. The allusions to issues that were urgent to the Avignon court at that time show that Opicinus made the drawing in response to contemporary discussions at the court.

Liturgical Reform and Pavian Politics

Opicinus used the liturgical calendar to reflect upon the issues which were urgent at the court during the time of its making. As part of the Avignonesse liturgical reform of the 1330s, for

²⁰⁰ A great deal can be said concerning Opicinus' use of the body as an allegory of the Church, particularly following Whittington's discussion of the geopolitical bodies, or 'body worlds,' within his drawings. See in particular chapter two, 'Empirical Allegory' and chapter four, 'Graphic Art' in Whittington, *Body-Worlds*, pp.61-101, 141-72.

example, the musical routine of the canonical hours was more strictly regimented and Pope Benedict XII established the *capellani capelle*, a papal chapel staff of twelve chaplains whose purpose it was to sing the mass and *horas canonicas cum nota*. The documentation of the reform indicates that this was mostly accomplished under the pontificates of John and Benedict and that the music of the liturgy was already a significant part of the court's routine under John. He wrote, in his *Docta sanctorum patrum* (1324), a detailed enumeration of specific abuses in the practice of church music and at his death in December 1334, he left a clear set of decrees concerning liturgical practice.²⁰¹ Even so, Benedict was quick to further reform papal liturgical custom after his election. In November 1336, he promulgated the bull *Redemptor noster*, which demanded more strict attendance at the Divine Offices for the followers of St Francis, and he established the *capellani capelle* in 1334.²⁰² Amongst the clerics who made up the *capella* were various members of the papal household, including scribes. It is not implausible that Opicinus was either involved in or associated with the *capella* and made this drawing to re-examine and organise his own understanding of the liturgy, or possibly even as a tool for its memorisation.²⁰³ The prominence of liturgical excerpts and hymns in the Palatinus drawing might therefore be expected.

A close look at the hymnal quotations of the *rectangular calendar* within this context reveals that they relate to the political situation in Pavia at that time. For Opicinus, this was a personal issue. This reading begins with a hymn, the *Te Deum*, which is written outside the uppermost circle containing busts of the Church Fathers (fig. 5c). In this instance, the alignment of the *Te Deum* with these images does not have a solely liturgical function, but also makes a political-historical statement about the significance of Pavia in ecclesiastical history. On the left above Ambrose is

²⁰¹ A. Tomasello, *Music and Ritual at Papal Avignon 1309-1403* (Michigan, 1983), p.9.

²⁰² Ibid., p.10.

²⁰³ The theory that Opicinus was in the *capella* is supported by a sketch in his journal (fol. 69r, fig. 7), which shows a monk seemingly reciting the calendar, represented by a vertical line of the Roman calendar system (as in the *rectangular calendar*) emerging from his mouth.

written *V(ersus): Te deum laudamus*, and opposite this text on the right above Augustine is *R(esponsum): Te dominum confitemur*. This visual alignment expresses the contemporary belief that the *Te Deum* was written at the baptism of Augustine by Ambrose, as described in Jacobus de Voragine's *Legenda Aurea* (c. 1252-60). Opicinus was, however, more likely to have taken this from the *Sermo de beato Augustino* of Nicholas of Allesandria. The *Sermo*, written in Paris in 1332, greatly contributed to shaping the identity of the Augustinian Order in the first half of the fourteenth century.

The sermon can be linked to Opicinus both by circumstance, as it was written just a few years before the drawing of the *rectangular calendar*, and by its argument concerning the relationship between the papacy and the monastic orders, which was important within Pavian politics. The political turmoil surrounding the Guelph and Ghibelline disputes was not limited to Rome and Avignon. It greatly affected central and northern Italy, forcing the Canister family to move on multiple occasions.²⁰⁴ Pavia had become the epicentre of struggle between papacy and empire due to the political activity of two religious bodies: the Ghibelline Canons Regular and the Guelph Hermits of St Augustine.²⁰⁵ On 20 January 1327, John XXII issued a bull, *Veneranda sanctorum patrum*, granting the Hermits shared possession of San Pietro in Ciel d'Oro in Pavia, in order that they might be 'reunited' with the relics of Augustine, their putative founder. Prior to this, the Church had been controlled by the Canons Regular for over a century. Nicholas of Allesandria's sermon played directly into the dispute as it discussed Augustine's death and the subsequent transfer of his body (in the eighth century) to Pavia. Following this sermon Nicholas was chosen to attend the Augustinian general chapter at Grasse (near Avignon) in 1335 in order to dispute the matter. The placement of the text by the monastic figures proves it to be a direct

²⁰⁴ Whittington, *Body-Worlds*, p.7.

²⁰⁵ S. Dale, 'A House Divided: San Pietro in Ciel d'Oro in Pavia and the Politics of Pope John XXII,' *Journal of Medieval History*, Vol. 27 (2001), pp.55-77, p.57.

reference to this sermon, and therefore to the dispute over the placement of Augustine's body. The citation of the *Te Deum* here served a political function.

Within this context, John's initial interest in Opicinus makes more sense. *Veneranda sanctorum patrum* was a carefully orchestrated policy forged by John and his legate, Bertrand du Poujet, in order to assert papal hegemony in Lombardy. For the same reason, John also appointed Hermits to the positions of papal sacristan, librarian and confessor.²⁰⁶ Perhaps he believed that, as a Pavian citizen, Opicinus was a suitable candidate for the promotion of St Augustine's relics there. Or perhaps Opicinus, who was very much aware of *Veneranda sanctorum patrum* as it is mentioned in his treatise of 1330 on the papacy, was trying to signal his suitability to John through his drawing.²⁰⁷

The *rectangular calendar* was a response to the discussion at the Avignon court concerning papal authority. Using the liturgical calendar as a foundation, Opicinus built a network of liturgical excerpts in order to illustrate the historical origins, and thus the patristic authority, of certain liturgical practices. By representing the historical significance of the *Te Deum* to the Augustinian Order, he expressed his argument on a specifically fourteenth-century issue: the appropriate location of Augustine's body during the 1330s. The medieval understanding of time is therefore integral to the diagram's reading. The liturgical calendar, understood in the fourteenth century to structure present time, was used to interpret current issues through the depiction and alignment of images which represented the history of the Church. This first evaluation of one of Opicinus's calendars proves that they are not only significant in evaluating the origin of the drawings, but

²⁰⁶ Ibid., p.57.

²⁰⁷ Ibid., p.64.

that they were also powerful vehicles of political and theological meaning through their connection of the biblical past with the medieval present.²⁰⁸

A Comparison of the *Rectangular Calendar* and *Palatinus A*

An isolated interpretation of the *rectangular calendar* could lead one to assume that Opicinus was copying his calendars from liturgical books. This is surely true in this case, but if this were the sole source of Opicinus's calendrical information it would imply that both his circular and oblong calendars were simply drawn from liturgical books which Opicinus had rendered into a circular format. This would be a reductive account of their construction. Each of the calendars is meticulously measured, detailed, and distinguished from the others. In addition, a comparison between the content of the calendars of the *rectangular calendar* and *Palatinus A* conclusively proves they could not have shared a common source. It is a valuable exercise as, first, it shows Opicinus to have used multiple calendrical sources and, second, it leads one to the origins of his circular calendars.

Immediately apparent from their comparison is that the *rectangular calendar* has far more entries than *Palatinus A*. While sixty-one of the entries include the same feasts, over 160 are different.²⁰⁹ This statistic alone might lead one to conclude that *Palatinus A*'s calendar is either a simplified form or partial copy of the *rectangular calendar*, but a detailed analysis of the individual feast days demonstrates this to be impossible. Two of the feast dates contradict one another, appearing in both calendars but under different dates, and *Palatinus A* includes at least ten feast days which

²⁰⁸ Wieck included a guide on how to determine the provenance of a calendar in 'How to Localize a Calendar,' in Wieck, *The Medieval Calendar*, pp.71-87.

²⁰⁹ In addition to the text which surrounds the *rectangular calendar*, which makes it clear that Opicinus was consulting liturgical books for the making of this drawing, this is the only calendar to include the dates of the vigils.

are not present in the *rectangular calendar* (this does not include the instances in which multiple feasts are inserted for one date).²¹⁰ In addition, *Palatinus A*'s movable calendar is far more detailed than that of the *rectangular calendar*. There are also multiple instances in which the representation of the written characters differs: numerically, as the golden numbers are expressed in Arabic numerals in the *rectangular calendar* and Roman numerals elsewhere, and textually, in the use of abbreviations. For example, the feast of 'St Francis, confessor' (4 October) appears as 'Franciscu' 9fessoris' in the *rectangular calendar* and 'Franciscu' 9' in *Palatinus A*, despite there being ample space for the longer form of the abbreviation. In summary, the two calendars are clearly copied from different sources.

But what is the significance of this distinction? The appearance of these highly-detailed calendars, surrounded by a plethora of distracting figures and legends, could give the impression that the calendars themselves do not warrant a thorough analysis. Yet the comparison of their content shows that whilst they might contain similar data sets, their forms reveal their difference in function. So far, this comparison has demonstrated the significance of liturgical calendars in the *rectangular calendar* and has disproved the notion that Opicinus's circular calendar in *Palatinus A* is copied from it, or vice versa. What remains is to use *Palatinus A* to evaluate the sources of Opicinus's circular calendars. In order to do so, one must shift attention away from the older type of calendars, established in liturgical manuscripts for centuries, and towards a new type, which began to accompany instruments which measured time and space only decades previous to the making of the Palatinus drawings. Through the evaluation of each calendar's sources, the rest of this chapter demonstrates how one can distinguish between the rectangular and circular models as examples of the old type and the new.

²¹⁰ Crispin, bishop of Pavia and confessor (30 October in the *rectangular calendar*, 31 October in *Palatinus A*) and the conception of John the Baptist (24 September in the *rectangular calendar*, 22 September in *Palatinus A*).

Part Two: Cartography and the 'New' Calendar

The maps within Opicinus's drawings have attracted a great deal of attention, more than any other component. This is due in part to the impressive accuracy of the portolan charts and their creative uses, but also to their contextual significance. As Whittington commented, 'Opicinus was working during a crucial moment in the history of cartography, when numerous artists and map makers sought to combine old and new forms'.²¹¹ At the end of the thirteenth century, portolan charts were the first representations of coastlines which were mapped through a mathematical process and they have therefore been heralded as 'the first true maps' and their invention as 'one of the most important turning points in the whole history of cartography'.²¹² The date of their invention has been disputed, although their earliest documentation exists from the late-thirteenth century. In Opicinus's portolans he used the most accurate form of cartographic representation available at that time. In addition, he integrated them with an older tradition of representing the earth, the model most commonly referred to as the *mappamundi*.

The cartographic elements of Opicinus's drawings are not the focus of this project, but it would be problematic to comment on his representation of time without considering his representation of space, as many of the portolan charts he used were accompanied by detailed circular astronomical calendars. How Opicinus learnt to draw and use portolan charts has been studied comprehensively, revealing invaluable information concerning the sources he was using and the process by which he learnt to draw the world. Through a consideration of this literature in relation to the making of his calendars, this part of the chapter suggests first, that when Opicinus learnt to draw maps he also learnt how to draw calendars; and second, that he was highly likely

²¹¹ Whittington, *Body-Worlds*, p.25.

²¹² Campbell, 'Portolan Charts from the Late Thirteenth Century to 1500,' p.371.

to have drawn upon calendars which were associated with the *Secreta* of Marino Sanudo in Avignon, and thus engaged with the intellectual activity of the 1320s in the penitentiary.

Genoa, Venice and Palma de Majorca were the main centres of cartographic production from the late-thirteenth to the fifteenth centuries, due to their status as the major Western Mediterranean entrepôts.²¹³ Salomon's initial study of the Palatinus suggested that Opicinus's maps were loosely based on either Majorcan or Genoese portolan charts, but the subsequent discovery of his journal confirmed that Opicinus learnt this skill in Genoa. He wrote: *Ianua dedit viam scientie describendi mundum Papie*, Genoa taught (the man from) Pavia how to design world maps.²¹⁴ Political change drove his family from Pavia in 1316 (when he was twenty) to Genoa, where he learnt book illumination to make a living. He mentioned Genoa in his journal just a few folios after his initial statement, where he demonstrated his understanding of how the Genoese and Majorcan cartographic ateliers depicted scale and therefore how the maps were made.²¹⁵

A great deal has been done to identify the source of Opicinus's cartography, most often without any solid conclusion concerning the specific model he used. Harding and Whittington have recently identified the significance of Opicinus's use of rhumb lines within many of his drawings. Distinctive to portolan charts, rhumb lines are networks of lines which cover the chart's surface. They are generated from two sixteen-point circles often made up of red, green and brown lines, which are in most cases placed side by side and share one point in common at the centre of the

²¹³ R. J. Puchades i Bataller, *Les cartes portolanes: la representació medieval d'una mar solcada* (Barcelona, 2007), p.487.

²¹⁴ Vaticanus, fol. 53r. Cited by J. G. Arentzen, *Imago Mundi Cartographica* (Munich, 1984), p.300. Salomon was the first to consider these models as potential sources for Opicinus: Salomon, *Weltbild und Bekenntnisse*, pp.56-57; Salomon, 'A Newly Discovered Manuscript,' p.46. Salomon's discussion of Opicinus's potential cartographic sources was originally corrected by Almagià in his *Monumenta Cartographica Vaticana*, 1, p.97. For the most recent discussion of Opicinus in relation to portolan charts, see 'Chapter One: Opicinus's Cartography,' in Whittington, *Body-Worlds*, pp.25-59.

²¹⁵ Vaticanus, fol. 59r. For the full journal entry, see n.620 below.

chart.²¹⁶ Harding accepted that it is not possible, nor totally necessary, to pinpoint a specific model which Opicinus may have seen either in Genoa or Avignon, but narrowed it down to 'a portolan chart based on two rhumb systems on twin-circle charts'.²¹⁷ Whittington believed that Opicinus worked with a single example as the portolan outlines are identical throughout his maps.²¹⁸ The debate still continues and is discussed by Piron in the most recent interpretation of Opicinus, in which he presented the possibility that Opicinus could have learnt to copy maps in Avignon. He raised the question of the relationship between cartographer and illuminator, which he definitively stated to be separate, before concluding that Opicinus's maps are closest to the Majorcan model.²¹⁹

Yet none of these conclusions seriously considered Opicinus's biography. More specifically, they do not address his two major periods of book illumination and copying: his training in Genoa, and his role as *scriptor* in the Avignon penitentiary. The issue of his training in illumination and map copying is directly relevant to how he learnt to render other components of his drawings. This can now be developed further thanks to Ramon Puchades i Bataller's recent study concerning the inner workings of cartographic workshops in the fourteenth century.

It is remarkable that amidst the scholarship concerning the portolan in Opicinus's drawings, no-one has looked at the calendars. Many of these studies consider the influence of the portolan charts of Pietro Vesconte, yet not the astronomical calendars which are attached to and work with his charts. These astronomical calendars are the only circular manuscript calendars to survive from before the Palatinus yet they have only been referenced in relation to Opicinus by

²¹⁶ Whittington, *Body-Worlds*, p.30.

²¹⁷ Harding, 'Opening to God,' p.30.

²¹⁸ Whittington considered two potential models: the Carte Pisane (BnF, Cartes et Plans, Rés.Ge.B 1118) from the late-13th century (most likely made, despite their name, in Genoa) and the prototype of the Dulcert Chart (named after its maker, Angelino Dulcert), which is the earliest surviving portolan chart. Whittington, *Body-Worlds*, p.27.

²¹⁹ Piron, *Dialectique du monstre*, pp.93-96.

Salomon who, correctly but briefly, acknowledged their significance.²²⁰ Salomon noted that whilst the basic structure of the calendar rings of Pietro and Opicinus is the same, their individual execution is quite different.²²¹

The significance of Pietro's calendars to the Palatinus does not lie solely in their visual, material and functional similarity, but also in the context of their making. Though one cannot be entirely certain whether they ever met, Opicinus crossed Pietro's trail at least once in Genoa, and possibly again in Avignon. Before Pietro moved to Venice he began his cartographic career in Genoa, where Opicinus was trained as an illuminator. After Genoa, Pietro had connections to the cartographic activity at the Avignon court under John XXII. It is not certain whether he was ever physically in Avignon, but the evidence suggests that his maps were. This overlap between the workshops in which Pietro and Opicinus were active at near-contemporary times has been underestimated and deserves to be explored. Before looking at the contextual connections between Pietro and Opicinus, one must identify the visual relationship between their calendars.

The Five Astronomical Calendars of Pietro Vesconte

Pietro's five surviving astronomical calendars are the most similar to Opicinus's in form, scale and arguably function.²²² Like the Palatinus calendars, all five are drawn and written on vellum

²²⁰ Salomon, *Weltbild und Bekenntnisse*, p.81.

²²¹ Ibid., p.82.

²²² The five surviving calendars are still kept with their respective portolan charts. In chronological order, they are: BnF, Cartes et Plans, GE DD-687 (dated 1313); Vienna, Österreichische Nationalbibliothek, MS 594 (dated 1318); Venice, Museo Correr, Port. 28 (dated 1318); Bibliothèque Municipale de Lyon, MS 175 (identified as c. 1321); London, BL, MS Add. 27376, folios 185^v-186^r (c. 1331/after 1327). Another calendar of almost identical form but different coloration, using a blue and red rather than a gilded background, is signed by Perrino Vesconte: Zentralbibliothek Zürich, R. P. 4 (c. 1321). Edson suggested that the BL, MS Add. 27376 model may have also been made by Perrino. E. Edson, 'Reviving the Crusade: Sanudo's Schemes and Vesconte's Maps,' in *Eastward Bound, Travel and Travellers 1050-1550*, ed. R. Allen (Manchester, 2004), pp.131-55, p.137. The question as to whether Pietro Vesconte and Perrino Vesconte were in fact the same person is still unresolved. As Perrino is the diminutive of Pietro, it is possible that Perrino was his student. P. Billon, 'A Newly Discovered Chart Fragment from the Lucca

with each date of the year precisely measured and delineated. They can be divided into two groups (of two and three), here referred to as his 'bare' and 'illuminated' calendar types. The bare calendars (figures 8 and 9) are not fully illuminated, yet in the earlier example (fig. 8), faint outlines and traces of colour on almost imperceptible signs of the zodiac can be identified towards the centre of the calendar circle. This example was dated and signed by Pietro in 1313 in Genoa. The exact date of the later example of the bare calendar (fig. 9) is not known, but it is thought to have been made in Venice in or after 1327, and is attached to an atlas which accompanies a third edition of Sanudo's *Secreta*. The relevance of this manuscript to the discussion of cartography in Avignon is investigated below. The main difference between the two bare calendars is their centres: the 1313 model includes the zodiac signs and appears to have had a volvelle attached, whereas the later model includes an astronomical table like those in the illuminated models. Apart from this and the slight difference in the order of their content, the two calendars are almost identical.

The other three, his illuminated type, have roughly the same content as his bare calendars but with a few significant differences. The three calendars are almost identical to one another. They each include astronomical tables which chart the zodiac signs in relation to the *dies lunae*, they are pasted onto wooden boards and they are ornamented with illumination, gilding and biblical iconography. Apart from the dates and signatures of some of his maps, there is no biographical documentation of Pietro Vesconte, which means that one cannot be entirely sure when he moved from Genoa to Venice or where he created the surviving calendars.²²³

Archives, Italy,' *Imago Mundi*, Vol. 63, No. 1 (2011), pp.1-21, p.19, n.10. In the tables in which the earliest portolan charts are chronologically organised, Pietro and Perrino are often categorised as separate makers. Billion took the charts from Campbell, 'Portolan Charts from the Late Thirteenth Century to 1500,' pp.371-461 and Puchades, *Les cartes portolanes*, pp.489-91, 510-18.

²²³ Puchades i Bataller, *Les cartes portolanes*, p.289.

Considering the three types of calendar together (*Palatinus A* and Pietro's bare and illuminated calendars), it is apparent that *Palatinus A* shares features from each of the others. The following comparison therefore considers both of Pietro's calendar types. The 1313 calendar (fig. 8) is selected as the representative of the bare type, and the 1318 example (fig. 10) as the representative of the illuminated.²²⁴ By considering both Pietro's bare and illuminated calendars it is possible to gauge the appearance of models which have not survived.

The purpose of this comparison is not to evaluate whether either of the two calendars was the definitive model which Opicinus used to draw his own; it instead suggests that they are representative of the calendars made in Genoa during the time in which Opicinus was trained there. Placing Pietro's models from 1313 and 1318 side by side, two distinct types of calendars can be observed. The 1318 model, through its illuminated biblical iconography and gilded curlicues, gives more insight as to how Pietro decorated his more lavish calendars, whereas the 1313 example displays its bare bones. Together, they reveal much about the making process of his calendars as well as the variation of Pietro's models. It is therefore probable that during Opicinus's map-making training in Genoa in 1316 he would have seen models similar to these two.

A Comparison of the Calendars of Pietro and Opicinus

The two most immediately striking similarities between the calendars are their relation to their accompanying portolan charts and the ways in which they are drawn. Each of Pietro's calendars

²²⁴ The 1313 model is chosen as the representative of the bare type as it has a clear date. The visual analysis of the Museo Correr atlas (1318) was made possible by a Studentship funded jointly by the Fondazione Giorgio Cini and TORCH (Oxford) for the purpose of consulting the atlas during a three-week residence at the Vittore Branca Centre, Venice (April 2017).

precedes his atlases: like Opicinus, he associated calendars with portolan charts. Although Opicinus often combined his maps and calendars, whereas Pietro kept his strictly separate, their common concern to render time and space to scale is evident.²²⁵ Second, through a detailed examination of the calendars themselves, one can detect similarities in the way in which Pietro and Opicinus drew their maps. The remaining holes between each dominical day in each model show that they were measured in the same way, using a compass to pinprick each of the dominical days.²²⁶ Considering their contextual proximity, it cannot be a coincidence that these rare early survivals of the new calendar shared the same structural elements and accompanied some of the earliest examples of portolan charts. The evidence suggests that Opicinus learnt how to draw calendars in Pietro's workshop in Genoa.

Despite this similarity, the distinction between the content of Pietro's and Opicinus's models demonstrates that Opicinus was not trying to make identical copies, but manipulated these forms towards his own ends. The majority of the contents of Pietro's earlier and later calendars are identical, including the date, the signs of the zodiac, their qualities (*frigidus/calidus*; *sicus/humidus*), their *domus* (or 'house' of the zodiac in which each sign is related to the planets) and the corresponding part of the body (most often illustrated through the zodiac man) written in the innermost rings. The ways in which certain elements are represented differ, however. For example, the zodiac is depicted through images in the earlier model and through text in the later. When *Palatinus A* is brought into the comparison a similar issue arises: it contains much of the

²²⁵ In terms of the material features of the calendars, 1318 is the outlier as the entire atlas has been pasted onto a wooden board which folds into a book-like form. (The way in which the boards were originally attached to one another is uncertain, but a first-hand consultation revealed that some sort of metal hinge kept them together. This is indicated by the holes at the base of each board (near where the ends of the 'spine' would have been) and the indented lines on the edges of the board which would have attached to the spine.) The outsides of the top and bottom boards are adorned with intarsia inset showing that it was intended to be seen closed, and probably kept in that way when not in use. The intarsia technique, which came later, indicates that the atlases were mounted in this way later on. In any case, the calendar would have been drawn on vellum first before it was pasted and so would have appeared more similar to the model of 1313 before their mounting.

²²⁶ In addition, the months are more clearly demarcated than the rest of the days in all three examples. This is emphasised by the two lines between the months in the 1313 model, a single heavier line in 1318, and a single heavier line which has been emphasised in red in *Palatinus A*.

same content as Pietro's models, but expressed differently. A second distinction reveals why: in *Palatinus A* each day is marked with the date according to the Roman calendar system and includes liturgical feasts, whereas in Pietro's each date is not marked but can be identified by counting the days from the beginning of the month. These are labelled in the outermost circle with the number of days they contain (for example, *augustus habet dies xxxxi*).

Their distinction reveals an intrinsic difference in how the calendars were intended to be used. Pietro's calendars are more appropriate to accompany maps which would be used for navigational purposes. While they quantify time, they also had the ability to measure space, as demonstrated by the demarcation of the 360 degrees of the circle (the red lines outside the descriptions of the zodiac) in relation to the zodiac. Most importantly, Pietro's calendars do not include the main component of this discussion, namely the *sanctorale*.

The centre of each calendar is particularly revealing with regard to their distinct priorities. They all relate to the movable calendar, and by extension the activity of the moon which is essential for its calculation, but each emphasises different aspects. Whereas Opicinus's central component is clearly a calendar of the movable feasts, Pietro's calendars are more concerned with the lunar movement by which these feasts are calculated. Four of the five surviving calendars by Pietro contain a table which tracks the zodiac sign in relation to the lunar month, and the 1313 model encloses a blank circle and a central hole large enough to thread a piece of string through, suggesting (as stated above) that it once contained a volvelle.²²⁷ In the light of the majority of volvelles which survive from astronomical almanacs of the fourteenth and fifteenth centuries,

²²⁷ A similar table appears in three of the *Palatinus* drawings: an astronomical table on fol. 7^v in which the months and zodiac are aligned, and fol. 19^r, in which the zodiac signs are placed in relation to the four elements in an oblong table. Tables such as these appeared in various types of manuscripts throughout the Middle Ages, so a more detailed study of the tables would not be useful to this comparison.

this was most likely a lunar volvelle.²²⁸ In contrast to the calendar of 1318, Pietro's 1313 model shows more concern for the movable calendar; there is a table on its left side for the use of calculating Easter, as explained in the rubric above it. This shows that the earlier model was more concerned with the movable liturgical calendar, as depicted by Opicinus.

In summary, the ways in which content was represented changed slightly between Pietro's models, yet they shared the same basic composition and data. Although structured and drawn in the same way, Pietro's are astronomical calendars, whilst Opicinus's are liturgical. This distinction is crucial to understanding what Opicinus was trying to achieve, but before considering this there is still one more point of comparison between the calendars which exposes important information about their making process: their biblical iconography.

One of the most striking similarities between Pietro's illuminated calendars and the majority of Opicinus's Palatinus drawings are the four Evangelists which frame the calendar, represented by the four-winged beasts: the ox, angel, eagle and lion. The presence of such figures is not a definitive link between *Palatinus A* and Pietro's later model. In addition to being omnipresent symbols in medieval visual culture, their representation here is stylistically distinct and certain iconographical features also differ.²²⁹ The variation between the beasts' wings provides a clear example. In *Palatinus A* (and the majority of the Palatinus drawings) the wings frame the calendar and contain scriptural passages concerning the relevant Gospel, whereas the wings in Pietro's do

²²⁸ Barely any astronomical volvelles are extant from the early or mid-14th century, so they are often seen to be a phenomenon of the late-14th century onwards. For an introduction to lunar volvelles, though primarily in printed books, see N. Kanas, *Star Maps: History, Artistry and Cartography* (New York, 2012), pp.234-41. On volvelles more broadly, see S. G. Lindberg, 'Mobiles in Books: Volvelles, Inserts, Pyramids, Divinations, and Children's Games,' transl. W. S. Mitchell, *The Private Library*, Vol 2, No. 2 (1979), pp.49-82; J. Helfand, *Reinventing the Wheel* (New York, 2002), p.19; S. Karr, 'Constructions both Sacred and Profane: Serpents, Angels, and Pointing Fingers in Renaissance Books with Moving Parts,' *The Yale University Gazette*, Vol. 78, No. 3/4 (2004), pp.101-27. The latter study is more concerned with the use of volvelles for memorisation and interpretation as opposed to astronomical calculation. Volvelles and their various uses are treated in more detail in the next chapter.

²²⁹ The same applies for two of Pietro's other surviving illuminated calendars and a calendar of Perrino Vesconte (see n.222 above).

not touch the calendar's rim, point outwards (apart from the angel's wings which point inwards) and are devoid of text.²³⁰ Opicinus may have been partially influenced by Pietro's inclusion of Evangelist iconography, but the formal features of the Palatinus beasts can be traced to other pictorial sources, as will be discussed in chapter four. From this it is clear that Opicinus did not emulate Pietro's figures.

The overall iconographical similarity is, however, still significant to the comprehension of medieval cartographic practice. First, it demonstrates that these complex astronomical images were not perceived as secular instruments. Second, it introduces important questions concerning the practices of map-making in Genoa. Who drew the biblical figures? Were they drawn by the same hands as those who measured the portolan chart? What could this tell us about the practices of cartographic workshops, specifically in Genoa? The relationship between manuscript illumination and map-making in Genoa is crucial to understand how Opicinus learnt to draw his figures and his maps.

Illumination and Cartography in Genoa

Until recently, the understanding of medieval cartographic practice was dominated by Tony Campbell's study of fifteenth-century workshops, in which he concluded that they functioned like illumination workshops of the same period. According to this, a manuscript would not be produced by an individual, but instead the stages of work would be shared between specialists: a scribe, a rubricator and one or more painters. From this, Campbell deduced that Pietro would have passed his drawn maps on to an illuminator for ornamentation and completion.²³¹ Puchades

²³⁰ The rationale behind the iconographic details of Opicinus's Gospel figures are expanded upon in chapter four.

²³¹ Campbell, 'Portolan Charts from the Late Thirteenth Century to 1500,' p.429.

i Bataller's recent study of the practices of map-making in Genoa tells a different story. Using a closer object-based interpretation of the making of Pietro's maps, he argued that during the fourteenth century, nautical cartography 'ateliers' were 'run by painter-cartographers who trained within the confines of their own social and production nuclei'.²³² According to this model, Opicinus would have learnt to draw maps and illuminate figures simultaneously.

Puchades i Bataller believed that the corner miniatures of Pietro's atlases, due to the stylistic similarity between each of his models, showed that Pietro either illuminated his own maps or secured the permanent service of a painter in his workshop.²³³ He also argued that their rich illuminated detail, in particular the coloured chevrons, ornamental borders and decorated scales, demonstrated Pietro's competence in illumination.²³⁴ Whether or not Pietro illuminated his own maps, it is highly likely that he drew the figures. It could even be suggested that Pietro drew his maps to the same stage as Opicinus's are now seen, before sending them to an illuminator. In the Palatinus, the figures are outlined but unpainted, leaving only the red and green of the rhumb lines to colour the maps.

This model was supported by the no-longer extant map of Giovanni da Carignano (c. 1250-1329). Giovanni was a priest of the parish church of San Marco in Genoa from 1293 to 1329 and was thus present there during the period of Opicinus's training. He provides a documented example of a Genoese illuminator who was also skilled in the art of cartography.²³⁵ From this, Puchades i Bataller suggested that earlier portolan charts were made by clerics, as they would have been present on naval voyages as notaries and chaplains and had access to the necessary

²³² Puchades i Bataller, *Les cartes portolanes*, p.497.

²³³ Ibid., p.490.

²³⁴ Ibid., p.489.

²³⁵ The Carignano chart was held in the State Archives in Florence before it was destroyed during the bombing of Naples in 1943, where it had been temporarily exhibited. All that remains of it are notes and low-quality photographs made before its destruction.

academic literature which would allow them to understand the technical elements of the charts' making.²³⁶ From the photographic remains of Giovanni's map, Puchades i Bataller concluded that Giovanni was not a professional cartographer working as an apprentice but instead used the information at his disposal to mould his own personal interpretation of the maps.²³⁷ Together, Giovanni's and Opicinus's theologically conceived portolans prove that such a practice, in which cartographers drew figures of Christian history into portolan charts, existed during the fourteenth century and that Pietro was highly likely to have done the same.

Although they were not making identical copies of each other's maps, the portolans of Giovanni da Carignano, Pietro and Opicinus demonstrate that in Genoa cartographers incorporated a sacred dimension into their maps by drawing biblical iconography into the portolans themselves, as opposed to passing the maps on to illuminators to draw the figures in a later stage of production. The roots of Opicinus's cartographic education can hence be more solidly situated within the practices of map-making in Genoa, and his calendars more closely aligned with those of Pietro.

There is another theological feature of Pietro's maps which indicates their influence on the Palatinus drawings. Pietro was one of the only cartographers of the fourteenth century to have incorporated the new portolan technology within a *mappamundi*: an older form of map which represented a Christian understanding of the world.²³⁸ Opicinus specialists have often argued these to be the inspiration for the cartographic images of the Palatinus.²³⁹ In both, the Mediterranean world is depicted in impressively accurate proportion, which could only be

²³⁶ Puchades i Bataller, *Les cartes portolanes*, pp.516-17.

²³⁷ Ibid., p.490.

²³⁸ Whittington, *Body-Worlds*, p.30, n.11.

²³⁹ Degenhart and Schmitt, 'Zwei Literaten des 14. Jahrhunderts,' p.96; Salomon, *Weltbild und Bekenntnisse*, p.60. Laharie argued that the variety of maps in both the *Secreta* (*mappaemundi*, regional maps and nautical charts) and the Palatinus indicated that Opicinus was probably inspired by those of the *Secreta*. Laharie, *Le journal singulier*, 1, pp.xxiv-xxv. Whittington supported this argument in *Body-Worlds*, p.30.

obtained through the mathematical system of the portolan chart, yet they were contained within the circular format of the *mappamundi*, with Jerusalem at its centre (see figures 11 and 12). Pietro's use of new technology to enhance traditional models can also be detected in Opicinus's calendars. Much like the combination of the *mappamundi* and the portolan chart, Opicinus considered both the old and new calendar types within his drawings by representing the old liturgical calendar in the form of the new astronomical one.

Pietro's earliest surviving *mappamundi*-portolans have, however, been dated from 1320 and were thus made after Opicinus left Genoa in 1318. If not in Genoa, how then did Opicinus see these maps? It could not have been in Venice, where Pietro spent the majority of his career (at least from 1318),²⁴⁰ as Opicinus made it explicitly clear in his journal that he had never been there.²⁴¹ By looking at the manuscripts in which Pietro's hybrid maps are contained, it becomes clear that Opicinus probably saw them in the Avignon penitentiary.

Cartography in Avignon: The *Secreta* of Marino Sanudo

Opicinus was trained in the art of making maps, calendars and illumination in Genoa, but questions still remain as to exactly how he would have drawn these in Avignon. Did he work from the memory of his Genoese training, or were there other sources at the penitentiary from which he took guidance? This section shows that elements of both are true. Opicinus's Genoese training surely influenced and informed his calendars, but other manuscripts in the penitentiary,

²⁴⁰ Edson, 'Reviving the Crusade,' p.137.

²⁴¹ In the journal entry describing his illness, Opicinus wrote, 'About this time, I dreamed that I was in Venice, a city which in fact I only know from descriptions'. Translation from Salomon, 'A Newly Discovered Manuscript,' pp.46-47.

which are considered in the remaining chapters, clearly played a part in the Palatinus's inception.

There is no documentation to conclusively prove that Pietro was ever in Avignon, nor any record of his calendars having been in the library. But one can be certain that a selection of Pietro's maps was available to Opicinus at the penitentiary during John XXII's pontificate. These maps were attached to the manuscripts of Marino Sanudo's *Secreta*, which he refined during his stay in the penitentiary. The presence of Pietro's maps in Avignon at this time could indicate that some of his astronomical calendars were sent to Avignon with them. This is supported by Pietro's latest astronomical calendar (fig. 9) which, although attached to a third edition of the *Secreta* and thus unlikely to have ever been in Avignon, suggests that the earlier editions which included Pietro's *mappamundi*-portolan charts may have originally included astronomical calendars. The first edition (BAV, Vat. Lat. 2972), which was offered to Pope John in Avignon, contains six maps, and the third edition (BL, MS Add. 27376), made in Venice, contains the maps included in the first edition, as well as the astronomical calendar and three additional maps of the Holy Land, Acre and Jerusalem. It is therefore possible that the third edition was originally identical to the first, which has since lost its calendar and maps.²⁴² This would mean that Opicinus had a copy of Pietro's astronomical calendar at the penitentiary in Avignon.

Just as significant, the demand for Pietro's drawings within Sanudo's larger project reveals John XXII's intellectual enterprise, based in the penitentiary, within which maps played a central role. The cartographic practices at Avignon as featured in the *Secreta* not only present potential sources which could have supplied Opicinus with practical reference tools, but also indicate the intellectual aims of the court in which he functioned.

²⁴² The first edition (BAV, Vat. Lat. 2972) contains four marine charts, the *mappamundi*-portolan chart, and a map of the Eastern Mediterranean. The third edition (BL, MS Add. 27376) contains four marine charts, the *mappamundi*-portolan chart, maps of the Eastern Mediterranean, Holy Land, Jerusalem and Acre, and an astronomical calendar. Edson, 'Reviving the Crusade,' pp.152-53.

Sanudo's project, as set out in his *Secreta*, offered a guide to crusading. This was a fairly common genre but Peter Lock, who translated it into English in 2011, noted that it was unique in the practicality of its suggestions and the extent to which they were budgeted and discussed in detail.²⁴³ The text was not purely theoretical; Sanudo hoped it would be used for a new crusade. After reworking the initial manuscript, which had been offered to Pope Clement V, Sanudo travelled to the Avignon court to present two copies of the *Secreta* to John XXII on 24 September 1321. It is generally believed that MS Vat. Lat. 2972, which includes one of Pietro's *mappamundi*-portolans (fig. 11), is one of those copies and that the other is now lost.²⁴⁴ Sanudo stayed in Avignon from September 1321 until May 1323, before he returned to Venice.²⁴⁵ During this time he made a second edition of the manuscript, but it is not known whether he completed this version before he left Avignon. The emended manuscripts of 1323 incorporated the numerous marginal notes Sanudo had made to the previous drafts whilst in Avignon. He then made a third edition of the manuscript, one of which includes another copy of Pietro's *mappamundi*-portolan (fig. 12) and the later model of the bare astronomical calendar (fig. 9).²⁴⁶

The identity of the maker of the *Secreta*'s original maps has previously been a point of contention, and they were originally believed to have been made by Sanudo, despite the lack of evidence of his cartographic training.²⁴⁷ This can be ascribed to the variety and complexity of the known

²⁴³ Lock, *Book of the Secrets*, p.12.

²⁴⁴ Edson, 'Reviving the Crusade,' p.136. Almagià suggested that BAV, MS Vat. Lat. 2971 was the second book, but that its maps were lost in the 16th century. Almagià, *Monumenta cartographica Vaticana*, 1, p.22. Other known surviving copies of the first edition are: Milan, Biblioteca Ambrosiana, Codex D 203; Naples, Biblioteca Nazionale, Codex V.F.35; BAV, Vat. Lat. 2003; BAV, Vat. Lat. 7315; and Venice, Biblioteca Marciana, MS Zanetti 410. Lock, *Book of the Secrets*, p.13.

²⁴⁵ Lock, *Book of the Secrets*, p.9. The second edition of this text survives in four manuscripts: BAV, MS Vat. Lat. 2971 and BAV, MS Reginae Cristiae 548, include five maps; Florence, Biblioteca Laurenziana, MS Plut. XXI, 23 includes four maps; Florence, Biblioteca Riccardiana, MS 237, includes four unfinished maps. Ibid., p.14.

²⁴⁶ The third edition survives in seven manuscripts: Brussels, Bibliothèque Royale, MS 9347; Brussels, Bibliothèque Royale, MS 9404; Florence, Biblioteca Nazionale, MS Magliabecchi II-II.169; BL, MS Add. 27376; Bodleian Library, MS Tanner 190; BAV, MS Ottob. Lat. 906; Valenciennes Public Library, MS D.4.10 (505). Lock, *Book of the Secrets*, p.14.

²⁴⁷ Edson, 'Reviving the Crusade,' p.137.

copies of the *Secreta*. There are multiple editions and their contents vary in each copy, and of the nineteen surviving manuscripts only nine contain maps.²⁴⁸ In addition, the number of maps in these copies varies and most of them lack signatures. The issue is further complicated by the misalignment between the texts and the maps in many of the later editions.²⁴⁹ Upon the discovery of Pietro's signature on a map in one of Sanudo's original manuscripts (fig. 11), however, the most recent scholarship has shown Pietro to be the most likely author of the maps.²⁵⁰ Although the lack of documentation of Pietro's activity in Avignon means that the exact nature of Sanudo and Pietro's relationship remains unknown, it is clear that Pietro made maps for Sanudo from the early 1320s, during which Sanudo was in the penitentiary.

In addition to establishing that Pietro's maps were available to Opicinus, this also contributes towards this thesis's reconstruction of the intellectual environment in Avignon under Pope John. Within his project to assemble a specifically visual and Christian encyclopaedic *summa* of human knowledge, cartographic and temporal technologies were vital components for the mapping of the physical world. Using the map, one could spatially situate the terrestrial Church within a divine scheme of physical existence. In the case of the *Secreta*, for example, Edson argued that the amalgamation of the old map with the new allowed Sanudo to express his message about the declining strength of Christianity through the *mappamundi* whilst using the newest technique by

²⁴⁸ Lock, *Book of the Secrets*, p.15

²⁴⁹ In Sanudo's introductory letter to the *Secreta*, he stated that it contains four maps, but the manuscript generally believed to have been given to John XXII and which was also offered to the king of France (BAV, MS Vat. Lat. 2972) contains six maps. Campbell, 'Portolan Charts from the Late Thirteenth Century to 1500,' p.406. Only two of these maps relate to Sanudo's description. Edson, 'Reviving the Crusade,' p.136.

²⁵⁰ Konrad Kretschmer identified this signature: K. Kretschmer, *Die italienischen Portolane des Mittelalters: Ein Beitrag zur Geschichte der Kartographie und Nautik* (Reinheim, 1909), pp.113-16. The signature led some to suggest that Pietro's maps were added after Sanudo presented them to John, but Edson's close visual analysis of the map in relation to the text argued this to show that Sanudo and Pietro were in close collaboration, 'with an almost perfect correspondence between map and text'. Edson, 'Reviving the Crusade,' p.145. Degenhart and Schmitt's seminal study of cartography in 14th-century Avignon supports her argument. They suggested that the maps described by Sanudo are found in the atlas signed and made by Vesconte in 1321. This atlas is found in BAV, MS Pal. Lat. 1362a. Degenhart and Schmitt, 'Zwei Literaten des 14. Jahrhunderts,' p.66. Salomon mentioned the presence of Pietro's maps in the *Secreta*, but did not pursue an evaluation of how Opicinus may have interacted with these manuscripts. Salomon, *Weltbild und Bekenntnisse*, pp.56-57.

which to render space.²⁵¹ Under John the most up-to date cartographic tools were being used for a definitively theological aim. For Opicinus, the *Secreta* provided a model of the tools of truth which John had been cultivating. The nature of Sanudo's project, a call to crusade, is particularly revealing with regard to Opicinus's motivations. It shows that he was responding, through his obsessively detailed drawings, to the urgency of John's project to save the people of Christendom.

A detailed visual comparison between the calendars of Opicinus and Pietro demonstrates how Opicinus learnt to draw his calendars in Genoa, and why he drew them in Avignon. This comparison has shown a stronger link between Opicinus and the Genoese workshop of Pietro Vesconte than has previously been imagined, while contextualising his drawings within John's papal agenda in Avignon. Opicinus was not trying to copy Pietro's calendars but he was greatly influenced by their making. He used the technical knowledge and experience he gained from Pietro's astronomical calendars to make calendars for his own theological project. This argument concurs with and therefore supports the overall conclusions of earlier secondary literature concerning Opicinus's cartographic sources. Whittington proposed that 'Opicinus's relationship to the portolan charts is thus one ...of fascination. Rather than reading the fundamental ways that Opicinus modified the charts as evidence that they troubled him, we should instead consider this as evidence of the potential for meaning that he saw in them'.²⁵² Salomon came earlier to the same conclusion, stating that just as Opicinus used the portolan charts to create a '*Carte moralisée*', he used the calendars to create a '*Calendrier moralisé*'.²⁵³

So far the comparison of Opicinus's calendars with those in liturgical books and Pietro's atlases has demonstrated his awareness of two forms of calendar, the bare and illuminated types, which

²⁵¹ Edson, 'Reviving the Crusade,' p.139.

²⁵² Whittington, *Body-Worlds*, p.58.

²⁵³ Salomon, *Weltbild und Bekenntnisse*, p.86.

were available to him in Genoa and probably in Avignon. What remains is to explain the inherent distinction between the Palatinus drawings and the two types of calendars treated thus far. The calendar of *Palatinus A* shares features with both the calendars from liturgical manuscripts and Pietro's circular astronomical calendars, as it is essentially a traditional liturgical calendar rendered into the form of the astronomical calendar. So how and why did this happen? To argue that Opicinus simply applied the content of the liturgical calendar to this new form would suggest that he invented the circular liturgical calendar, a form which survives in objects from the fifteenth century and became popular later on. This is possible but unlikely.

This chapter does not celebrate Opicinus as the first to make the circular liturgical calendar but instead suggests that more calendars like those of the Palatinus must have existed prior to the fifteenth century. To evaluate this hypothesis, one must shift their focus away from manuscripts and towards the time-keeping technologies of the fourteenth century onwards. Following the above analysis of how Opicinus learnt to draw the calendar of *Palatinus A* and for what reason, the next section contextualises the circular liturgical calendar within the history of technology in order to show how Opicinus could have drawn this calendar.

Part Three: Horological Instruments

Circular renderings of the liturgical calendar do not survive in manuscripts or portolans, but they do appear on horological devices. Opicinus's are the only circular liturgical calendars to have survived from before the fifteenth century, but it is possible that many more existed on vellum but have since been destroyed or lost.²⁵⁴ The liturgical calendars found on contemporary horological instruments are, however, a key to understanding Opicinus's inspiration and intention for his own calendars. This section builds the case for the existence of circular liturgical calendars contemporary to Opicinus by considering large fifteenth-century volvelles, such as the San Zeno Wheel and the calendar from the astronomical clock in Gdańsk, in relation to the textual evidence for similar fourteenth-century artefacts.

Salomon considered circular calendars on astronomical instruments as potential sources of influence, but referred to only two examples. Both are antique instruments. One was a golden circle divided into 365 cubits, upon which each day of the year was demarcated. It does not survive but was recorded in Diodorus Siculus's description of Hecataeus of Abdera's trip to the Ramesseum (the memorial temple for Pharaoh Ramses II) in Thebes around the third century BC.²⁵⁵ The second is a Roman bronze disk plate found at Grand, Vosges (North-East France).²⁵⁶

²⁵⁴ Forms of circular calendars including saints' days did survive from the late-13th century on the back plates of astrolabes, such as the Sloane Astrolabe (c. 1290-1300, British Museum, SLMathInstr.54), see 'The Sloane Astrolabe,' *The British Museum: Collection*, http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?assetId=30533001&objectId=54863&partId=1 (consulted 10/06/2015). Astrolabes with saints' days are, however, extremely sparse and it is unlikely that they would have included the movable feasts. Despite containing certain saints' days, they could not have functioned as liturgical calendars and so are not considered in this chapter.

²⁵⁵ The description is found in Diodorus' *Bibliotheca historica*, a work of universal history written c. 60-30 BC. It records that on the roof of the memorial, 'a gold circle was to be seen, three hundred and sixty-five cubits long and one cubit high. Images for each day of the year were set out around this circle, one for every cubit: the rising and setting of the stars were recorded for each day, together with the signs with which those astral movements furnished the Egyptian astrologers'. (i.46.8). L. Canfora, *The Vanished Library*, transl. M. Ryle (Palermo, 1986; repr. California, 1990), p.10.

²⁵⁶ The disk is currently in the Musée des Antiquités Nationales, St Germain-en-Laye. Salomon, *Weltbild und Bekenntnisse*, p.81. North has since identified the disk as part of an anaphoric clock, another example of which was found in Salzburg in the 19th century. See North, *God's Clockmaker*, p.151.

Although only a fragment of the latter instrument survives, it has been deduced that the plate had a diameter of thirty-seven centimetres upon which the solstices were marked, with 366 holes around the circumference.²⁵⁷ These sources are fascinating relics of antique forms of calendars, but more relevant to the Palatinus are the calendars of the fourteenth and fifteenth centuries which survived as parts of horological instruments.

Salomon did not draw comparisons to medieval instruments nor to technology documented at the Avignon court. This can be partially attributed to the state of knowledge concerning medieval technology, particularly horology, in the early-twentieth century. The history of technology was not recognised as a subject in its own right until the 1930s and even then, historical circumstance brought the development of the discipline to a temporary halt.²⁵⁸ The 1960s saw a reinvigoration in historical horology, as shown by Carlo Cipolla's *Clocks and Culture* (1967).²⁵⁹ Soon after, scholars began to consider the mechanical clock within its intellectual, social and economic contexts. For example, Jacques Le Goff attempted to categorise Christian, merchant and Church time from a study of the clock's uses within the different sectors of society.²⁶⁰ In recent years, these narratives have been re-evaluated and re-problematized by scholars such as Gerhard Dohrn-van Rossum in *The History of the Hour*

²⁵⁷ Henry King suggested that it was a component of a larger mechanical time-keeping device, such as the medieval time-keeping instruments considered below. H. King, *Geared to the Stars: the Evolution of Planetariums, Orreries, and Astronomical Clocks* (Toronto, 1978), p.12.

²⁵⁸ In the preface to Lynn White Jr.'s collected essays concerning the history of technology (1978), he recalled the genesis of the discipline. After determining 1931 to be the *annus mirabilis* of publication for the field, which then lagged for 'sombre reasons', he believed the publication of Alistair Crombie's *Augustine to Galileo: The History of Science 400-1650* (1952) signalled the recovery of the field along with the History of Science. L. White Jr., *Medieval Religion and Technology: Collected Essays* (California, 1978), pp.xiv, xvi.

²⁵⁹ C. M. Cipolla, *Clocks and Culture 1300-1700* (London, 1967). There had of course been studies in historical horology previous to this, mainly focused upon individual objects, as well as the occasional catalogue, such as Alfred Ungerer's *Les horloges astronomiques et monumentales les plus remarquables de l'antiquité jusqu'à nos jours* (Strasbourg, 1931). Less had been done, however, to form a coherent narrative of how the mechanical clock (in the form in which we know it) proliferated in western Europe.

²⁶⁰ J. Le Goff, 'Au Moyen Âge: temps de l'Église et temps du marchand,' *Annales. Économies, sociétés, civilisations*, Vol. 15, No. 3 (1960), pp.417-33. This was translated and reprinted within a collection of Le Goff's essays in J. Le Goff, *Time, Work & Culture in the Middle Ages*, transl. A. Goldhammer (Chicago, 1980).

(1996) and even more recently, Matthew Champion in *The Fullness of Time* (2017).²⁶¹ This new turning point has provided a fresh perspective on the medieval conception of clocks and how they changed the perception of time.

This section considers Opicinus's calendars in relation to the most recent research in historical horology. In order to do so, the appearance of liturgical calendars on horological instruments are evaluated, before a hypothesis is offered as to what extent they could have influenced Opicinus's calendars. To find examples of circular renderings of the Roman calendar system, one must look to objects of the fifteenth century, by which time the liturgical calendar had been fully integrated into time-keeping instruments. Only a small number of circular vellum calendars survive from the fifteenth century: the map of Giovanni Leardo (1452), the San Zeno Wheel (c. 1455, fig. 13) and the calendar of St Mary's Church in Gdańsk (1464-70, fig. 14).²⁶²

Salomon noted that Leardo's map, following Opicinus's, is the earliest example of one encompassed by a detailed liturgical calendar.²⁶³ Yet the calendars of surviving horological objects are more useful in the evaluation of Opicinus's calendars, as there is evidence that they belong to a larger group of similar horological objects which date back to the early-fourteenth century, and that these may have been accessible to Opicinus. Salomon would have surely mentioned these in his study, but their existence has only become public since its

²⁶¹ For the most recent survey of the invention of the clock in Europe, see 'Chapter 4: Medieval *Horologia* and the Development of the Wheeled Clock,' in Dohrn-van Rossum, *History of the Hour*, pp.45-123. Also useful is M. Champion, *The Fullness of Time: Temporalities of the Fifteenth-Century Low Countries* (Chicago, 2017).

²⁶² The Leardo map is signed 'Johanes Leardus de Venetiis me fecit abano domini 145(?)'. The last digit is illegible, but the date is generally agreed to be 1452, since the Easter dates within the calendar are valid from 1452 to 1547. Salomon argued this map to be the first time, following Opicinus, in which a map was framed by a liturgical calendar. There has since been no evidence to prove otherwise. For more on the Leardo Map, see J. Kirtland Wright, *The Leardo Map of the World (1452 or 1453) in the Collections of the American Geographical Society* (New York, 1928); J. B. Harvey and D. Woodward, *The History of Cartography*, Vol. 1 (Chicago, 1987), pp.316-17.

²⁶³ Salomon cited this as the earliest surviving circular calendar in *Weltbild und Bekenntnisse*, p.83, n.2.

publication.²⁶⁴ This is certainly true of the San Zeno Wheel, which was hidden in private collections until 2010, and of the *astrarium*, which only gained major recognition after it was reconstructed, using fourteenth-century horology manuals, in 1960.²⁶⁵ The analysis of the Palatinus calendars can therefore be greatly advanced by what has been established, since Salomon's study, concerning northern-Italian calendars from monumental horological objects contemporary to Opicinus. The rest of this section therefore evaluates the calendars of time-keeping devices and considers Opicinus's probable familiarity with their hypothetical fourteenth-century prototypes. They also show that whereas Opicinus's calendars may be unique survivals of the fourteenth century, they did not exist in a cultural vacuum as they drew upon recent developments in technological culture.

Opicinus and Horology

The Palatinus drawings and mechanical clocks were born from the same place and historical moment. Both were made possible by the invention of time-keeping devices in early fourteenth-century northern Italy, which has been pieced together from textual sources.²⁶⁶ Although scholars debate what constituted the invention of the first significant device, they agree that it came into being within the latter half of the thirteenth century.²⁶⁷ It was not, however, until the

²⁶⁴ The limitation of sources available to Salomon in comparison to the present (the increase in awareness of which can be partially attributed to the digitisation of collections) is reflected in the illustrations of *Weltbild und Bekenntnisse*, which consist entirely of two-dimensional images (primarily manuscript details with four panel paintings and a stained-glass window). Salomon, *Weltbild und Bekenntnisse*, Vol. 2.

²⁶⁵ No *astraria* survive from the Middle Ages, but their manuals are in fact so clear that multiple modern replicas have been made. They are considered in the next chapter.

²⁶⁶ For example, a manuscript written in 1334 documented the installation of Henri de Vick's clock in Paris around 1300. Ungerer, *Les horloges astronomiques*, p.125.

²⁶⁷ This subject has been often discussed in the history of technology. The invention of the escapement and its role in the development of the clock, as considered by historians, has often featured in this discussion. For example, Cyril Beeson argued that the earliest known reference to a clock with a mechanical escapement was recorded in the Annals of Dunstable Priory in 1283. C. F. C. Beeson, *English Church Clocks, 1280-1850: History and Classification* (London, 1971), p.16. Gerald James Whitrow also pronounced on the issue of the escapement in G. J. Whitrow, *Time in History: Views of Time from Prehistory to the Present Day* (Oxford, 1988), p.104. Another reading suggests that its invention can be defined by the marriage of time-keeping device and movement. By this logic, the earliest recorded

fourteenth century that calendars were recorded as components of such time-keeping devices. Much of the surviving documentation of public clocks from this time comes from France and northern Italy, and indeed from the very cities with which Opicinus had connections.

The purpose of this overview is not to recount a teleological chronology of the development of the clock, but instead to build a clearer contextual image of the technology, more specifically the large-scale calendars, which would have been accessible to Opicinus. His movement around northern Italy in the first decades of the fourteenth century, before he settled in Avignon in 1329, meant that he was highly likely to have seen a mechanical clock before he began his drawings. His autobiographical writing states that after political turmoil drove his family out of Pavia he spent a year in Milan (1314-15) as a tutor for the son of Johann I of Saarbrücken and the daughters of Filippo Langosco.²⁶⁸ The church of St Eustorgio in that city already had a clock (from 1309) and, by the time that Opicinus was making the majority of the Palatinus diagrams in 1335, there is textual documentation of a twenty-four hour clock which chimed upon the hour, installed at the Visconti Palace.²⁶⁹ If by any remote chance Opicinus had not seen any of these devices during his time in Italy, he would have almost certainly done so in Avignon.²⁷⁰ In other words, Opicinus was situated at the very centre of the culture in which mechanical clocks proliferated and so would have been aware of the features of their development. What is left, in gauging Opicinus's visual experience of these artefacts, is to specify how large-scale calendars associated with time-keeping would have appeared at this time, and to what extent they are visually similar to the Palatinus calendars.

clock is Isaac ibn Sid's mercury clock: an astrolabe ringed by thirty-six wooden teeth attached to a perpetual movement wheel filled with mercury, as described in Alfonso X's *Libros des saber de astronomie* (c. 1276). *Time: Catalogue*, ed. A. J. Turner (The Hague, 1990), p.96. This list is in no way comprehensive but demonstrates the different ways in which the question has been approached.

²⁶⁸ Morse, 'Opicino de Canistris: Confessions,' p.414.

²⁶⁹ Cipolla, *Clocks and Culture*, pp.40-41; G. Bilfinger, *Die mittelalterlichen Horen* (Stuttgart, 1892), p.176.

²⁷⁰ See nos 118-20 above.

Fifteenth-Century Horology: The San Zeno Wheel and the Gdańsk Astronomical Clock

Two liturgical calendar volvelles exist from the fifteenth century: the San Zeno Wheel (c. 1455) and the calendar from the astronomical clock in Gdańsk (1464-70). In combination with the Palatinus calendars, they reveal much about the representation and display of the liturgical calendar in relation to horological devices in the fourteenth and fifteenth centuries. The San Zeno Wheel (hereafter, 'the Wheel') is a virtually unstudied and unique horological device, yet certain features correspond to contemporary manuscript volvelles and to the liturgical calendars of larger horological devices.²⁷¹

This object is a large volvelle consisting of three movable disks which turn on a central axis. The disks are made of pine covered in vellum, giving the impression of a huge manuscript sheet. The diameter of the main disk is 1.28 metres, indicating that it was designed to be used by more than one viewer at a time. The layout of the calendar is similar to that of *Palatinus A*. Proceeding from the outer margin towards the centre, the outermost set of information constitutes a fixed saints' calendar.²⁷² This includes: the date in both Arabic numerals in black ink and Roman numerals in red; dominical letters; the saints' days with their liturgical gradings (many of which are particular to San Zeno);²⁷³ the golden number (where relevant); and the potential dates of Easter. Within

²⁷¹ The San Zeno Wheel is the oldest wooden liturgical calendar disk to survive. For more on its history, date and hypothetical use, see S. M. Griffin, 'Synchronising the Hours: A Fifteenth-Century Wooden Volvelle from the Basilica of San Zeno, Verona,' *Journal of the Warburg and Courtauld Institutes*, Vol. 81 (2018) forthcoming. Prior to this, just one article had been written on the Wheel: A. Avena and G. V. Callegari, 'Un calendario ecclesiastico veronese del secolo XV^o,' *Madonna Verona*, XI, No. 1, fasc. 41 (1917), pp.1-33.

²⁷² This description of the calendar's data is indebted to earlier accounts, the most recent of which is found in the Daniel Crouch sale catalogue, which is seemingly translated from Callegari's description in Italian. 'A Unique Late Medieval/Early Renaissance Volvelle Astronomical Calendar,' *Daniel Crouch Rare Books: Catalogue VI*, ed. D. Crouch, E. Napoleone and N. Trimming (London, 2014), pp.12-25, pp.18-19; Avena and Callegari, 'Un calendario ecclesiastico veronese,' pp.30-33.

²⁷³ In some cases, they are followed by fixed dates of astrological and liturgical significance (such as the equinoxes and solstices) and Roman numerals used to calculate the movable feast dates (such as Septuagesima and Easter, mostly in black but some in red to emphasise the most significant feasts.)

this liturgical calendar are sets of astronomical data, including the degrees of each sign of the zodiac (represented in Arabic numerals in red) and the sidereal months (represented with the letters a to z in black). The following six columns concern the timing of each day and so are not treated here. Inside, the twelve signs of the zodiac are represented.

From its data alone, one can deduce that the Wheel essentially functioned as a time-keeping device which allowed the user to track the saints' days and relevant liturgy, calculate the movable feasts by aligning the lunar and solar calendars by the turning of the volvelle, and compute the time of day from the hours of daylight.²⁷⁴ Apart from the innermost astronomical data and the way in which Easter is represented, the sets of content included (as distinct from the content itself such as the individual saints' days) are very similar to those contained in *Palatinus A*. Its inclusion of the liturgical calendar within the form of an astronomical calendar, as seen in the atlases of Pietro Vesconte above, in fact makes it the most similar calendar to Opicinus's to survive.

Although the Wheel is a unique object, it can be clearly categorized within a group of monumental calendars which were originally components of larger horological instruments, such as astronomical clocks. During the Middle Ages, these were compendia of temporal information, such as the orbit of the planets, the annual calendar and, in many cases, figural narratives of Christian salvation history (in the case of late-medieval clocks with automata).²⁷⁵ The other fifteenth-century calendar which survives is in the astronomical clock in St Mary's Church,

²⁷⁴ One should note that its categorisation as an astrolabe is incorrect as it cannot map the stars.

²⁷⁵ The relationship between such clocks and the alignment of biblical and present time in the Palatinus drawings is explored in chapter five. For a recent list of automata on astronomical clocks from the 14th to 16th centuries, including a detailed description of the automata of the Strasbourg clock, see G. Oestmann, *Die astronomische Uhr des Straßburger Münsters. Funktion und Bedeutung eines Kosmos-Modells des 16. Jahrhunderts* (Stuttgart, 1993), pp.21-26. To contextualise the Strasbourg automata in relation to later automata, see K. Maurice and O. Mayr, *The Clockwork Universe: German Clocks and Automata 1550-1650* (Washington, 1980), p.9.

Gdańsk.²⁷⁶ Constructed by Hans Düringer between 1464 and 1470, the Gdańsk clock was functional until approximately 1553, when it fell into disrepair and remained this way until it was placed in storage during World War II. It was finally brought out of storage and reconstructed in 1983, and nearly eighty per cent of the original clock was re-used. This includes the calendar disk, which still contains the relevant entries for the years 1463 to 1538.²⁷⁷ If it had not broken in the sixteenth century, it would have been later destroyed and replaced, illustrating another reason why perpetual calendars of this period do not survive.²⁷⁸

Like the Wheel, the Gdańsk calendar is a large wooden disk, containing at its centre a smaller disk.²⁷⁹ Both calendars were organised in the same format as *Palatinus A*'s: the outer calendar ring of the *sanctorale* encompassing the *temporale*. Where the lunar volvelle is situated on the San Zeno Wheel, the central disk of the Gdańsk model (1.1 metres in diameter, made of copper covered in paper) is an extension of the calendar, containing all of the information of the movable calendar. It is covered by a disk with arc-shaped windows which, when turned, reveal the correct information at the appropriate time. Unlike the Wheel and Palatinus calendars, the Gdańsk model's ring of zodiac signs does not appear inside the calendar but is instead found in the dial above, with a mechanism which tells the time of day according to the modern hours. The data sets included in the Gdańsk, San Zeno and *Palatinus A* calendars are not exactly identical, but are

²⁷⁶ The Daniel Crouch catalogue entry for the Wheel briefly mentioned its similarity to the Gdańsk calendar, which still contains its original wooden and copper calendar volvelle. 'A Unique Late Medieval/Early Renaissance Volvelle Astronomical Calendar,' *Daniel Crouch Rare Books: Catalogue VI*, ed. D. Crouch, E. Napoleone and N. Trimming (London, 2014), pp.12-25, p.18.

²⁷⁷ The damaged parts which were replaced include the zodiac figures, the twenty-two figures and six of its engines. The latter were reconstructed according to 15th-century principles. A. Januszajtis, 'Wiederaufbau- und Erhaltungsprobleme einer astronomischen Uhr,' in *Mittelalterliche astronomische Großuhren: Internationales Symposium in Rostock 25. bis 28. Oktober 2012*, ed. M. Schukowski, U. Jahnke and W. Fehlberg (Leipzig, 2014), pp.341-52, pp.342-43.

²⁷⁸ Because the Julian calendar repeats every 532 years, the calendar has in fact been valid since 1995. Ibid., p.349. Note that it does not synchronise with the current liturgical calendar, as Easter is no longer determined by the Julian calendar outside Orthodoxy.

²⁷⁹ Note that whilst the San Zeno Wheel was covered in parchment, the Gdańsk calendar was covered in canvas. Januszajtis, 'Wiederaufbau- und Erhaltungsprobleme einer astronomischen Uhr,' p.346. This is supported by Zimmermann's description from before the clock was brought out of storage. G. Zimmermann, 'Das Kalendarium der Astronomischen Uhr in der Marienkirche zu Danzig,' *Mitteilungen des Westpreussischen Geschichtsvereins*, Vol. 33, No. 4 (1934), pp.75-86, p.77.

all primarily concerned with the reckoning of the liturgical calendar. All contain a saints' calendar in addition to the necessary data to calculate the movable feasts, including the dominical letters, the date according to the Roman calendar system and golden numbers, in a circular format which is aligned with the zodiac ring.²⁸⁰

That the Wheel and Gdańsk calendar are exceptional survivals might be expected from their fragility, as they are both written on vellum and contain outdated calendrical data. It is implausible that no other such objects existed in the Middle Ages, but there remains the question of when exactly they began to appear. Studies of other surviving time-keeping devices, or medieval descriptions of such objects, show that circular liturgical calendars were constructed, and were even relatively common, during the fourteenth to sixteenth centuries as components of astronomical clocks.²⁸¹ No calendar disk exists from the fourteenth century, with the result that scholars have been left to piece together their conclusions concerning their appearance from later replacement calendars and textual descriptions.²⁸² The remainder of this chapter presents the case for the existence of monumental circular liturgical calendars, the probable components of astronomical clocks, during the fourteenth century. This would indicate that liturgical calendars similar to Opicinus's existed in his day.

²⁸⁰ For a detailed description of the Gdańsk calendar's contents, see Januszajtis, 'Wiederaufbau- und Erhaltungsprobleme,' p.349.

²⁸¹ King, *Geared to the Stars*, p.44.

²⁸² For a recent example, see Günther Oestmann's treatment of the Strasbourg clock. This informs the discussion of the Strasbourg clock below. Oestmann, *Die astronomische Uhr des Straßburger Münsters*. The disk which survives from before the 16th century is also comprehensively treated.

Fourteenth-Century Liturgical Calendars: The Strasbourg Clock, the 'Italian Dial' and the *Astrarium*

There are difficulties in dating mechanical instruments, as they are likely to have been subject to maintenance and even multiple modifications since their original construction. Many of the most well-known astronomical clocks first made in the Middle Ages are actually copies or have been altered gradually over time so that little or none of the original device remains, problematizing a visual analysis based purely on their current state. The San Zeno and Gdańsk models are anomalies as they were taken down and thus protected before they expired and were replaced. A select few of these medieval clocks, such as those in Lund (1380) and Rostock (1472 onwards), still contain calendars in the same format as the surviving calendars described above, suggesting that they may have originally looked similar.²⁸³ But their inner calendars, at least, must have been modified many times due to the inevitable expiration of the movable calendar's content. For example, the Rostock clock only displays at present the data for the years 1885 to 2017, and the Lund clock for the years 1923 to 2123, so that the central panel will have to be replaced in the coming years and has no doubt been replaced multiple times since the fifteenth century. One can gain an idea of their original form by looking at documentation of their maintenance, but this is rarely so clear as to describe the original composition.

The most explicit piece of evidence concerning the existence of a fourteenth-century liturgical calendar disk is the description of the first Strasbourg clock. Begun in 1352 and erected in 1354 under Jean de Lichtenberg, it was replaced around 1572-74 (and has since again been replaced).²⁸⁴ The only surviving component of the original clock is an automaton cockerel

²⁸³ A. Götlind, *Technology and Religion in Medieval Sweden* (Doctoral Thesis, University of Göteborg, 1993), p.142; *The Astronomical Clock of the St. Marien Kirche in Rostock*, <http://www.astronomischeuhr.de/en/files/vorwort.html> (consulted 4/9/15).

²⁸⁴ G. Schmidt, *Notice historique sur l'horloge astronomique de la cathédrale de Strasbourg* (Strasbourg, 1842), p.4.

(Strasbourg, Musée des Arts Décoratifs), which was re-used on the second clock.²⁸⁵ In order to reconstruct the appearance of the first clock, Théodore Ungerer used the description of 1578 by Conrad Dasypodius (1532-1600), the designer of the sixteenth-century clock.²⁸⁶ According to Dasypodius the original device combined a rich array of temporal information and Christian salvation history in figures, just like the Gdańsk clock. Below a portrait of the Virgin and Child was a circular wooden dial with a liturgical calendar, including a perpetual calendar with what Ungerer called 'un système d'aiguilles' indicating the correct date for the current year.²⁸⁷

Considering this description in relation to the fifteenth-century calendars, this section hypothesises first, and most importantly, that objects very similar to the San Zeno and Gdańsk calendars existed as components of astronomical clocks during the fourteenth century. In fact, it is likely that many more calendar disks existed but have not survived due to their physical fragility and the expiration of their content. This supports the hypothesis of Henry King, who traced the existence of calendar dials back into the earlier-fourteenth century in the cities of northern Italy with which Opicinus was familiar. Circular liturgical calendars were included in what King called 'the Italian dial'. He deduced certain trends in the composition and content of the calendar dials by combining the documentation of various astronomical clocks (some

²⁸⁵ King, *Geared to the Stars*, p.43; 'Coq Automate,' *Musées de la ville de Strasbourg*, <https://www.musees.strasbourg.eu/oeuvre-musee-des-arts-decoratifs/-/entity/id/318051> (consulted 28/3/2018).

²⁸⁶ T. Ungerer, *L'horloge astronomique de la cathédrale de Strasbourg* (Strasbourg, 1922), p.6. Ungerer cited 'Wahrhaftige Auslegung des astronomischen Uhrwerks zu Strassburg, beschrieben durch M. Conradum Dasypodium, der solches Astronomische Uhrwerk anfanglich erfunden und angeben,' Bibl. no. 39, pp.B4-C1. Note that at least one of the later editions of Ungerer's description contains a misleading misprint in the date of Conrad Dasypodius' text. The 1949 edition wrongly states that Dasypodius' text was written in 1378 rather than 1578. Oestmann, the most recent scholar to study the Strasbourg clock(s), provided a description of the first clock using Dasypodius' text of 1580: *Conradi Dasypodii Warhafftige Außlegung vnd Beschreybung des Astronomischen Vhrwercks zu Straßburg / welches er Anfaenglich erfunden vnnnd angeben hat. Auch ein Altes Lied vom dem Kampff vn streyt / so entstanden / Zwischen dem Roraffen (welcher vnder der Orglen im Muenster zu Straßburg ist) vnd dem Hanen / so auff der Alten Vhren war / vor 200. Jharen Gedicht* (Strasbourg, 1580). This is a second extended edition of the 1578 print cited by Ungerer. Oestmann, *Die astronomische Uhr des Straßburger Münsters*, pp.17-18, n.18. The description of the liturgical calendar does not differ from Ungerer's so is not scrutinised here. My thanks to Günther Oestmann for his clarification, in our personal correspondence, of Dasypodius's descriptions of the calendars of the first and second clocks.

²⁸⁷ T. Ungerer, *L'horloge astronomique de la cathédrale de Strasbourg* (Strasbourg, 1949), p.11; King, *Geared to the Stars*, pp.43-44; Oestmann, *Die astronomische Uhr des Straßburger Münsters*, p.18. For more on its decoration according to Dasypodius, see chapter five.

descriptions but principally details of maintenance) together with their current renovated appearance, in order to gauge which components were most widely used in different contexts and regions. From such evidence he categorised the types of dials of extant and non-extant clocks into three classes: the Italian dial, consisting of two or more concentric plates; the astrolabe dial; and the hybrid dial, in which an astrolabe is the central component of the concentric circles.²⁸⁸ In each of these variants, the calendar would have been featured below the hour dial of the clock.

According to King, the Italian concentric dial consisted of two or more plates which combined to make a perpetual calendar, including a disk of the lunar calendar, in order that the movable feasts could be calculated. Like the Palatinus, San Zeno, Gdańsk and Strasbourg calendars, many would have included the golden number, the dates of movable church feasts and the twelve zodiac symbols.²⁸⁹ King traced the Italian dial further back than this, arguing that two pieces of sheet iron once formed the dial of a clock at the monastery of Cluny as early as 1320. He hypothesised that this had two plates, one containing the *sanctorale*, the other the *temporale*, which made a volvelle like the Gdańsk calendar. King's deduction of the appearance of the 'Italian dial' suggested that this type of liturgical calendar existed as a component of astronomical clocks that were native to fourteenth-century northern Italy and South-East France, and were therefore likely to have been known by Opicinus.²⁹⁰

In addition to the Italian calendar dial there was one other known form, which existed as part of a time-keeping device from the mid-fourteenth century, which cannot be ignored: the calendar

²⁸⁸ King, *Geared to the Stars*, p.44.

²⁸⁹ Ibid., p.52.

²⁹⁰ King believed the Cluny dial, like many others, to have been torn down and sold for scrap metal soon after the French Revolution. King, *Geared to the Stars*, p.47; Ungerer, *Les horloges astronomiques*, pp.85-86.

of the *astrarium* designed by Giovanni de' Dondi (c. 1348-64).²⁹¹ The *astrarium* is a mechanical device which tells the time of day whilst displaying a vast amount of temporal and astronomical data, including indications of the motions of the planets according to the Ptolemaic system. Most significantly here, it includes two moving calendars: a cylindrical wheel with the *sanctorale* and a complex system of chains representing the *temporale*, which gives the dates of five significant movable feasts for the year (the latter component is important to the next chapter). The *sanctorale* is etched onto the curved edge of a cylindrical wheel which rotates once a day to move the appropriate day into the gap of the viewfinder. Viewing the calendar as if on a flat plane (fig. 15) it is almost identical in format to the calendars of contemporary manuscripts as described in part one, with a column each for the date, the dominical letter and the name of the saint celebrated on that day.

Although its inclusion of the liturgical calendar demonstrates that the calendar was associated with mechanical time-keeping by the mid-fourteenth century, the *astrarium* is more significant in its depiction of the *temporale*. At this point one must leave the depictions of the *sanctorale* to rest and shift one's attention towards the most curious and complex feature of Opicinus's drawings: the *temporale*. As the next chapter shows, the relation between the mechanical *temporales* of the *astrarium* and the Palatinus reaffirms that Opicinus did not simply render the old calendar into a circle. Instead he engaged with the new forms of calendar which began to appear in the fourteenth century.

²⁹¹ S. A. Bedini, and F. R. Madison and A. Silvio, 'Mechanical Universe: The Astrarium of Giovanni de' Dondi,' *Transactions of the American Philosophical Society*, Vol. 56, No. 5 (1966), pp.1-69, p.5. The *astrarium* is further contextualised in a discussion of the *temporale* in the next chapter. The biographies of Opicinus and Jacopo de'Dondi, father of Giovanni and also a clock maker, were remarkably similar. Born in Padua around 1290, Jacopo studied medicine at the University of Padua before moving further East to Chioggia in 1313 to become a physician before returning to Padua, where he died in 1359. Jacopo mirrored Opicinus's interest in maps, having been credited with painting the first topographical map of Padua, used by Giovanni de' Dondi in the negotiations between Venice and Padua following the war in 1372-73. It would not be preposterous to suggest that Opicinus had connections with the family. L. Thorndike, 'The Clocks of Jacopo and Giovanni de' Dondi,' *Isis*, Vol. 10, No. 2 (1928), pp.360-62, p.360; 'Dondi Dall'Orologio, Iacopo,' *Dizionario Biografico degli Italiani*, [http://www.treccani.it/enciclopedia/iacopo-dondi-dall-orologio_\(Dizionario-Biografico\)/](http://www.treccani.it/enciclopedia/iacopo-dondi-dall-orologio_(Dizionario-Biografico)/) (consulted 11/9/15).

The remaining documentation of circular liturgical calendars, which were most often components of monumental time keepers, only hints at their appearance in the fourteenth century. Together, however, the evidence builds a substantial image of a new form of calendar. Horological forms were being developed in northern Italy during the time in which Opicinus was moving between these cities and so he is more than likely to have been aware of their most up-to-date forms. Opicinus's calendars were not born in a vacuum, nor were they his own creations upon which was founded a long-lasting tradition of calendrical representation. The hypothesis presented here is that Opicinus, whilst not well versed in the science of the calendar, took his calendars from the cutting edge of technological development. Besides informing the practical issues as to how Opicinus could have drawn his calendars in this way, his interest in the most innovative technology of his time is important in itself as it defines more precisely what he was trying to achieve. Like the image-instruments made and copied in Avignon, and like Opicinus's integration of the portolan charts into his drawings, he tried to create the most accurate images of time and space which human knowledge at that time would allow.

Conclusion

Whilst centred on Opicinus's calendars, the above interpretation significantly adds to previous scholarship concerning his relationship with contemporary cartography, particularly that of Pietro Vesconte, and his engagement with Pope John's intellectual project, which inspired Opicinus to draw upon the most recent forms of time-keeping images. Each part of this chapter has considered a different group of calendars from the fourteenth and fifteenth centuries, including those from liturgical books, atlases and horological instruments. From their histories one can see how a new form of liturgical calendar, which was related to the images and objects

of space and time measurement, such as astronomical clocks, appeared in the first half of the fourteenth century. Opicinus's diagrams, through their incorporation of the new calendar, were clearly affected by the changing ideas about time within his wider intellectual and visual culture, exposing how the diffusion of mechanical horology influenced the medieval cognition of time.

The significance of this chapter goes beyond its primary objective to define exactly how and why Opicinus drew the Palatinus calendars. It contributes to a more sophisticated understanding of the calendar in relation to other time systems in mid-fourteenth century northern Europe and of what this tells us about medieval ideas about time. *Palatinus A* provides evidence of the existence of circular *sanctorales* in the early-fourteenth century which have until now only been postulated by descriptions in medieval texts. The Palatinus is not an isolated document but a valuable artefact as the material trace of a larger trend in the representation of time in the fourteenth century. It should, therefore, be considered a primary source for the study of time and the history of the calendar.

Chapter Three: The *Temporale* and the Movement of Time

Throughout the Middle Ages, the depiction of the calendar of movable feast days (referred to here as the *temporale*) presented a problem: How could it be clearly represented when its dates, and the distance between them, moved from year to year? It was represented in a variety of ways: in tables, *rotae*, mechanical instruments and, as in the case of Opicinus, multi-layered cosmological drawings. It was not enough that the viewer should observe these images and objects. In order to understand their content, the viewer was required to engage with them in such a way that, as this chapter hypothesises, they visualised the movement of their components. The previous chapter identified the potential sources for Opicinus's liturgical calendars, yet the greatest differentiator between his calendars and these sources are his *temporales*. The way in which he represented the *temporale* is unique to his diagrams: a perpetual calendar of the movable feast dates framed by the calendar ring of 365 dominical days. By isolating, transcribing and comparing the *temporale* in three of the four Palatinus drawings in which they exist, this chapter deciphers how these components were constructed, how they worked, and what purpose they had within the diagrams.²⁹²

Following an interpretation of their function, one can discern a system informed by interaction with contemporary time-reckoning technologies, therefore revealing more about what Opicinus saw to be the purpose of his drawings, and how diagrams were perceived and used more generally within medieval visual culture. Opicinus's drawings are rare survivals of diagrams which show their own making process through their emendations and the repeated iterations of the

²⁹² Fol. 5^r (fig. 19) has been included in the illustrations as it has a *temporale* with multiple insertions of the same date on separate levels. This example is, however, far less similar to *Palatinus A* than the other two examples. First, the *temporale* is, in this instance, the outer oblong calendar which circumvents the map, whilst the *sanctorale* is the smaller circular calendar at its centre. Secondly, it does not have a dial system (described below) like the others, and is therefore not useful to this interpretation.

same component (such as the *temporale*) across multiple drawings. By offering insight into the diagrammatist's process of making, the study is not only valuable to an understanding of Opicinus's process, but to a broader history of diagrammatic visual language. By using the diagram in the way that Opicinus intended, to calculate the movable feast dates, one must envisage the movement of certain components of the drawing. A study of *temporales* contemporary with Opicinus shows that whilst his system is unique, movement (imagined or actual) is a key to the reading of this category of diagrams, in which static images could be activated in order to find more information.

This chapter considers the function of medieval diagrams in relation to contemporary technology in order to inform the question: To what extent did the medieval viewer perceive instruments as moving diagrams, and vice versa? Opicinus's *temporales* were a particular type of moving diagram which integrated features from three-dimensional instruments. The *temporale* of *Palatinus A* was not superficially copied from horological devices, but worked in the same way. Its categorisation as an image-instrument thus supports the hypothesis that it conformed to the same types of diagrams which were produced at Avignon and that incorporated technological depictions of time and space. The study of this category of diagrams engages wider art-historical issues, such as the question of the visualisation of movement in images, and how our understanding of such diagrams can be informed by the history of technology.

The Movable Calendars in the Palatinus

The representation of the *temporale* within a single image is exemplified in three *Palatinus* drawings: folios 14^r (*Palatinus A*, fig. 16), 6^r (fig. 17) and 25^r (fig. 18). Although their structure is similar to that of the *sanctorale*, each being composed of a calendar ring with each day of the year

marked by the dominical letters (a-g repeated), the dates of the *temporale* are not marked with Roman numerals according to the Roman calendar system (as are found in the *sanctorale* of fol. 6^r and *Palatinus A*). As the date of each day is not specified, the *temporale* is more fluid, reflecting the mobility of its feasts, which are not defined by their date but by their place within their liturgical season (for example: Pentecost will always mark the end of the Easter season).

The inner calendar contains all of the liturgical seasons of the movable calendar according to the medieval Roman Rite.²⁹³

- Advent: Sunday nearest 30 November – Christmas
- Christmas: 25 December and the following three to four Sundays
- Pre-Lenten Season: fourth Sunday before Ash Wednesday – Ash Wednesday
- Lent and Passiontide: Ash Wednesday – Easter Sunday
- Easter: Easter Sunday – Pentecost
- Sundays after Pentecost: Pentecost – the last Saturday before the first Sunday of Advent²⁹⁴

As the definitions demonstrate, the feast dates are interdependent. This creates difficulties in fixing them into a static image, with the result that many medieval images of the *temporale*, as shown below, are not represented like the *sanctorale*, but in tabular form, and require further calculation dependent on the particular year. Opicinus's representation of the *temporale* is a unique artefact in the history of time reckoning, making an evaluation of how it works and how he constructed this system significant not only for the study of his drawings, but for the visual history of time reckoning.

²⁹³ This is distinct from the use of Sarum, which labelled Sundays after Pentecost as 'Sundays after Trinity'. See: B. Blackburn and L. Holford-Strevens, *The Oxford Companion to the Year* (Oxford, 1999), p.597.

²⁹⁴ Ibid., pp.597-635. Note that the 'Sundays after Pentecost' have been referred to as 'Ordinary Time' since 1969 (Ibid., p.635).

The names of the feast days are inserted into the calendar in the same way as in the *sanctorale*, written perpendicularly to the dominical letter. Each feast is written into the calendar twice, on the earliest possible date on which it can lie and again on the latest. The mobility of the movable feasts is represented through fork-like structures, hereafter referred to as ‘dials’, which join and categorise the feasts. In folios 6^r and 25^r the dials are simplified and joined into two continuous chains: one connecting the earliest possible dates on which the movable feasts can take place, and the other the latest (one red and one black, although the use of colour varies slightly between the diagrams). *Palatinus A* is far more complex, and is the focus of this description. There are multiple dials which act to separate the different liturgical seasons, as shown by the two dials of Easter in table A below. Each structure (red and black) joins the following feasts: *Pascha domini*, *Octavia*, *ij*, *iiij*, *v*, *Rogationes*, *Ascensio domini*, *post ascensionem* and *pentecostes*. The Roman numerals are weekly markers to show each Sunday of the liturgical season and are referred to as the nth Sunday after Easter. The dials therefore categorise the seasons of the liturgical year, such as the example below, which constitutes the Easter dial.

The greatest innovation of these structures is their visualisation of the parameters of the feast dates, better known as the calendar *termini*, which show the earliest and latest dates on which they can fall.²⁹⁵ This is because all of the movable feasts of the liturgical calendar centred on the date of Easter, the first Sunday after the full moon which followed the Spring Equinox, which consequently changed each year. Governed by astronomical and mathematical principles, it was common practice to calculate these dates using the lunar calendar. Here the parameters of Easter are 22 March and 25 April, conforming to the Julian calendar used by the Church before the

²⁹⁵ For a detailed explanation of how the calendar *termini* work, including an illustrated example with a Carolingian *computus* manuscript, see F. Wallis, ‘3. *Computus* Tables and Texts I:22. *Computus Graecorum*- 4c. How to find termini,’ *The Calendar and the Cloister: Oxford, St John's College MS 17*, McGill Library Digital Collections Program, 2007, <http://digital.library.mcgill.ca/ms-17> (consulted 01/08/2015).

Gregorian calendar reform in the sixteenth century.²⁹⁶ This makes the first entry of each of the Easter dials (*Pascha domini finis*) fifty-six days apart.



Dials of Easter season. Detail of *Palatinus A* (fig. 1)

3	22-Mar	Pascha domini finis	4	25-Apr	Pascha domini finis
	29-Mar	Octavia		02-May	Octavia
	05-Apr	ij		08-May	ij
	12-Apr	iiij		16-May	iiij
	19-Apr	iiij		23-May	iiij
	26-Apr	v		30-May	v
	27-Apr	Rogationes		31-May	Rogationes
	30-Apr	Ascensio domini		03-Jun	Ascensio domini
	03-May	post ascensionem		06-Jun	post ascensionem
	09-May	pentecostes		13-Jun	pentecostes

Table A: The Easter dials (3 and 4 in appendix I), *temporale* of *Palatinus A* (for the remaining dials, see appendix I).

²⁹⁶ For an explanation of the parameters, see 'Easter Limits,' *Time and Date*, Epact: Scientific Instruments of Medieval and Renaissance Europe, <http://mhs.ox.ox.ac.uk/epact> (consulted 31/3/2018). For a history of how the Easter parameters have changed over time, see A. A. Mosshammer, *The Easter Computus and the Origins of the Christian Era* (Oxford, 2008).

In order to understand exactly what Opicinus was doing and why, one must become fully engaged in the minutiae of his system. *Palatinus A* is a particularly useful case study as its multiple dials and emendations demonstrate how Opicinus drew links, conceptually and physically, between certain dates in order to understand how the movable calendar was organised. This demands a comprehension of how the dials of *Palatinus A* function, focusing first on the liturgical seasons, second on the Ember days, and third on the remaining miscellaneous dials.

The Liturgical Seasons



Detail of *Palatinus A*, showing emendations in drawing fork structure of the Sundays after Pentecost: Dial 5 in black lettering and red rungs and dial 6 in red lettering and black rungs.

Each dial emphasises the temporal parameters of the liturgical seasons, as described above (for a tabular transcription of each dial, see appendix I).

For most seasons, there are two identical dials: one in black and the other in red, one defining their earliest parameters, the other their latest.²⁹⁷

In the case of the identical dials (Advent, Pre-Lent and Lent, Easter and Sundays after

Pentecost), if one were to mentally turn the black rungs around the inner calendar ring about the central axis, they would map perfectly onto their red counterparts.

²⁹⁷ Salomon mentioned this feature briefly in his descriptions of fol. 6^r and *Palatinus A*, and in more detail in his short chapter on the calendar in the Palatinus. He noted, as above, that there are thirty-five potential *Jahresformen*, and so identified the two forms (referred to here as 'dials') as forms one and thirty-five. Salomon, *Weltbild und Bekenntnisse*, p.82.

In some cases, the pair of dials is dissimilar owing to the varying number of Sundays of the season, which is dependent on the day of the week in which the season begins. For example: the Sundays after Pentecost are distinct from other liturgical seasons as it can differ in length quite considerably. The season varies from twenty-two weeks if Easter falls on 24 or 25 April, to twenty-seven weeks if Easter falls on 22 to 26 March inclusive. This is shown in *Palatinus A* in dials 5 and 6 (appendix I). As shown in the above detail, dial 5 ends on *xxiiij* whilst dial 6 ends on *xxiiij*. The confusion over the varying length of the seasons is reflected in the emended lengths of the dials. Although the rung of dial 5 reaches *xxiiij*, the following four weeks are numbered to *xxviiij* (up to the Sunday before Advent and therefore when the season correctly finishes). From the still-visible marks leading up to *xxviiij* and leading on from the end of the red dial after *xxiiij*, one can see that a choice had to be made considering its length, leading Opicinus to correct himself. Unlike the other, more standardised liturgical seasons, the dials of the Sundays after Pentecost could not perfectly map onto one another if they were to be turned about the central axis. Perhaps this is why Opicinus experimented with a different colour coding system: not in this case a red system and a black system like the identical liturgical seasons, but combining red text with a black structure and vice versa. The experimentation with and emendation of complex data illustrate how Opicinus grappled with the mechanisms of the calendar in an attempt to find the clearest possible way to represent the distinction of this liturgical season from the others.

The Ember Days

The colour coding takes on a new pattern in the dials circumventing the Ember days, reflective

of their functional difference.²⁹⁸ These days of fasting and abstinence happen four times per year, one set of days for each liturgical season. For this reason, they were referred to as the *quattuor anni tempora*. Each takes place on the Wednesday (*Feria iij Jejunia*), Friday (*Feria vj.*) and Saturday (*Sabbatum*) of a week.²⁹⁹ Instead of having two identical sets of four dials which map onto one another, Opicinus drew four dials connecting the Wednesday of the earliest parameter with the Friday of the latest parameter, so that each dial delineates the period of time in which the Ember days can take place in that year. For example: the dial of the *tempora mensis quarti* (dial 9 in appendix I) runs from 13 May (the Wednesday of the earliest parameter) to 19 June (the Saturday of the latest parameter). Those two sets of Ember days which are less changeable from year to year (labelled *tempora mensis septimi* and *tempora mensis decimi*) have red dials, whilst those which vary more and therefore constitute longer dials (*tempora mensis primi* and *tempora mensis quarti*) are black. The colours therefore work to emphasise the difference between the longer and shorter variations, which is further accentuated by the difference in the size of the font that labels each structure. The visual effect of inserting the Ember days into a circular format is a kind of symmetry, dividing the calendar into four equal seasons and complementing the other quaternal qualities displayed.

The Miscellaneous Dials

There are then two sets of dials which do not fit into either of the above two categories. The first exists solely to connect the earliest and latest date on which Ash Wednesday (*Feria iij cinerum*) can occur. The reason for Opicinus to highlight this date is not entirely obvious, but the

²⁹⁸ Salomon noted that the naming of the Ember days as *jeiunii*, *quarti*, *septimi* and *decimi* is based on the *Decretum Gratiani* (Decr. Grat. C. 6. Di. 76; 2 pars). Salomon, *Weltbild und Bekenntnisse*, pp.81 (n.7), 82.

²⁹⁹ M. Sauer, 'Ember Days,' in *The Oxford Dictionary of the Middle Ages*, Vol. 3, ed. R. E. Bjork (Oxford, 2010), pp.558-59.

detail shows again how he drew these structures in order to visualise the interrelationships between the feasts. The second miscellany does not have its own structure drawn, but is inserted beneath the rungs of the dials to which it relates. To do so, the dials of *Palatinus A* reach further into the circle's centre in an attempt to find more space, as is clearly demonstrated in the detail below of the inner median of the calendar, where multiple dials occupy four tiers of information. On the inside of these structures is written a selection of the most important feast dates and Sundays from the Pre-Lenten and Easter seasons, excluding the days of fasting, such as the Ember days (*Feria iiij cinerum*; *Feria iiij Je[junia] I*). Most intriguing is how Opicinus calculated this information: each is the median of the earliest and latest date on which it can lie. In dials 1 and 2, for example, Septuagesima (*lxx*) lies on 18 January (*prima lxx*) and 21 February (*ultima lxx*) respectively, whilst on the median dial it is on 4 February, the exact midpoint of these two dates.³⁰⁰



04-Feb	<i>lxx</i>
11-Feb	<i>lx</i>
18-Feb	<i>l</i>
25-Feb	<i>xl</i>
04-Mar	[illegible mark]
11-Mar	<i>iiij</i>
18-Mar	<i>iiiiij</i>
25-Mar	<i>v de passione</i>
01-Apr	<i>vi in palmis</i>
08-Apr	<i>pascha domini</i>
15-May	<i>ascensio dei</i>
27-May	<i>pentecostes</i>

Inner 'median' dial (dial 13 in appendix I), detail of

Palatinus A

³⁰⁰ Salomon, *Weltbild und Bekenntnisse*, p.82. Fol. 5^r of the *Palatinus* (see n.292 above) contains a similar *temporale* system. Whilst the movable feasts are repeated in the outer calendar ring, the median of the two dates is marked just inside the calendar ring. For example, *Rogationes* is inserted in red on 27 April and black on 31 May, thus thirty-five

As can be seen by the multiple rubbed out circle lines in the above image, one could either conclude that Opicinus made many mistakes before realising his later system, or that he first intended to create a more complex system stretching across multiple tiers of information before realising that it would not be clearly legible. Opicinus continued to experiment with the form in order to distil the information given in the outer rings into one set of information, including only the most important feast days and placing them at the mid-way point of their potential range. What remains to be interpreted are the inner-most insertions of this calendar system (also present in fol. 6^v), in which red biblical commentary on the calendar is aligned with the content of the outer *sanctorale* (transcribed in appendix 1). This does not concern Opicinus's time reckoning systems, so is not treated here.³⁰¹

The *Temporale* of Folios 6^r and 25^r

One can see Opicinus's logic at work in his colour coding of the separate dials, but his experimentation in *Palatinus A* leads to an over-elaborate and cluttered product. The *temporale* systems in folios 6^r and 25^r are more simple and clear, joining the feasts into two complete circles: one red with red text, the other black with black text. In these instances, one circle is representative of the earliest parameters of these dates, the other circle of the latest. The dials are

days apart. The median *Rogationes* is marked at the exact midpoint between the two on 14 May (seventeen units from the earliest and latest date).

³⁰¹ These consist of short passages connected to the *sanctorale*. Salomon, in his commentary of this inner-most calendar ('in denen den üblichen Benennungen der Heiligtage geheimnisvoll klingende Formeln beigegeben sind') stated that they are connected by a kind of word play ('Grundlage von Assonanzen und "etymologischen" Gelehrsamkeitsbrocken'), the type of which we see throughout the *Palatinus* and *Vaticanus*. For example, the entry for 18 January in the *sanctorale* is *Cathedra petri in urbe* whilst the entry for 18 January in the *temporale* (thus rotated 180 degrees from the *sanctorale*) is *Thronus domini ira tonantis*. The word play here is clearly the relationship between the *thronus* (throne) with the *catbedra* (seat). As the *sanctorale*'s content is fixed, Opicinus must have inserted the *temporale*'s passages based on the content of the *sanctorale* in order to create a kind of exegetical calendar. This is more concerned with Opicinus's use of text and thus out of the remit of this thesis. Salomon, *Weltbild und Bekenntnisse*, p.85-86.

further clarified in the latter two drawings as they only occupy two tiers of information.³⁰² What Opicinus lost in detail of content he gained in clarity, providing further evidence that *Palatinus A* is one of Opicinus's earliest experiments, in which he seems to have been interpreting the information available to him as he drew. A detailed analysis of the dials of each example shows a clear chronology: from the initial experimental stages of their conception in *Palatinus A* to the more coherent forms in folios 6^r and 25^r, as shown below. A comparison of these structures presents a more vivid idea of what he was trying to achieve, whilst demonstrating his intellectual process.

³⁰² There is one exception on fol. 6^r of a set of Ember days at the end of September, but the shakiness of the line, drawn without a rule and which breaks to avoid the text *Tempora jejuniū septimi*, shows this is a later insertion and most likely a correction.



Tempora primi mensis in *Palatinus A* (above), labelled as *Tempora jejunii primi* in fol. 6^r (centre) and fol. 25^r (below)

Although the dials of folios 6^r and 25^r are simplified and thus individually do not give as much information as *Palatinus A*, a comparison of their entries can tell us more about how Opicinus further refined the dial system whilst also confirming what Opicinus was trying to achieve in *Palatinus A*. For example, the labels *tempora jejunii primi* and *tempora jejunii quarti* perfectly align with

the parameters of the Ember days under that title. They are, however, far clearer in fol. 6^r than in *Palatinus A*; the letters are more uniform, straight and vertically elongated, allowing them to delineate more clearly the feast days in question. The change of wording from *tempora primi mensis* to *tempora jejunii primi* is also more consistent with the content within the calendar. Overall, Opicinus clarified his depictions of the dials and their corresponding text in each drawing. Fol. 25^r, the only example here which does not include a *sanctorale*, combines elements of each of the other two drawings: using the same text as fol. 6^r, reading *tempora jejunii primi*, but in the same lettering as *Palatinus A*. The colour coding of each is also slightly different: fol. 6^r's outer dial is red and inner circle black whilst fol. 25^r has the reverse, despite the fact that their content is identical. The slight variation between folios 6^r and 25^r demonstrates that Opicinus was still refining his forms.

The differences between the three movable calendars show that whilst the making of *Palatinus A* was an exploratory and experimental exercise, in which Opicinus was working through the *temporale* and realising the interrelatedness between the feasts of the movable calendar, folios 6^r and 25^r functioned as a summary of this process. The latter are clear visual systems which express the most vital information in order that Opicinus could continue to experiment with other diagrammatic forms before aligning them with the calendars. An inspection of these systems also shows that whilst Opicinus may have experimented with a huge variety of forms and structures, the content changed less and less, becoming more concise each time as he built and refined his own visualisation of the calendar ring, which were simplified further in his later diagrams.³⁰³ It is therefore not the content which is abstracted, but the forms in which he expressed it.

³⁰³ The calendar in fol. 1^r (fig. 3), for example, is one of Opicinus's last calendars and consists only of a single ring of the repeated dominical letters.

With an understanding of exactly how Opicinus's systems work, one can begin to understand how he built these systems. The next question is, therefore: Where did he find the elements of these systems? If, as shown in the previous chapter, his calendars are unique objects or at least unique survivals, what sources of calendrical information informed his visualisation of the *temporale*? Was he informed by the same sources as for his *sanctorales*? To know this, one must understand how the *temporale* was represented up to and during his period of activity.

Medieval Representations of the *Temporale*: Perpetual and Finite Calendars

Opicinus's system of cyclic fork structures does not survive elsewhere, yet its origins can be traced to medieval sources of time reckoning for the feast days: from early-medieval *computus* manuscripts to calendars on horological devices. In order to understand how and why Opicinus depicted the movable feasts in this way, an overview of the various methods of representing the calendar *termini* is necessary.

The earliest representations of the *temporale*, as found in Carolingian *computus* manuscripts, supply the necessary data to calculate the calendar *termini* (most often in tables), accompanied by a textual explication of how to compute them. To use the *computus* manuscript of Byrhtferth of Ramsey (c. 970-c. 1020) as an example, the movable feast dates of a certain year (deciphered by its place in the nineteen-year lunar cycle) are calculated using the *tabulae* of the *claves terminorum* and *ultimi termini* (fig. 20). This is explained to the reader in the accompanying text on the right of the folio, entitled *Qualiter termini inveniendi possint*.³⁰⁴ The complexity of this system, which requires calculation using various sets of information and thus a working knowledge of *computus*, rendered

³⁰⁴ This system is traditional to the *Computus graecorum*. Note that there were different types of *termini*. For example, according to the Julian calendar the *ultimus terminus* of Easter is 11 March, but the calendar *terminus* is 22 March, and thus this is the earliest date on which it can occur.

this form inaccessible to the lay reader but would have been familiar to members of the clergy and *scriptores*, such as Opicinus.

There was a growing tendency in the later *computus* diagrams of the thirteenth and fourteenth centuries (such as figures 21 and 22) to combine this information into a single, circular image without textual explication, summarising the process of computation into one diagram. The rendering of the tables' content into a single *rota* transformed a collection of data into an instrument for its calculation, so that the form itself gained functional value. Some *temporales* were intended to be used with a table, providing a shortcut which allowed the viewer to avoid some of the steps of computistical calculation. The San Zeno Wheel discussed in the previous chapter is an example of this. In a column inside its liturgical calendar, the potential dates of Easter are marked by the letters a-u in black and a-q in red. The column was probably used with a table to find the moon's age (by indicating the new moon for every month of the year throughout the nineteen-year cycle), with which the viewer could calculate the feast date. The Wheel still requires some calculation, but less than if one were to use a *computus* manuscript.

Here an important distinction must be made between the two types of *temporale* in circulation during the Middle Ages: the perpetual and the finite. Perpetual calendars (those described above) could be used to calculate the feast days for any given year and were, in theory, eternally valid, whereas the finite calendar was only valid for a fixed number of years. In these instances, which were generally later than the above examples, the years were listed with the most significant movable feast dates given beside them. This form was often found in the centre of the calendars of astronomical clocks, such as the Rostock clock mentioned in the previous chapter. Inside the fixed saints' calendar, the *temporale* lists the years from 1885 to 2017 in a cyclical column, by which the date of Easter for each year is written in a column closer to the circle's centre. Finite calendars expire and so must be changed and updated: another reason why many fourteenth-

century calendars with finite *temporales* do not survive. They were intended to be impermanent.³⁰⁵

In short, the finite calendars gave the answers for the dates of Easter but not the means by which to calculate them; perpetual calendars gave all the necessary content but required calculation.

Amidst these later examples, a third category can be identified: *temporales* in which movable parts assist their use. These were essentially *rotae* of calendrical information, much like those in *computus* manuscripts described above, which were partially covered with revolving disks which only revealed the data relevant to a given year. The *temporale* of the Gdańsk clock described in the previous chapter (fig. 14), for example, is a copper disk covered in canvas situated in the centre of the liturgical calendar.³⁰⁶ This disk is covered by another disk with arc-shaped windows which, when turned, reveals the correct information at the appropriate time. This calendar not only calculates the apposite date for the viewer, but also shows the information relevant to the year in question. No prior computistical knowledge is necessary for its use. The hand-held perpetual calendars which were popular in the early-modern period function by the same basic mechanism. Often consisting of brass and ivory instruments with movable parts, their dials could be turned to give the significant dates for the relevant year. An example is a silver-gilt German perpetual calendar from the sixteenth century (fig. 23). Although many perpetual calendars include complicated astronomical volvelles with multifarious functions, simpler devices such as this were made for the lay user.

Opicinus's methods of representation cannot be categorised into just one of these groups.

Although *Palatinus A* was intended as a perpetual calendar, it is distinguished from the others because the *temporale* is found in the centre of the *sanctorale*, like the finite calendar disks of

³⁰⁵ This would also explain why the calendar *termini* found in codices are almost exclusively perpetual calendars, as the alternative would demand that their folios be frequently replaced, thus disrupting their codicological structure.

³⁰⁶ Januszajtis, 'Wiederaufbau- und Erhaltungsprobleme einer Astronomischen Uhr,' p.346.

astronomical clocks. As discussed in the previous chapter, astronomical clocks are therefore particularly significant sources of comparison. The alignment of both systems must have been challenging for Opicinus, as implied by the multiple emendations in his first calendar (*Palatinus A*), and was probably the reason for their simplification in his subsequent examples.

The theological connotations of the eternal validity of perpetual calendars cannot be ignored. The drawings showed time from (to borrow Whittington's phrasing) a 'God's-eye view', as emphasised by the figure in the calendar's centre.³⁰⁷ The Saviour is enthroned in the heavens: above and out of time. Opicinus inserted this *temporale*-system into the same structure as the calendar ring of the *sanctorale* in order to perfectly align the two. He worked out how to draw his calendars by making *Palatinus A*, and then simplified and refined the *temporales* in his later drawings. This allowed him to integrate more temporal systems into his cosmologies, including the hours of the day, days of the week, ages of man, and ages of the world.

Opicinus did not make his calendars for the lay reader, nor were they computistical *rotae* for the use of a priest in his regular calculation of the feast dates. They are not purely practical tools whose sole purpose is to clearly present the movable dates. The 'moving' dials illustrate the different elements of the movable calendar and how they interrelate. These are Opicinus's experiments which, whilst the evaluation of his sources is useful in considering why he chose certain features, were adapted to his own purpose: to create blueprints of the cosmos.

Another consequence of the form of Opicinus's perpetual calendars is that they required further action to find the significant feast dates. Whilst the manuscript medium of his diagrams rendered the dials stationary, the viewer could use the image to compute the feasts of the relevant year by

³⁰⁷ Whittington, *Body-Worlds*, p.45.

visualising the movement of its dials about its central axis in order to align them with the relevant content on the calendar's rim, like the motion of the hand of a modern clock to tell the time of day. The role of visualised movement to activate this computation means that the most analogous system one can adduce to explain its function is not found in the *computus* tables, but in the moving mechanisms of horological instruments. In order to find a closer parallel with the work of Opicinus, one must look to the earliest documented mechanical movable calendar: the *astrarium* of Giovanni de' Dondi. Like Opicinus's dials, the chains of the *astrarium*'s calendar show how the complex interrelations of the (movable) seasons change each year.

The Moving-Movable Calendar

As was announced in the previous chapter, the *astrarium* was a mechanical device originally designed by Giovanni de' Dondi which included two moving calendars: a cylindrical wheel with the *sanctorale* and a complex system of chains representing the *temporale*, which gave the dates of five significant movable feasts for any given year. There is no evidence of the existence of another mechanical calendar until the making of the third Strasbourg astronomical clock in 1842 by Jean-Baptiste Schwilgué.³⁰⁸ Jean Gimpel argued that no others were constructed in the intervening centuries due to the introduction of the Gregorian calendar in 1582 in place of the Julian calendar, which made the movable feasts even more difficult to represent.³⁰⁹ Yet as this thesis shows, Opicinus's calendars suggest that more calendrical devices like this may have existed before the Gregorian calendar reform.

³⁰⁸ H. A. Lloyd, *The Collector's Dictionary of Clocks* (London, 1964), p.52.

³⁰⁹ J. Gimpel, *The Medieval Machine: The Industrial Revolution of the Middle Ages*, 2nd edn. (London, 1976), p.164.

Whilst no *astraria* survive from the Middle Ages, multiple modern replicas have been made using their medieval manuals. The first was completed in 1960 for the Smithsonian Institution in Washington, a project initiated by Herbert Alan Lloyd.³¹⁰ The entire structure consists of two major sections on a hexagonal framework: the top has seven dials giving the motion of the sun, moon and five planets, and on the lower framework are the twenty-four hour dial, the fixed and moveable feasts and the points of interaction of the orbits of the sun and moon. On each side of the horary dial are wings which indicate the time of the rising and setting of the sun in Padua, the place in which the original *astrarium* was designed. The clock dial moves anticlockwise, like the months in the calendar rings of the Palatinus.³¹¹ The *astrarium* is not just a clock as one would understand the word today, but a moving model of the universe, presenting both the microcosm and macrocosm of time in relation to astronomical activity. By comparing the *temporale* of the *astrarium* with that of the Palatinus images, one can see a functional connection between Opicinus's calendars and these scientific instruments.

The most useful documentation of the development of mechanical clocks is Giovanni de' Dondi's description of the *astrarium* in his *Tractatus astrarii Johannis de Dondis Paduani civis cui tres sunt partes*. The earliest surviving copy was probably written under Giovanni's guidance and is therefore dated to before his death in 1389.³¹² One of the most detailed surviving descriptions of the *astrarium*, the *Opus planetariorum Johannis de dondis fisici paduani civis*, survives in a manuscript in the Bodleian (fig. 24, reconstructed in fig. 25). As stated at its end, it was written by John of Leyd and the drawings were completed by Jacomo Polito on 8 November 1461.³¹³ Although it is a fifteenth-century copy, the level of detail and the quality of its drawings are extremely useful in re-imagining the lost device.

³¹⁰ Lloyd, *The Collector's Dictionary of Clocks*, p.48.

³¹¹ Bedini, Madison and Silvio, 'The Mechanical Universe,' p.14.

³¹² Padua, Biblioteca Capitolare Vescovile, MS Cod.D.39, which is presented in *ibid.*, p.41.

³¹³ Bodleian, MS Laud Misc. 620, presented in Bedini, Madison and Silvio, 'The Mechanical Universe,' p.42.

Most significant to this investigation is the system created for displaying the movable feasts, the components of which are described and pictured at length in chapter seven of the *Opus planetarj*: *Et est doctrina/ componendi capsulam trium circularum/ secundum solaris lunaris et indictionum*. The first observation is that despite the mechanical connection between the structures of the fixed and movable calendars, they are treated separately and visualised through different devices. The *sanctorale* is relatively simple, consisting of one wheel which turns at a constant rate (one unit each day), but the *temporale* is made up of several components whose movements are based on numerous astronomical algorithms which dictate when the feasts will fall in each lunar year. To understand the relationship of this system to Opicinus's, one must first understand how the *astrarium* functions.

The system comprises a series of links and chains, which Lloyd described with clarity.³¹⁴ There are three movable chains (see figures 24 and 25). The top represents the solar year: each of the twenty-eight links displays the number denoting the year of the solar cycle and its dominical letter(s) (as the days of the month fall on the same pattern of the days of the week once every twenty-eight years) and therefore establishes the sequence of dominical letters of that year. These are essential for the *temporale*, as the feasts are dependent upon the date of Easter, which must fall on a Sunday. The central chain represents the lunar calendar. Each of the nineteen links lists the golden number (or place within the lunar calendar) above five dates: Septuagesima, Quinquagesima, Easter, Rogations and Pentecost. Easter is inserted into the centre as it governs the dates of the other four feast days: Septuagesima is the ninth Sunday before Easter, Quinquagesima the sixth Sunday before, Rogations the fifth Sunday after, and Pentecost the

³¹⁴ H. A. Lloyd, *Giovanni de Dondi's Horological Masterpiece 1364* (s.l., 1955), pp.6-7.

seventh after Easter. The lower chain represents the Indiction period, which is not directly relevant to understanding the relationship between Giovanni's and Opicinus's systems.³¹⁵

There is a great deal of overlap between the ways in which Giovanni's and Opicinus's systems function. Both give the same data in the same order: golden number; dominical letter; and feast day.³¹⁶ Although this similarity in content is to be expected, as both are based on the same data (the calendar *termini* of the movable feasts given in *computus* tables), it is their strategy of visualisation which is significant to this interpretation. Like moving *computus* tables, both the *astrarium* and *Palatinus A* required sets of information to move and click into place elsewhere. In Giovanni's clock, the chains are shifted at different rates by moving cogs, changing the alignment between the lunar and solar years. *Palatinus A* visualises this movement by showing the information sets (the dials of feast days) in both their earliest and latest possible positions.

It should be noted that the nature of their movement is different. The *astrarium*'s chains move through space, whereas Opicinus's chain structures, incapable of movement on the manuscript plane, require the viewer to visualise their movement about the central axis. The direction of movement is indicated by the repetition of the structure as it depicts two moments in time (the calendar *termini*) in order to show that the dials can be placed at any point between. The actions which the hand and eye perform are essentially those of visualised movement; the eye must move across the two-dimensional surface of the diagram whilst the components of instruments move through three-dimensional space.

³¹⁵ Lloyd, *Giovanni de Dondi's Horological Masterpiece*, p.7.

³¹⁶ The two also prioritise the same feast days, though this is true of most medieval *temporales*. Septuagesima, Easter and Pentecost all mark the beginnings and ends of dials on *Palatinus A*, and also indicate respectively when the liturgical seasons of Pre-Lent, Easter and the Sundays after Pentecost begin. Although the other two dates displayed on the *astrarium*, Quinquagesima and Rogations (marking the beginning of Lent) are also present in *Palatinus A*'s calendar (Quinquagesima as $\times^k$), they do not mark the beginning or end of a dial.

A comparison between the two shows that Opicinus ordered time in the same way as the earliest mechanical instruments of calendar. This is also supported by the similarity between the two forms of *sanctorale* (see figures 15 and 25). Yet it is not enough to simply acknowledge their similarities; one must ask how they can be explained. Are they similar solely because they visualise the same data? Did the two forms directly influence one another, or are their traits symptomatic of the historical and cultural moment which they shared? In the latter case: Is the similarity demonstrative of the visual manifestation of a movable set of the same feast dates? Did Opicinus consciously take inspiration from time-keeping devices? Or were they both the products of the same visual culture of time reckoning in fourteenth-century northern Italy?

Giovanni de' Dondi and Opicinus worked in broadly the same context, following the development of time-keeping devices in the late-thirteenth and early-fourteenth centuries in southern France and northern Italy. Contemporary accounts suggest that the *astrarium* was first begun in 1348 and completed in 1364, following a sixteen-year development period.³¹⁷ No form of the instrument, however, survives from before the twentieth century, and the remaining evidence of its medieval existence is purely textual. Even so, and as described in the previous chapter, one can be confident that mechanical time-keeping devices existed prior to the *astrarium* and were available to Opicinus.

The point of this comparison is not to conclude that Opicinus was consciously emulating the *astrarium*, but to show that he was active in the same period in which mechanical time-keeping instruments were being made. This suggests that Opicinus shared visual experience with horologists, such as Giovanni de' Dondi, and so learnt to order time in a similar way. It should therefore not be surprising that these same impulses to capture the movement of time can be

³¹⁷ Bedini, Madison and Silvio, 'The Mechanical Universe,' p.5.

seen in the Palatinus. The *astrarium* is not necessarily significant here in defining Opicinus's source of inspiration, but represents a culture in which the data found in manuscripts was transformed into moving technologies, and which ordered time in a specific way. Whilst it might not be possible to identify whether there was a specific horological device with which Opicinus was most familiar, the rare survivals of the *temporale* which were being developed contemporaneously to the Palatinus show that his method of representing the moveable feasts engaged with the most recently-developed calendars of his time.

This argument is supported by the way certain images, particularly those concerned with measuring time, were used in the Middle Ages. Following a broader consideration of how images of time and movement have been evaluated in art history, the rest of this chapter studies the current state of the scholarship regarding how certain medieval diagrams were activated by the user's visualisation of the movement of certain components within them, before considering to what extent this was affected by the introduction of mechanical movement to the visual experience of time. This shows that whilst diagrams which required visualised movement existed previously, a particular type of diagram emerged around the fourteenth century whose use was informed by the movement of its technological counterparts.

Reading Movement in Images

The immobility of images and the desire to render movement has often been discussed in the history of art, though often under the headings of 'time', 'narrative' and 'space'. In order to express movement one must capture multiple moments in time, and so the depiction of narrative is inextricably intertwined with the conception of time and space. The question of how one visualises time has been approached through numerous methodologies: ranging from historical

overviews which examine the different methods artists have used to visualise time,³¹⁸ to more recent studies which have cited psychological and neuroscientific research to consider such images in relation to how the eyes and brain perceive movement.³¹⁹

Many of these interpretations compare the representation of time in texts and images to show that in order for an image to contain more than a single moment in time, it should be rendered in a way which required the viewer to read it like a text. Gotthold Lessing, in *Laocoön* (1767), identified the distinction between poetry and painting to be essentially temporal; the painter cannot depict more than a single moment whereas the poet does not have this constraint.³²⁰

Whilst poetry can only exist in the time in which it is spoken/read, a painting can only show a subject in a given moment. In a more recent study of time in images and its comparison to text, Mieke Bal's theory of 'sticky images' offered a useful explanation as to how the 'reading' of an image is crucial to the visual representation of time. She argued that 'sticky images... hold the viewer' through their 'many levels of figuration [that] cannot be seen at once'. Sticky images therefore act like a text as they are read, and therefore experienced, in time.³²¹ Opicinus's

³¹⁸ A. Sturgis, *Telling Time* (London, 2000). Sturgis discussed the changing terminology used to define different methods of narrative, including studies of narrative in early Christian art. F. Wickhoff, *Roman Art: Some of its Principles and their Application to Early-Christian Painting* (London, 1900); K. Weitzmann, *Illustration in Roll and Codex: A Study of the Origin and Method of Text Illustration* (Princeton, 1947). The latter offers a threefold division of narrative art but uses different terms for their categories. Sturgis cited two useful summaries: L. Andrews, *Story and Space in Renaissance Art* (Cambridge, 1995), pp.120-26; M. Stansbury-O'Donnell, *Pictorial Narrative in Ancient Greek Art* (Cambridge, 1999), pp.1-7.

³¹⁹ For example, Gombrich discussed how the movement of the eye around the image gives us the impression that the image is moving. E. H. Gombrich, 'Moments and Movement in Art,' in *The Image and the Eye: Further Studies in the Psychology of Pictorial Representation* (London, 1994), pp.40-62. James Elkins brought a neuroscientific reading to Gombrich's theory which has shown that our retinas often 'look ahead' to anticipate what they will see next, with the result that one never sees a single moment in time: J. Elkins, 'Time and Narrative,' *Academia*, https://www.academia.edu/165600/The_Visual_chapter_on_Time_and_Narrative_ (consulted 01/08/2015). Elkins cited neuroscientific research, such as J. R. Duhamel et al., 'The Updating of the Representation of Visual Space in Parietal Cortex by Intended Eye Movements,' *Science*, Vol. 255 (1992), pp.90-92; J. W. McClurkin et al., 'Concurrent Processing and Complexity of Temporally Encoded Neuronal Messages in Visual Perception,' *Science*, Vol. 253 (1991), pp.675-77. Much work has been done since on this topic. David Freedberg has collaborated with neuroscientists to study the neural responses evoked by the observation of implied motion in art. C. Concerto, C. Infortuna, L. Mineo, M. Pereira, D. Freedberg, E. Chusid, E. Aguglia and F. Battaglia, 'Observation of Implied Motion in a Work of Art Modulates Cortical Connectivity and Plasticity,' *Journal of Exercise Rehabilitation*, Vol. 12, No. 5 (2016), pp.417-23.

³²⁰ G. Lessing, *Laocoön: An Essay on the Limits of Painting and Poetry*, transl. R. Phillimore (London, 1874), pp.28, 36.

³²¹ M. Bal, 'Sticky Images: The Foreshortening of Time in an Art of Duration,' in *Time and the Image*, ed. C. B. Gill (Manchester, 2000), pp.79-99, pp.80-82.

drawings certainly qualify as 'sticky images'. They cannot be understood from a single glance but require time to be read, as if they were texts. But how do they achieve this visually?

Alexander Sturgis, in his broad overview of the ways in which time has been depicted in art, identified different narrative devices before differentiating between 'sequential narrative' and 'continuous narrative'.³²² The former consists of a number of repetitious scenes, each with details slightly altered in order to tell different stages of a story which 'follow' one another, like present-day comic strips. This narrative device exists in medieval art works, such as in the *vita* icons discussed by Hans Belting, which he argued could be referred to as 'reading icons' as they offer a pictorial equivalent to hagiographical texts.³²³ He gave as an example an icon of St John the Baptist from Mount Sinai, in which an image of John is surrounded by scenes from his hagiography running clockwise around the border. This example does not, however, relate to the depiction of time and movement in Opicinus's calendars as the icon depicts distinct moments in St John's life which are in no way spatially connected. Medieval artists clearly used 'sequential narrative', but the way in which Opicinus displayed movement can be better understood in relation to 'continuous narrative'.

As continuous narrative depicts numerous stages set within one scene, a significant feature of its representation is repetition. Everything remains the same excluding one element, which changes slightly in each scene. A better comparison for Opicinus's method of representing movement over time is *The Nativity and the Adoration of the Magi* (c. 1325-30, fig. 26), a painting taken from a polyptych made by a painter active in Bologna, now referred to as the Pseudo-Jacopino di

³²² Sturgis, *Telling Time*, pp.22-25, 51-59.

³²³ H. Belting, *Likeness and Presence: A History of the Image Before the Era of Art* (Chicago, 1994), p.249. Belting also discussed how certain early-fourteenth-century narrative wall paintings were equivalent to texts in H. Belting, 'The New Role of Narrative in Public Painting of the Trecento: *Historia* and Allegory', in *Pictorial Narrative in Antiquity and the Middle Ages*, ed. H. Kessler and M. S. Simpson, *Studies in the History of Art*, Vol. 16 (1985), pp.151-68, p.165-66.

Francesco.³²⁴ By depicting the Virgin and Child twice within one landscape, the artist showed two moments in one scene. The visual strategy differs from Belting's 'reading icon' as it implies the movement of the Virgin in the space depicted. The hagiographical scenes in the icon of St John, on the other hand, depict distinct moments in his life which are in no way spatially connected. The same proposition of Jacopino's painting can be applied to the *temporale* dials of *Palatinus A* (and in the lunar diagram below). The medieval viewer of the Palatinus calendar moved the dial structure about the central axis and placed it between the earliest and latest parameters depicted. The emendations of the dial structures (fig. 27) show that Opicinus may have intended to draw more of these dials in-between on various tiers. The same visual capability which identifies narrative in figurative painting can be applied to non-narrative movement.

Psychological and neurological research has informed art-historical studies on how continuous narrative works, but their conclusions are based on the visual responses of the modern viewer. One must consider how such responses are culturally shaped, and how the modern response is distinct from the perception of the medieval viewer.³²⁵ Sturgis, for example, considered the optical theory of Alhazen (956-1039, available in Latin from the twelfth century), who argued that a clear visual perception of an image was made up of a series of individual observations, a combination of the glance (*aspectus*) and scrutiny (*intuitio* or *obtus*).³²⁶ This gave some medieval context to Ernst Gombrich's theory that the movement of the eye around an image gives the impression that the image itself is moving and that the 'scrutiny' of an image is essentially the

³²⁴ The painting is currently in the North Carolina Museum of Art. For the other known panels from the polyptych, see 'Pseudo-Jacopino di Francesco,' *North Carolina Museum of Art*, http://ncartmuseum.org/art/search?loose_ends=right&search_mode=auto&keywords=pseudo+jacopino (consulted 25/3/2018).

³²⁵ For more on medieval vision, see S. Akbari, *Seeing Through the Veil: Optical Theory and Medieval Allegory* (Toronto, 2004); S. Biernoff, *Sight and Embodiment in the Middle Ages* (New York, 2002); M. Camille, 'Before the Gaze: The Internal Senses and Late Medieval Practices of Seeing,' in *Visuality Before and Beyond the Renaissance: Seeing as Others Saw*, ed. R. S. Nelson (Cambridge, 2000), pp.198-224; D. G. Denery, *Seeing and Being Seen in the Later Medieval World: Optics, Theology and Religious Life* (Cambridge, 2005).

³²⁶ Sturgis, *Telling Time*, p.62. Sturgis in fact wrote *innitio*, but this is a mistranscription. See G. Federici-Vescovini, *Studi sulla prospettiva medievale* (Turin, 1965), p.120.

same as the reading of an image (like a text) over time.³²⁷ This concurs with the theories of more recent scholars outlined above. Yet as Gombrich and Sturgis did not cite any medieval images, they provided no evidence that medieval illustrators took theories of vision into account when making their images. The history of vision is not, in any case, necessarily reflected in the changing forms of the images themselves. One must not only consider theories which wed such concepts of medieval visualisation and perception to images, but also more specifically the particular images here under scrutiny: diagrams.

Moving Diagrams in the Middle Ages

Mickey Abel, in a study of portal sculpture, has discussed 'diagrammatic motion' as understood within the *Quadrivium* (the study of arithmetic, geometry, music and astronomy). She argued that motion (*mobilitas*), because it was perceived as 'a function of pattern, rhythm, and number', was the common denominator of the subjects of the *Quadrivium*.³²⁸ Within the early-medieval writings of religious scholars such as Bede and Isidore of Seville, motion expressed the interrelated nature of intellectual and philosophical ideas of the *Quadrivium*. It therefore 'bridged the gap between the formal abstraction of the logico-mathematical space of the concepts being related and the practico-sensory realm of reading and comprehension'.³²⁹ In another study, Abel clarified how she believed this theoretical understanding of *mobilitas* to have affected image making. She argued that there was a specific way of reading (or moving through) two-dimensional diagrams, by

³²⁷ Gombrich, 'Moments and Movements in Art,' p.50-51. Gombrich also considered other medieval ideas about time, such as St Augustine's 'Confessions' in which he pondered upon the elusiveness of the present moment. Ibid., pp.46-47. Umberto Eco also praised Augustine for his sophisticated conception of time, and linked his ideas back to Aristotle: 'time is the calculable measure of motion with respect to before and afterness' (*Physics*, I V, 11, 219, b1). K. Lippincott, *The Story of Time* (London, 1999), p.10.

³²⁸ M. Abel, *Open Access: Contextualizing the Archivoluted Portals of Northern Spain and Western France within the Theology and Politics of Entry* (Cambridge, 2012), p.67.

³²⁹ Ibid., p.68. (This includes a thorough bibliography on the role of *mobilitas* in reading images).

which their ‘repetitive, rhythmic imagery’ encouraged their comprehension through the ‘correlation of spatially configured fragments’.³³⁰ In summary, *mobilitas* was understood by medieval religious scholars to be a way of reading or thinking through an image.

Although it is plausible that medieval intellectuals, such as Opicinus, incorporated the theoretical understanding of *mobilitas* in the making of their images, other scholars have offered more practical and persuasive suggestions as to the role of movement in medieval diagrams. Carruthers studied the process and function of *mobilitas* in medieval manuscript images by exploring how visual mnemonic techniques and the visual route, or *ductus*, guided the user through a composition.³³¹ She considered the possibility that the medieval viewer, in order to use the meditational cherub diagrams which often illustrate the homiletic text, *De sex alis*, was expected to move its parts mentally (bending the wings back and forth, up and down). This, she argued, is shown by the ‘radically different’ ways in which the wings are organised in four examples which she considered.³³² Whilst Carruthers’s interpretation focused more on the function of movement in images, both she and Abel argued that medieval illustrators used their knowledge of rhetorical strategies to design their images as mnemonic devices which required movement, exemplified for instance in Hugh of St Victor’s description of his charts.³³³

Most relevant to this study, Carruthers concluded her discussion with volvelles:

³³⁰ M. Abel, ‘Intellectual Projection, Liminal Penetration: Programmed entry and the tympanum-less portals of western France and northern Spain,’ in *Push Me, Pull You: Imaginative and Emotional Interaction in Late Medieval and Renaissance Art*, Vol. 2, ed. S. Blick and L. D. Gelfand (Leiden, 2011), pp.423-65, p.442.

³³¹ For more on *ductus*, see M. Carruthers, *The Craft of Thought: Meditation, Rhetoric and the Making of Images 400-1200* (Cambridge, 1998), p.77-81.

³³² M. Carruthers, ‘Moving Images in the Mind’s Eye,’ in *The Mind’s Eye: Art and Theological Argument in the Middle Ages*, ed. J. Hamburger (Princeton, 2006), pp.287-305, p.300.

³³³ Abel, *Open Access*, p.68, who cited Hugh of St. Victor, ‘The Three Best Memory Aids for Learning History,’ transl. M. Carruthers, in *The Medieval Craft of Memory: An Anthology of Texts and Pictures*, ed. M. Carruthers and J. Ziolkowski (Philadelphia, 2002), p.36.

But does all this mental work within the mind's eye ever affect physical images in ways we can demonstrate? Here the evidence is indirect, as I think it must be. After all, except for the ubiquitous *rotae* in later medieval manuscripts, that are made of cut-out parchment disks tied onto the page, it would be difficult to see how the technology of the day could have permitted a full graphic realization of most of the images I have been discussing.³³⁴

A consideration of volvelles is thus necessary to connect Carruthers's study with the above discussion and therefore to question whether a study of technology could permit a 'full graphic realisation' of these concepts.

This is not to revive a discussion of how the visualisation of movement (and therefore time) works, a broad question debated since the birth of self-conscious image making and interpretation, but to ask how the medieval viewer and maker dealt with such issues of dimension and movement. By comparing images which visualise time and movement on a two-dimensional plane with instruments that illustrate the same data but which have the ability to move mechanically, one can return to a question posed at the beginning of this section: Did the medieval viewer perceive instruments as moving diagrams, and vice versa? This would not only offer clarification as to how the medieval viewer understood and used diagrams of time and space more broadly, but would also place Opicinus within this intellectual climate in which diagrams, like time-keeping technologies, were activated through visualised movement and thus functioned as instruments as well as images. His *temporales* are a case in point.

³³⁴ Carruthers, 'Moving Images in the Mind's Eye,' p.295.

A Lunar Case Study

Diagrams of the phases of the moon, which show how it waxes and wanes during the lunar month of thirty days (now known to be slightly less than this), frequently appeared in medieval astronomical miscellanies. Figure 28 is a lunar diagram found in an English scientific miscellany from the first quarter of the fourteenth century, which includes many diagrams illustrating mathematical and astronomical principles.³³⁵ Here one sees the phases of the moon at eight different moments as it orbits the earth. This does not express the idea that the moon has eight finite phases but shows how the shape of the moon gradually changes, dependent upon its position in relation to the earth and the sun.

Comparable to the relationship between Opicinus's dials and the *astrarium*, the lunar diagram has a technological counterpart. The geared astrolabe of Muhammad ibn Abī Bakr al Ibarī, made in Isfahan in 1221/22 (fig. 29), is the oldest known complete geared mechanism to survive. The cogs rotate a disk on which two black circles are drawn. Part of the disk can be viewed through a small circular window within the astrolabe case, revealing the changing shape of the moon as circles move partially in and out of sight, corresponding to the date of the lunar month (which is shown through a small square window also moved by the rotating disc).³³⁶ Whilst both have the same function and content, the process of 'reading' each image differs. Like the *astrarium*, the geared astrolabe displays the answer for the single moment of time in which it is viewed, so one must wait for the information to be displayed. By contrast, the viewer of the diagram is prompted to move their gaze around the image in order to identify the correct phase for a particular time. In the case of the diagram it is the mind's eye of the viewer which moves, not the

³³⁵ 'MS Royal 12 C XVII,' *British Library Catalogue of Illuminated Manuscripts*, <http://www.bl.uk/catalogues/illuminatedmanuscripts/record.asp?MSID=5482&CollID=16&NStart=120317> (consulted 21/10/15)

³³⁶ 'Geared Astrolabe Animation', *Museum of the History of Science (Oxford)*, <https://www.youtube.com/watch?v=OiUgBeb2vtk> (consulted 16/9/15)

mechanism. In each case the function of the image/instrument is activated by movement, either by the mechanism or the eye.

The process of reading the lunar diagram is physically re-enacted by using a volvelle. The example shown in figure 30 (Bodleian, MS Ashmole 370) is taken from an early-fifteenth-century English copy of an astronomical miscellany of Nicholas of Lynn, an astronomer active in the mid-fourteenth century. Just as the viewer's gaze moves around the orbital path to identify the date, and can then infer the correct shape of the moon by comparing the moons on either side, the user of the volvelle moves the arm of the disk in order to identify the correct phase as seen through the circular window. As shown in the four depictions, in which the lunar arm has been turned about the central axis by ninety degrees each time, the isolated lunar phases are identical to those drawn in the lunar diagram discussed earlier. The visual path of the viewer is directed by the movable arm, which therefore acts as a physical complement to the gaze. In the manuscript volvelle and diagram, the human hand and eye activate the actions of the diagrams which are functionally equivalent to the automatic movements of the mechanical astrolabe. The comparison is not complete, but it shows how the medieval maker of astronomical and time-reckoning diagrams was familiar with moving *rotae* to show celestial movement and to calculate time.

The Volvelles of Ramón Llull

Whilst the vast majority of astronomical volvelles, such as those described above, survive from the late-fourteenth century onwards, movement was used to activate the functions of images long before. The theological volvelles of Ramón Llull (1232-c. 1315), for example, existed from the beginning of the fourteenth century. Llull began his *Ars inventione veritatis* at Montpellier in the 1290s: a phase of work which was to culminate in his *Ars generalis ultima* (1305-08) and *Ars brevis* (1308, an abbreviated

version of his *Ars magna*). It is likely that Llull's work would have been known to Opicinus: either in Genoa, where Llull worked from March to April in 1308, or in Avignon, whose proximity to and association with manuscript production in southern France, possibly including Montpellier, was outlined in chapter one.³³⁷ The latter included the volvelles, which Llull referred to as *figurae*, for which he is best known.³³⁸ Llull's volvelles are not only useful in their indication that Opicinus would have been familiar with paper instruments with revolving disks. They also show how the movement of volvelles and their related diagrams meant that these images could be used as instruments, or as will shortly be suggested, 'thinking tools', for the reasoning of truth, thus helping to clarify the function of Opicinus's diagrams.

The volvelles consisted of multiple layers of disks upon which were written letters (BCDEFGHIK) indicating concepts according to Llull's system of classification. These were intended to be combined by rotation as a method of answering theological questions and settling religious disputes.³³⁹ Anthony Bonner asserted that these letters were not symbolic, nor did they stand for variables. The volvelles were 'mnemonic devices for exhibiting the basic structural components of the *Art*' which showed how the components of the *Art* were organised whilst facilitating its 'combinatorial and calculational mechanisms'.³⁴⁰ The process is manual, yet the movement of disks in order to combine different data sets (as in the *temporales* discussed above) has led scholars to identify Llull as one of the earliest computation theorists. In Bonner's words, Llull created a 'network of systems systemizing systems' which comprised an 'almost total mechanisation of the process of the *Art*'.³⁴¹ This aspect of the images has led multiple scholars to

³³⁷ P. Rossi, *Logic and the Art of Memory: The Quest for a Universal Language*, 2nd edn. (London, 2006), p.195.

³³⁸ A. Bonner, *Selected Works of Ramón Llull (1232-1316)*, Vol. 1 (Princeton, 1985), p.571.

³³⁹ In two of Salomon's studies, he argued Opicinus's method of experimentation to be similar to Llull's in his superimposition of various names and places upon his maps. Salomon, 'A Newly Discovered Manuscript,' p.53. Although Salomon did not find any instances in which the content of Opicinus's and Llull's works were identical, their similar methodologies led him to question: 'Hat er die *Ars magna* einmal in der Hand gehabt?' Salomon, *Weltbild und Bekenntnisse*, p.134.

³⁴⁰ Bonner, *Selected Works of Ramón Llull*, 1, p.307.

³⁴¹ Bonner referred to Llull's *Ars Brevis*. Ibid., p.574.

draw connections between the moving wheels of Llull's *rotae* and the Turing Machine.³⁴² These readings are initially intriguing in their incorporation of the history of technology into their analysis of Llull's *figurae*. Yet their placement of his images within a teleological narrative of the development of certain machines which came into existence centuries later is not helpful to this study, which is concerned with how the medieval viewer would have engaged with them.

Frances Yates, in *The Art of Memory*, offered a more helpful interpretation for understanding the use of such images in the Middle Ages. The idea of moving through an image was emphasised in her consideration of Llull's volvelles: 'These are simple devices, but revolutionary in their attempt to represent movement in the psyche'.³⁴³ In other words, the movement of the parts of these objects were a way of thinking through the image.

The movement through Opicinus's drawing was visualised, not physical, but they functioned in the same way. In Whittington's analysis of Opicinus's portolan charts, he engaged with Steffan Bogen's and Felix Thürlemann's study of a specific type of diagram which they called *Denkfiguren*. They argued that to make a *Denkfigur* was to make a hypothesis, and that to use one was to interpret and test it. Its meaning was thus activated through its use.³⁴⁴ The function of a diagram as a tool or instrument for understanding complex content is very different from that which simplifies and organises content in an easily-understandable manner. In the former group, one can see how certain images moved or were moved through for the purpose of thinking through and finding new information: whether a feast date, or a new understanding of the world.

³⁴² Ton Sales read a direct connection between Leibniz's *Mathesis universalis* and Llull's search for a universal notation. T. Sales, 'Llull as Computer Scientist,' in *Ramon Llull: From the Ars magna to Artificial Intelligence*, ed. A. Fidora and C. Sierra (Barcelona, 2001), pp.25-37. For the logical devices behind his combinations of letters see D. Link, 'Scrambling T-R-U-T-H: Rotating Letters as a Material Form of Thought,' *Variantology 4. On Deep Time Relations of Arts, Sciences and Technologies in the Arabic-Islamic World*, ed. S. Zielinski and E. Fülus (Cologne, 2010), pp.215-66. For an example of a comparison of Llull's system to the Turing machine, see W. Künzel and H. Cornelius, *Die Ars Generalis Ultima des Raymundus Lullus. Studien zu einem geheimen Ursprung der Computertheorie* (Berlin, 1991).

³⁴³ F. Yates, *The Art of Memory* (London, 1966; repr. 2014), p.177.

³⁴⁴ Bogen and Thürlemann, 'Jenseits der Opposition von Text und Bild,' p.2.

Whittington appropriately translated this term to argue that Opicinus, by experimenting with information through the different arrangements of visual components, used his diagrams as ‘thinking tools’.³⁴⁵ The analysis of Opicinus’s *temporales* certainly supports this. In *Palatinus A*, Opicinus drew out the calendar in order to understand, or think through, the detailed mechanisms, before drawing a clarified version in his later *temporales*.

Whilst this is surely a useful way to think about how Opicinus intended his diagrams to function, it lacks a contextual understanding of why he used diagrams in this way. In addition to showing Opicinus’s experimental drawing process, the *temporales* of the Palatinus also offer perspective as to how the visual culture of the Middle Ages, namely scientific instruments, conditioned their making. In these diagrams, one can observe how Opicinus digested the *temporales* he had seen in northern Italy and Avignon before he created his own system, which partook of both images and instruments. The conception of the Palatinus drawings as thinking tools is complementary to their definition as image-instruments, but the latter offers a more nuanced understanding of how this type of diagram would have been used and why. The term ‘image-instrument’ more accurately reflects the importance of contemporary technology to the changing function of diagrams during the fourteenth century.

By the categorisation of the Palatinus drawings as image-instruments, opposed to thinking tools, their relation to certain contemporary diagrams becomes more pronounced. This is demonstrated in the other sources made in Avignon. Other works which incorporated technological features and which were made in the penitentiary before Opicinus’s arrival, such as

³⁴⁵ Whittington provided a thorough bibliography on the epistemology of diagrams (*Body-Worlds*, p.187, n.65). Most of these sources, however, do not concern medieval diagrams.

the portolan charts (and probable calendars) of Sanudo's *Secreta*, functioned as both images and instruments. This trend is observed throughout the thesis.

Conclusion: Image-Instruments in the Fourteenth Century

The analysis of Opicinus's *temporales* shows that *Palatinus A*, through its various iterations and emendations, is Opicinus's earliest surviving calendar. It therefore illustrates how he processed the calendrical data and began to mould his system. The system was activated by the visualised movement of its dials. Although unique, the way in which Opicinus ordered time and visualised its movement is characteristic of the way in which time was represented by contemporary time-keeping instruments, such as the *astrarium*, indicating that his understanding of time was likely to have been informed by his technological context. Through the system of moving dials, the viewer observed the algorithms of the *temporale* and thus the theological-astronomical computation which underpinned the structure of the calendar. To read *Palatinus A* was as if one were to remove the cover of the *astrarium's* *temporale*, and watch the moving chains beneath. His calendars can therefore be more plausibly accepted as testimony to a larger contemporary field of medieval images related to time, than as unique outliers.

This understanding of how Opicinus intended the viewer to read the calendar has offered insight into the medieval perception and use of a certain group of diagrams. The calendars of contemporary time-keeping devices and Opicinus's drawings are distinguished by the nature of their movement: the former physically moved in space, whilst the latter required the visualisation of their movement. The drawings prompted the viewer to deduce information through a specific type of reading which is more aptly described as visualised movement, or thinking through the

image. The concept of visualised movement in medieval diagrams has been explored to an extent by Abel, Carruthers, and Yates, yet there is still much to be learned from an exploration of the relationship between image and technology which revolves around movement and, therefore, time. This type of diagram, whose central circle could be turned (through physical movement or visualisation) to combine different sets of the content, worked as an instrument.

The study of these moving images reveals a category of medieval diagrams, or ‘thinking tools’, which used features and ideas from contemporary technology to make tools of interpretation. In *Palatinus A*, for example, the nature of its movement was informed by the technological culture with which Opicinus was engaged. As we have seen in the other images made in the penitentiary, this type of image was popular at the Avignon court. The contextualisation of Opicinus’s drawings is thus not only useful to the study of medieval diagrams, but also contributes to the current understanding of the intellectual and artistic practices of the papal court.

Opicinus’s calendars are meticulously measured instruments which provided a solid foundation for his cosmological ‘thinking tools’. Having explored how he represented the movement of time in his calendars, chapters four and five investigate how Opicinus aligned various medieval theological perceptions of time into his drawings, and thus how he turned his calendars into cosmologies.

Chapter Four: Biblical Time: The Wheels of Ezekiel as Scriptural Cosmologies

The vision of Ezekiel as described in Ezekiel 1 served as a source for medieval theologians to draw connections between biblical and astronomical learning.³⁴⁶ Its content provided the potential for celestial interpretation in its description of the firmament and natural phenomena, the animals in the sky, and the depiction of a wheel-within-wheels. Combined with the visionary nature of the text, these features prompted its medieval interpreters to consider how knowledge of the natural world might enhance an understanding of the vision and therefore inform its visualisation. The link between the physical universe and scripture was deliberated in the patristic commentaries on Ezekiel, which seized upon the celestial quality of the vision. They interpreted the wheels as cosmologies, each author's description of which varied slightly in detail. The animals and wheels as described in Ezekiel thus appropriately featured in medieval cosmologies to express the alignment of scripture with the human understanding of the physical cosmos. This chapter shows that Opicinus's integration of scriptural content into his cosmologies reveals the strong influence of Ezekiel 1 and its commentators.

In the light of the extent to which the visual features of *Palatinus A* were influenced by Ezekiel 1 and its commentators, part one evaluates how Opicinus visualised concepts drawn from the patristic commentaries on Ezekiel, in which the wheels were presented as vehicles of cosmological order. This shows how the Church Fathers informed Opicinus's understanding of the link between the physical and scriptural descriptions of the universe. Part two further contextualises this attitude by looking at the intellectual and visual tradition of Ezekiel 1 leading

³⁴⁶ The subject has attracted some historically inaccurate literature. The mathematician and historian of science, Anatoly Fomenko, for example, argued that 'All the astronomical fragments from the biblical book of Ezekiel are manifestations of the mediaeval, or possibly late-mediaeval, scientific culture,' which he illustrated with examples of 15th-century prints. The patristic texts (discussed below) prove that Ezekiel's vision was conceived in this way long before. A. Fomenko, *History: Fiction or Science?*, Vol. 1 (Paris, 2007), p.177. For more on the issue and the ancient origins of constellations in relation to biblical narrative, see J. H. Rogers, 'Origins of the Ancient Constellations: I. The Mesopotamian Traditions,' *Journal of the British Astronomical Association*, Vol. 108, No. 1 (1998), pp.9-32.

up to the period of Opicinus's activity. In doing so this chapter identifies a little-known text concerning the wheels of Ezekiel which includes a set of complex and colourful diagrams, and proves that it was available to Opicinus in the Avignon penitentiary.

The text in question, which survives in two copies, is an illustrated version of Henricus de Carreto's (c. 1270-1323) extensive commentary on Ezekiel's vision, the *De Rotis Ezechielis*, referred to in this chapter as *De Rotis*. These manuscripts contain the most comprehensive diagrams of the vision of Ezekiel to have survived from the Middle Ages, yet neither has been subjected to a thorough art-historical analysis. Both manuscripts are in the Bibliothèque nationale de France: BN 12018 (1313-15, corrected 1320-21) and its later copy, BN 503 (1320-21).³⁴⁷ Illuminated at the Avignon court less than a decade before Opicinus's arrival, BN 503 shares certain motifs with the Palatinus, and is highly likely to have been seen by Opicinus. Salomon's and Whittington's evaluations of Opicinus's drawings have sought to identify potential sources of his diagrammatic content, yet they did not cite the *De Rotis* as a relevant source. The later copy of the *De Rotis*, in fact, contains the only other known set of biblical diagrams to have been created at the Avignon court and which remained there during Opicinus's activity. By looking at the context of its making in relation to the practices of the manuscript workshops at the court, part two suggests that John XXII was closely involved in the production of the diagrams of the *De Rotis*, and thus supports a hypothesis of this thesis, that he had a particular interest in diagrams.

Through a detailed comparison of the images of the *De Rotis* and the Palatinus, part three evaluates the extent to which Opicinus incorporated elements of the *De Rotis* into his own drawings.³⁴⁸ By using visual analysis to consider how they influenced the Palatinus drawings,

³⁴⁷ Meek, 'Del Carretto, Enrico'.

³⁴⁸ The comparison focuses on the leaves of the two *De Rotis* manuscripts which illustrate the terrestrial view of the vision: BN 12018: folios 123^r, 124^r, 125^r, 126^r; and the correlating leaves cut from BN 503.

stylistically, iconographically and conceptually, one can define exactly how Opicinus used the *De Rotis* for his own scriptural cosmologies. His engagement with the *De Rotis* is implied by the striking similarity of the Gospel animals (these are generally referred to as the *animalia*, following their description in Ezekiel 1) which frame the circular structures in both sets of diagrams.³⁴⁹ This significant discovery, whose only allusion in the secondary literature concerning Opicinus to date is a brief acknowledgment by Manzari of their visual similarity, offers a more solid basis for Opicinus's biblical cosmology.³⁵⁰ The comparison shows that Opicinus not only took certain iconographic features from the *De Rotis*, but that he also deployed similar strategies of diagrammatic visualisation to depict difficult three-dimensional content.³⁵¹ This investigation is novel to the study of Opicinus's drawings, and is significant as the first interpretative investigation of the illuminations of the *De Rotis*.

Opicinus's use of the *De Rotis* demonstrates how he drew upon the rich theological culture of the Avignon court while adapting it to his own particular project. Part four evaluates what Opicinus, though his use of Ezekiel 1, was trying to achieve. An interpretation of another of his drawings (fig. 44) illustrates how he used Ezekiel's wheels as a multivalent symbol of the entirety of scripture. Henricus's diagrams, and their associated commentaries of Ezekiel 1, thus hold a key with which one can unlock the process by which Opicinus wedded depictions of the physical world with theological exegesis. The chapter demonstrates that Opicinus's sophisticated visualisations of time and space were not only influenced by the maps and calendars at the court, but also by these novel and complex depictions of scripture.

³⁴⁹ The choice of the word *animalia* also signifies their pre-iconographic identification as animals, and not yet as tetramorphs or Gospel beasts, which would imbue them with additional biblical meaning.

³⁵⁰ Manzari was the first to draw a connection between the Palatinus and the *De Rotis*. Manzari, *La miniatura ad Avignone*, p.12.

³⁵¹ Ibid., p.12.

Part One: *Palatinus A* and Ezekiel 1

Of the fifty-two *Palatinus* drawings, thirty-one are framed by the wings of the four Gospel beasts, which sometimes appear multiple times in one image.³⁵² They are probably the single most common motif of the *Palatinus*. The depiction of the Evangelists as animals (John as the eagle; Mark as the lion; Luke as the ox; and Matthew as the angel) is omnipresent in medieval visual culture, from sculpture to time-reckoning instruments (such as the astronomical clocks and calendars discussed in chapter two). Yet the methods by which these animal portraits and wings were composed are not only stylistically various, but carry a diversity of purposes. In her study of diagrammatic angels, Carruthers differentiated between the angelic creatures of the bible with their varying names and number of wings. Those with four were the *animalia* described in Ezekiel 1 and cherubim in Ezekiel 10: 5-22; those with six wings were the seraphim in Isaiah; and those with two were the cherubim who carried the Ark in Exodus 25 and in 1 Kings 6 (in the Temple of Solomon).³⁵³

If one were to consider Opicinus's beasts in isolation (fig. 31), the number of their wings (two each) might initially suggest that he intended to depict the cherubim who supported the Ark of the Covenant. The Ark certainly featured in some of the *Palatinus* drawings, as will be shown in part four, but there are multiple issues with this identification. First, if one looks at the other details within these passages, the beasts are more similar to the *animalia* described in Ezekiel 1. In Opicinus's drawings there are always four beasts, as in Ezekiel 1, whereas only two angels supported the Ark according to Exodus and 1 Kings. In addition, the wings of the *Palatinus* beasts flow into one another as if they were joined, as described in Ezekiel 1:9: 'And the wings of

³⁵² The majority of the diagrams not including the Gospel beasts either seem incomplete (such as folios 5^v, 6^v, 12^r, 15^r and 23^v) or are depictions of time before the era of Christ (folios 9^r and 9^v) when the New Testament could not have yet been written.

³⁵³ M. Carruthers, 'Ars oblivionalis, ars inveniendi: The Cherub Figure and the Arts of Memory,' *Gesta*, Vol. 48, No. 2 (2009), pp.99-117, p.104.

one were joined to the wings of another'.³⁵⁴ Second, Opicinus clearly drew from the beasts in another set of manuscript diagrams in Avignon, Henricus's *De Rotis* (see table 1 for comparison), which were explicitly concerned with Ezekiel 1.³⁵⁵

Third, the features of the diagrams (in this case, the beasts) should not only be considered in isolation, as Opicinus meaningfully connected each component in his drawings to its surrounding features. When one considers the beasts of *Palatinus A* in context, both in relation to the rest of the drawing and to the intellectual culture in which they were made, one can see how Opicinus's beasts are part of an established medieval tradition concerning the interpretation and visualisation of Ezekiel's vision. This is demonstrated by looking at how Opicinus's depiction of the calendrical *rota(e)* in *Palatinus A* relates to the interpretation of the wheels of Ezekiel in patristic commentaries. An understanding of these commentaries is required first.

Ezekiel's Wheels as Vehicles for Cosmology in Patristic Commentaries

The most popular commentaries on Ezekiel in the fourteenth century were based on the writings of the Church Fathers, many of which are listed in the papal inventory of the Avignon libraries of 1369.³⁵⁶ The medieval commentaries on Ezekiel have been surprisingly little studied. Fortunately, Christman's *What did Ezekiel See?* and Helen Dow's summary of the fourteenth-century copies of commentaries in the Bibliotheca Palatina collection of the Vatican, of which the latter is more directly relevant to medieval visual culture, offer a great deal of insight into the cosmological features of the commentaries.³⁵⁷ These would have certainly been available to

³⁵⁴ Ezek. 1:9: *innctaeque erant pinnae eorum alterius ad alterum*.

³⁵⁵ The relationship between the two is considered in depth in part three.

³⁵⁶ See n.358 below.

³⁵⁷ A. R. Christman, *What did Ezekiel See?* (Leiden, 2005); H. J. Dow, 'The Rose-Window,' *Journal of the Warburg and Courtauld Institutes*, Vol. 20, No. 3 (1957), pp.273-86, pp.273-79.

Opicinus in the Avignon library. The papal inventory of 1369 includes at least five records of manuscripts of Gregory's commentary on Ezekiel, four of Jerome (one of which includes a commentary by Hugh of St Victor), and another including Joachim of Fiore's commentary on the Apocalypse and Ezekiel (in addition to Isaiah, and Hugh of St Victor's writings on the Church).³⁵⁸ One of the commentaries by Jerome was, in fact, copied under Jean Durand for twelve florins in February 1332, just before Opicinus's most productive period.³⁵⁹ Opicinus was highly likely to have been familiar with these sources.

Jerome's and Gregory's writings constitute the kernel of Western Christian exegesis upon which most of the medieval commentaries on Ezekiel are founded. Jerome was one of the first to explain how the *animalia* of Ezekiel's vision signified the Gospels of the New Testament. Jerome, in letter fifty-three to Paulinus, wrote that Matthew, Mark, Luke and John were interwoven with one another like four wheels and were moved and energised by the Holy Spirit.³⁶⁰ Dow noted that Jerome listed a number of analogies with reference to the four wheels, most often concerning the natural world: the four elements of which the world is composed (earth, water, fire and air), the four seasons, and the cardinal directions.³⁶¹ Jerome also included other groups of four which featured in conventional medieval cosmology, such as the cardinal virtues (prudence, justice, courage and temperance), the dispositions of the soul (according to Cicero's *Tusculan Disputations*: conscience, will, intelligence and desire), and the emotions (according to the *Aeneid*: joy, grief, greed and fear).³⁶² It should be noted that Dow's primary source for her

³⁵⁸ The following commentaries on Ezekiel are cited in Faucon, *La librairie des papes d'Avignon*. Commentaries by Jerome: Vol. 1: n.171 (p.108); Vol. 2: nos 217, 221 (p.58), 503, 506 (p.106). By Gregory: Vol. 1: nos 145, 151 (p.106), and 155 (p.107); Vol. 2: unnumbered (p.36), nos 358 (p.84), 368 (p.85). By Joachim of Fiore: Vol. 1: n.360 (p.125). There is also a commentary from Origen, thus in the same tradition as Jerome: Vol. 2, n.457 (p.97).

³⁵⁹ Faucon, *La librairie des papes d'Avignon*, 1, p.38.

³⁶⁰ Dow, 'The Rose-Window,' p.274. She cited Jerome's Letter 53 to Paulinus, reproduced in *A Select Library of the Nicene and Post-Nicene Fathers of the Christian Church*, Second Series, Vol. 6: *The Principal Works of St. Jerome* (New York, 1893), p.101.

³⁶¹ This is considered below in relation to Opicinus's depiction of the wheels in the Vaticanus journal (fol. 86^v), in which theological fours, such as the Church Fathers and Gospels, are placed opposite one another within the structure of four wheels.

³⁶² Dow, 'The Rose-Window,' p.274, which referenced BAV, MS Pal. Lat. 25, fol. 15.

analysis of Jerome's commentary is a fourteenth-century manuscript which is now in the same library as the Palatinus drawings in the Vatican. It is possible that they were copied in the same place, at a similar time, and travelled with one another thereafter.

Many of these elements can be identified in Opicinus's cosmologies, in which the cosmological components are often organised into groups of four. *Palatinus A* includes the fours of the natural world as listed by Jerome in the crosshatch-sign across its centre upon which the elements (*terra, aqua, aer, ignis*) are labelled. Yet Opicinus differed from this patristic content by his incorporation of a fourteenth-century understanding of the physical world. In addition to some of the groups of four which characterised the physical world according to the Church Fathers, Opicinus also incorporated the most up-to-date technologies of time and space measurement available to him at the Avignon court. He sought to render the most accurate picture of the world possible through the use of portolan charts and the latest calendar forms, yet still worked with the same basic structure of the universe as had been presented by the Church Fathers.

Because of the range and overlap of content included in various medieval cosmologies, it is not particularly useful, or even possible, to identify a specific source for Opicinus's cosmologies, even if one overlooked the variables between each Palatinus drawing. What is significant is the potential of Ezekiel's wheels as vehicles for organisation and the awareness and utilisation of such thought at the Avignon court. The following section considers in more detail how the Church Fathers used the wheels of Ezekiel to organise information and to what extent their precedent can be detected in *Palatinus A*.

The Wheels as Scripture and Cosmological Calendars

According to the patristic commentaries, the wheel-within-wheels described in Ezekiel 1 signified scripture and its interrelation. Dow showed how from Jerome onwards, the wheel within a wheel ‘signified the New Testament prophesied in the Old, the Church arising from Synagogue; “rota in rota, lex in legem, vetus in novum,” the law within the law, the old within the new’.³⁶³ Following on from the Church Fathers, the wheels were used throughout the Middle Ages as symbols of the correspondences between different scriptural passages. The representation of the Old and New Testaments as separate wheels was present centuries before Opicinus, as in the illustrations of a twelfth-century illuminated encyclopaedia, the *Hortus deliciarum*.³⁶⁴ The understanding of the wheels as the Old and New Testaments, which exist within one another to represent scripture as a whole, was thus typological.

Particularly relevant to *Palatinus A* is the way in which a cosmological branch of patristic thought on Ezekiel had connected this text to the calendar. Jerome drew a parallel between the wheel and the year: *rota in rota, annum in anno*, and hence used the wheels to frame the cyclical *quattuor* associated with the year: the seasons, days and weeks.³⁶⁵ Opicinus’s drawings often contain calendars-within-calendars, and *Palatinus A*, which is essentially an image of a wheel within a wheel and a calendar within a calendar, could be interpreted as a visualisation of this concept. Moving outwards from the centre where God is enthroned, the wheels are layered in the following order: Old Testament references in the inner-most dial system, the *temporale* of feasts celebrating New Testament events, the *sanctorale* (including some New Testament feasts but

³⁶³ Dow cited Walafrid Strabo (c. 808-49), a Benedictine theologian. Dow, ‘The Rose-Window,’ p.275.

³⁶⁴ O. Gillen, *Hortus deliciarum* (Neustadt, 1979), Plates XXII and XXIII. The original manuscript was destroyed in the bombing of Strasbourg in 1870, so the surviving edition relies on the copies of the miniatures made by Christian Maurice Engelhardt in 1818.

³⁶⁵ Quote from Virgil’s *Aeneid* VI, 748 in Dow, ‘The Rose-Window,’ p.275. The visualisation of the interrelation of these cycles is significant to Opicinus’s other calendar drawings, which are focused upon in the next chapter.

mainly saints and figures from the era after Christ), and outside the *rota*, excerpts of theology from thirteenth- and fourteenth-century texts which signify the medieval present.³⁶⁶ According to this reading, the wheels of different time periods are layered upon one another (concentrically and chronologically) to show their typological interrelation.

Whilst the idea that Opicinus purposefully illustrated the *rota in rota, annum in anno* is an attractive one, it is implausible. As encountered in the previous chapters, the calendar within a calendar, which is the *sanctorale* encompassing the *temporale*, is the most frequent form of the movable and immovable calendar for instruments and calendars of medieval astronomy, time-keeping and cartography. Opicinus drew the foundations of his calendars with these sources in mind, not on the basis of Jerome's commentary. It is instead more likely that Opicinus, who was aware of the commentaries on Ezekiel and the multivalent understanding of the *rotae* as the wheels of Ezekiel, the cosmos and the calendar as established in Jerome's commentary, saw how his own cosmological-calendar *rotae* could also be symbols of scripture. He thus emphasised the scriptural significance of his *rotae* through the prominence of the tetramorphs in his drawings.

It is clear that Opicinus's depiction of the beasts and his use of *rotae* belong to an established textual tradition concerning the vision of Ezekiel, but what about the visual tradition of Ezekiel 1? Did Opicinus invent these images from reading the commentaries or was there a medieval tradition, in which their concepts were visualised, upon which Opicinus could have drawn? Here, the copies of Henricus de Carreto's *De Rotis* become significant. Not only do they include the most extensive known diagrams concerning of the vision of Ezekiel, but at least one copy was present in Avignon during Opicinus's time in the penitentiary.

³⁶⁶ For the inner-most dial system, see n.301 above.

Before looking at the images of *De Rotis* in detail, an outline of the visual culture of the vision of Ezekiel in the thirteenth and fourteenth centuries is necessary. The survey is not only useful in its presentation of the potential visual sources for the diagrams of Opicinus and Henricus, but it also displays the various visual contexts in which Ezekiel 1 featured and thus how it was understood within broader theological programmes in the Middle Ages. It shows that during this period the diagrammatic and typological potential of the wheels described in Ezekiel 1 began to be more fully recognised, especially at the University of Paris and in northern Italy. Within this context one can better understand how Henricus and Opicinus became interested in the subject and how Opicinus may have perceived the vision of Ezekiel apart from his interaction with the *De Rotis*.

Part Two: The Visualisation of Ezekiel's Vision in the Thirteenth and Fourteenth Centuries

The imagery of Ezekiel's vision offers fresh material for the study of medieval visual culture. Not only have Henricus's diagrams in the *De Rotis* manuscripts not yet been analysed, but depictions of Ezekiel's wheels in thirteenth- and fourteenth-century France and Italy have also been neglected. From a brief survey of this visual tradition, which spreads across media in art and architecture, certain features of the diagrams of the vision stand out: the depiction of the *animalia* and the use of their wings, the wheels as organisational structures, the interaction of the *animalia* with the wheels and of the wheels to one another (including the wheels within the wheels), in addition to the typological and cosmological implications which had first been adumbrated in patristic commentaries.

Ezekiel's vision of the Temple of the heavenly Jerusalem (Ezek. 40-42) has received art-historical attention, particularly in Walter Cahn's analysis of the to-scale depictions of the ground plans illustrated in Richard of St Victor's (d. 1173) commentary on the Temple.³⁶⁷ Richard, a Scottish theologian, was in the same monastic school based at the Abbey of St Victor (near Paris) as Hugh of St Victor. This group of philosophers, the Victorines, were associated with the schools of Paris and so it is likely that Henricus was familiar with such texts. On the other hand, the vision of the wheels has been little discussed. In a century-old study, Wilhelm Neuss ambitiously addressed the representation of the entire book of Ezekiel, both through textual description up to the eleventh century, focusing on the commentary of Rupert of Deutz, and through visual depictions.³⁶⁸ The scope was too large to engage with the intricacies of these complex descriptions and Neuss's study serves more as an historical overview than a full analysis. Dow

³⁶⁷ W. Cahn, 'Architectural Draftsmanship in Twelfth-Century Paris: The Illustrations of Richard of St-Victor's Commentary on Ezekiel's Temple Vision,' *Gesta*, Vol. 15, No. 1 (1976), pp.247-54.

³⁶⁸ W. Neuss, *Das Buch Ezechiel in Theologie und Kunst bis zum Ende des xii. Jahrhunderts, mit besonderer Berücksichtigung der Gemälde in der Kirche zu Schwarzrheindorf* (Münster, 1912).

offered a more focused exposition of later-medieval representations of the wheels as part of her study of the rose window. Her visual sources were primarily architectural, but her discussion of the patristic commentaries directly relates the wheels to diagrams of cosmological and exegetical content, offering invaluable insight into the application of Ezekiel's vision to *rotae*.³⁶⁹

The lack of scholarship concerning the wheels can be attributed to the scarcity of surviving depictions of Ezekiel 1, which in turn could be explained by the complexity of the scene described. It is fantastical and bordering upon contradictory, not only in its description of the natural phenomena and beasts, of which 'every one had four faces, and every one had four wings', but even more in its account of the wheels themselves. Ezekiel described a 'wheel in the middle of a wheel. When they went, they went by their four parts; and they turned not when they went'.³⁷⁰ The interrelation of these circles required visualisation beyond the second dimension.

The illustrators of the late-thirteenth- and fourteenth-century depictions, to which this investigation is confined, focused on various details within the description of Ezekiel 1 (the *animalia*'s faces, their wings, and the wheels), which were often used to visualise broader theological concepts. The rare representations which survive are therefore diverse.

In many instances the descriptions of the cherubim are seized upon, such as in the illuminated initials in Italian bibles.³⁷¹ These examples emphasise the figurative elements of the vision but the

³⁶⁹ Dow directly referenced the Palatinus (specifically the autobiographical calendar) and claimed that Opicinus's calendars were based on the rose-window scheme. Opicinus did not directly reference this architectural feature, but the Palatinus calendars should certainly be considered within the broader conception of the wheel in the Middle Ages. Dow, 'The Rose-Window,' p.259.

³⁷⁰ Ezek. 1:6: *'et quattuor facies uni et quattuor pinnae uni; 1:16-17: 16et opera quasi sit rota in medio rotae 17per quattuor partes earum euntes ibant et non revertabantur cum ambularent*

³⁷¹ For examples of the illuminated initials in two 13th-century bibles from Bologna, see Bodleian Library, MS Canon. Bibl. Lat. 57, fol. 305^r and Los Angeles, J. Paul Getty Museum, MS Ludwig I 11, fol. 356. Beverly Kienzle and Travis Stevens's short survey of the 12th-century tradition of Ezekiel in relation to the writing of Hildegard of Bingen focused on biblical initials such as these but, as has already been shown, far more complex and monumental images of the vision existed. B. M. Kienzle and T. A. Stevens, 'Intertextuality in Hildegard's Works: Ezekiel and the Claim to Prophetic Authority,' *A Companion to Hildegard of Bingen*, ed. B. M. Kienzle (Leiden, 2014), pp.137-62, pp.158-161. This type of depiction also appeared in enamels, such as the enamel plaque from the Meuse valley (1160-70) in the Musée du Louvre, inv. no. MRR 24.

utilisation of other components, such as the wings of the cherubim and the wheels, offered more potential for the schematic organisation of content. The diagrammatic angel which often accompanied texts concerning penance, for example, are schematic versions of the cherubim described in Ezekiel with text written upon its wings.³⁷² These were often labelled as cherubim in twelfth- and thirteenth-century manuscripts. Yet the most commonly seized upon feature of the vision, especially in terms of diagrammatic organisation, were the wheels. In some of the schematic angel drawings the figure stands upon a wheel, consolidating their identification as the cherubim described in Ezekiel. The wheel thus also became a diagram in itself. In an English copy from c. 1310-20 (fig. 33), the cherub stands upon a wheel labelled *opera misericordie* (works of mercy), in which the seven acts of mercy that God will consider at the Last Judgement are written between the seven spokes of the wheel, as explained in the text to its right.³⁷³ Ezekiel's wheels were here used as a system by which to organise theological information.

Dow discussed at length how the wheels described in Ezekiel's vision permeated the diagrammatic tradition as they were aligned with *rotae* of cosmological and scriptural content. She primarily considered rose windows to argue that they were conscious depictions of the vision, using the thirteenth-century window on the West façade of Ruvo Cathedral in southern Italy (fig. 34) as an example.³⁷⁴ It is difficult to conclude with absolute certainty whether rose windows

³⁷² The diagram has historically been connected to, or even referred to as, the cherub from the *De sex alis cherubim*, but Carruthers has shown that the text and image are often found separately. There is also confusion as to the author of the *De sex alis cherubim*, many believing it to be Alan of Lille (d. 1203), but the earliest attributions (1190–1200) are to Clement of Llanthony, a priory near Gloucester. She argued that as the two earliest extant images are from different texts, only a couple of decades apart, the image probably already existed. Carruthers, 'Ars oblivionalis, ars inveniendi,' p.103. Carruthers argued that the wings and their feathers contained excerpts of text concerning penance which were laid out in a certain way in order to guide the viewer through an intended route and therefore enabled 'a particular method of analytical thought that divides a general subject into its constituent topics'. Ibid., p.104. This prompted the reader to perform an act of meditational penance. The function of the wings as a canvas for scriptural content is also used by the tetramorph in the Palatinus, but the process of their reading is different. Instead of the wings being read together in a specific order, Opicinus used this feature to draw connections between the two passages written on each beast's wings.

³⁷³ Florence, Biblioteca Medicea Laurenziana, MS Plut. 30. 24, fol. 3v. Ibid., p.107.

³⁷⁴ She described the window as framed by the four *animalia* and recorded that above is 'the likeness of the throne,' which has the 'appearance of a man above upon it' (Ezek. 1:26: *26et super firmamentum quod erat inminens capiti eorum*

were originally designed with the vision of Ezekiel in mind, but the sculptural programme ornamenting the façade around them occasionally suggests that they were conscious evocations of Ezekiel 1, showing an interest in the vision across different media.

Shifting one's attention away from Italian sources and towards the scholastic interests of the University of Paris and the Avignon court, the visualisations of Ezekiel 1 became more engaged with the typological meaning of the vision, as discussed in patristic texts, and how this might inform their almost impossible rendering. This is shown in the Oxford-Paris-London Bible Moralisée made in Paris around 1233.³⁷⁵ The Bible Moralisée depicts each scene of the bible's narrative accompanied by a roundel of a type or antitype. Ezekiel 1 is far from unique as a subject of typological interpretation, yet the moralised bible is particularly useful in showing the antitypes of the New Testament with which it is most traditionally associated, as well as the visual strategies used to depict this complex and potentially troublesome imagery. The Bible Moralisée shows the typological relationship between scenes through the layout of the page. The (Old Testament) types in the first and third lines of roundels (read left to right) correlate to their (New Testament) antitypes in the roundels immediately below.³⁷⁶ As seen in Henricus's diagrams of the vision in the *De Rotis* (described below), the typological aspects are not expressed through the layout of the page, but through the composition of the wheels themselves. The different forms of the wheel-within-wheels reflect the exegetical process of reading the Old Testament within the New and vice versa.

quasi aspectus lapidis sapphyri similitudo throni et super similitudinem throni similitudo quasi aspectus hominis desuper) and that the enthroned figure is seated upon the fragment of a circle representing either the firmament or the 'appearance of the rainbow' (Ezek. 1:28: *28velut aspectum arcus cum fuerit in nube in die pluviae hic erat aspectus splendoris per gyrum*). Dow also cited the tetramorphs framing the rose windows of three Umbrian churches: San Pietro in Spoleto, Sant'Eutizio near Preci, and the Cathedral of San Francesco in Assisi. Dow, 'The Rose-Window,' p.277, n.153. For a brief history of Ruvo Cathedral, see A. Petrucci, *Cattedrali di Puglia* (Rome, 1960), pp.90-91. Dow's argument is supported by Painton Cowen's observation that rose windows in Italy were very often wheels, many of which were wheel(s) within wheels in reference to Ezekiel 1:16. He also gave the rose window in the Upper Basilica of San Francesco at Assisi (c. 1250) as an example. P. Cowen, *Rose Windows* (London, 1979), p.33, n.50.

³⁷⁵ BnF, MS Lat. 11560. J. Lowden, *The Making of the Bibles Moralises* (Philadelphia, 2000), p.4.

³⁷⁶ For more on the variation between the typological layouts of Bibles Moralises, see Lowden, *The Making of the Bibles Moralises*.

In addition to the varied depictions of the *animalia*, the miniatures of the Bibles Moralisées also demonstrate the different ways in which the wheel-within-wheels could be depicted.³⁷⁷ The interrelation and movement of the wheels are shown in multiple ways, as described in Ezekiel 1:

¹⁵ Now as I beheld the living creatures, there appeared on the earth by the living creatures one wheel with four faces. ¹⁶ And the appearance of the wheels, and the work of them was like the appearance of the sea: and the four had all one likeness: and their appearance and their work was as it were a wheel in the midst of a wheel...
²¹ When those went these went, and when those stood these stood: and when those were lifted up from the earth, the wheels also were lifted up together, and followed them: for the spirit of life was in the wheels.³⁷⁸

The wheels-within-wheels are represented in two medallions of fol. 186^r (figures 35a and 35b) in two ways before their separation and movement are depicted on fol. 187^v (figures 35c).³⁷⁹ This experimentation reveals an impetus to visualise a three-dimensional scene upon a two-dimensional plane, a tension which is inherent in the diagrams of Henricus and Opicinus. It is in fact possible that Henricus would have seen these images, either during his studies at the University of Paris or in Parisian stained glass windows,³⁸⁰ such as the Ezekiel window in the upper chapel of the Sainte Chapelle (1242-48).³⁸¹

³⁷⁷ The *animalia* are depicted as the four beasts with a human face (fol. 184^r), each beast with the face like a man's (fol. 184^r), and the beasts with the face of a lion, angel, ox and eagle (fol. 185^v).

³⁷⁸ Ezek. 1:15-16; 21: ¹⁵*cumque aspicerem animalia apparuit rota una super terram iuxta animalia habens quattuor facies* ¹⁶*et aspectus rotarum et opus earum quasi visio maris et una similitudo ipsarum quattuor et aspectus earum et opera quasi sit rota in medio rotarum...* ²¹*cum euntibus ibant et cum stantibus stabant et cum elevatis a terra pariter elevabantur et rotae sequentes ea quia spiritus vitae erat in rotis.*

³⁷⁹ The wheels are in the same configuration in the Farfa Bible (c. 1027-32, BAV, Vat. Lat. 5729, fol. 208^v), in which they overlap to make a diamond, in the same configuration as the wheels in Opicinus's journal (discussed in part four).

³⁸⁰ Boureau, *Satan the Heretic*, p.46.

³⁸¹ L. Grodecki and C. Brisac, *Gothic Stained Glass 1200-1300* (London, 1985), p.106. The similarity between the Bible Moralisée and the glass of the Sainte Chapelle has led some to suggest there was a direct relationship between them. Y. Christe, 'Les Bibles moralisées et les vitraux de la Sainte Chapelle: le vitrail de l'Exode,' *Bulletin Monumental*, Vol. 157, No. 4 (1999), pp.329-46. According to Meredith Cohen's recent study on the Sainte Chapelle, Henricus would

The typological utilisation of the wheels in their various configurations can be found in larger and more complex diagrams in manuscripts. Joachim of Fiore, for example, constructed two distinct compositions based on the four wheels: a simpler version in the *Praemissiones* (found only in pseudo-Joachimite texts) and a more elaborate version in the *Liber figurarum* (early-thirteenth century, fig. 36).³⁸² As Marjorie Reeves observed, 'the mysterious *rotae* of Ezekiel supplied him [Joachim] with an image which is at once abstract and concrete', thus offering a flexible form by which various concordances and their changing relationships could be described.³⁸³ Joachim's include the *quattuor*, the *animalia*, the types of *intelligentia*, the four orders and the cardinal directions, and the wheel-within-wheels read as the relationship between Old and New Testaments.³⁸⁴ Just as in the patristic commentaries and *Palatinus A* above, this form was used as an organising principle, in addition to a literal depiction of an event. In these latter two examples from Paris and northern Italy, the diagrammatic and typological potential of the (various iterations of the) wheels of Ezekiel as a platform for scriptural exegesis, as interpreted in patristic commentaries of the vision, clearly informed how they were visualised. That Henricus, a northern-Italian priest who studied theology at the University of Paris, would have been in contact with such images is highly likely.

have had access to the upper chapel. Cohen argued that the design of the building, its programme of use and its liturgical function suggests that 'the chapel's audience included a broad public, ranging from the international elite to the poorest inhabitants of the city'. M. Cohen, *The Sainte-Chapelle and the Construction of Sacral Monarchy: Royal Architecture in Thirteenth-Century Paris* (New York, 2015), p.148.

³⁸² For the example in the *Praemissiones*, see Venice, Biblioteca Marciana, MS Lat. I, 74, fol. 226^v. For the image in the *Liber figurarum*, see Oxford, Corpus Christi College, MS 225A, fol. 16^v. M. Reeves and B. Hirsch-Reich, *The Figurae of Joachim of Fiore* (Oxford, 1972), p.224.

³⁸³ Reeves and Hirsch-Reich, *The Figurae of Joachim of Fiore*, p.257.

³⁸⁴ Ibid., p.258.

Henricus de Carreto and the *De Rotis Ezechielis*

Henricus de Carreto (also referred to as *Enrico di Carretto*) was born to a powerful Genoese family which was related to, or allies of, the Fieschi family. After studying theology at the University of Paris, he was appointed as bishop of Lucca by Boniface VIII in 1300, against the wishes of the canons. He remained there until the conquest of Lucca by Ugucione della Faggiuola (1250-1319) in June 1314. His exact location during these years is not entirely clear, but it is known that Henricus was in the Castle of the Caselli in the diocese of Acqui on 8 March 1316, before moving to Avignon later that year on 30 December. He settled there for the remainder of his life (d. 1323) under the papacy of John XXII.³⁸⁵ The remaining documentation suggests that Henricus had a close intellectual relationship with the pope. John gave Henricus the responsibility of examining the case of the Spiritual Franciscans in 1318, which culminated in the bull *Cum inter nonnullos* in 1323.³⁸⁶ John also summoned him for formal consultation concerning the heretical nature of the Catalan adaptation of Peter John Olivi's commentary on the Apocalypse in 1319 and, as mentioned above, the nature of magic and images in 1320, showing that they must have discussed the power of images.³⁸⁷

Henricus died in Avignon six years before Opicinus arrived, so they were unlikely to have ever met. It is possible that Opicinus could have been aware of Henricus's work prior to his move to Avignon, as they moved in similar circles at approximately the same time. Both were born in northern Italy and became priests. Following political turbulence, they fled to Avignon, where they remained until their deaths. Considering Henricus's Genoese roots, it is possible that

³⁸⁵ Meek, 'Del Carretto, Enrico'; Boureau, *Satan the Heretic*, p.46; F. Manzari, 'Contributi per una storia della miniatura ad Avignone nel XIV secolo,' in *La vie culturelle, intellectuelle et scientifique*, pp.111-40, p.126.

³⁸⁶ The judges eventually concluded that the doctrine which states that Christ and his apostles had no possessions was 'erroneous and heretical'. K. Schatz, *Papal Primacy: From its Origins to the Present* (Minnesota, 1996), pp.117-18. For more on the bull, see Nold, *John XXII and his Franciscan Cardinal*, pp.169-78.

³⁸⁷ S. Piron, 'Avignon sous Jean XXII,' p.366-67.

Opicinus may have come into contact with his works or previous colleagues during his period of training in Genoa. During their time at the papal court, both attended theological consultations with John XXII, including discussion on the poverty of Christ, concerning which they each wrote texts dedicated to John: Henricus's *Tractatus de statu dispensativo christi et specialiter de paupertate eius et apostolorum* (1322-23) and Opicinus's *De paupertate christi* (1328), *De virtutibus christi* (1328), *Lamentationes virginis marie* (1328) and *De preeminencia spiritualis imperii* (1329), the last of which he claimed John was most pleased with.³⁸⁸ As discussed in the first chapter, it was only logical that Opicinus, from a similar background and as part of the same intellectual project, would look to Henricus's theological diagrams for guidance. The papal inventories show that at least one of Henricus's manuscripts was present at the court, so is likely to have been available to Opicinus as a *scriptor* in the penitentiary.³⁸⁹

The Two Manuscripts of the *De Rotis*: BN 12018 and BN 503

Most likely because of the extraction and dissemination of the later and more lavish copy's manuscript leaves in the early-sixteenth century, the diagrams of the *De Rotis* have not received detailed art-historical attention.³⁹⁰ The two extant copies of the text have been briefly cited in the secondary literature concerning manuscript illumination at Avignon, but a thorough study of the images and text is needed. Alison Stones has provided the most detailed description of the illuminations of BN 12018 in a catalogue entry for her *French Gothic Manuscripts*.³⁹¹ After a short

³⁸⁸ For Opicinus's statement that John was pleased with his treatise of 1329, see Vaticanus, fol. 74r (transcribed in Laharie, *Le journal singulier*, 2, p.760).

³⁸⁹ Faucon, *La librairie des papes d'Avignon*, 2, p.54, n.166: *Item liber oraculorum sacre scripture, alias vocatus Super visionem rotharum Ezechielis, editus a fratre Henrico de Carreto, Lucano episcopo*. This is noted in Manzari, *La miniatura ad Avignone*, p.53, n.149.

³⁹⁰ Gousset hypothesised that the codex was unbound during its stay at Collège de Foix at the beginning of the 16th century. A. Bergeron-Foote, 'The Wheel of Ezekiel: the Preeminence of the Face of the Lion,' *Dr. Jörn Günther Rare Books* (2016), pp.1-9, pp.1-2.

³⁹¹ Stones, *Gothic Manuscripts 1260-1320 Part 2*, 1, pp.143-50.

description of each image, she focused on their stylistic significance rather than their iconography. One of the objectives of this chapter is to provide a description of the content of a selection of the diagrams and thus to show how they interrelated as a set.

As Beryl Smalley, the only commentator on the text itself, has noted, the *De Rotis* presents a Christian Aristotelian interpretation of the bible which focuses (particularly in the final book, *Liber mysteriorum*, and its accompanying diagrams) on the good and bad in society in relation to the reception of truth.³⁹² Both copies of the manuscript include the same text. Each begins with scriptural comments on (in this order) the Psalms, Proverbs, Ecclesiastes, Song of Songs, Book of Wisdom, Ecclesiasticus, Isaiah, Jeremiah, Ezekiel, Daniel, Minor Prophets, Gospels and Acts, Pauline Epistles and Canonical Epistles. Yet the manuscript is referred to in the colophon of BN 12018 as the *liber super visionem rotarum ezechielis* and the rest of the text is dedicated to the commentaries on the wheels.³⁹³ This is because Henricus understood Ezekiel 1 to be the key to the entirety of scripture. His text is divided into six books: *Liber oraculorum*, *oculorum*, *aspectuum*, *motuum*, *sensuum* and *mysteriorum*. Only the *Liber oculorum* (book two), *Liber aspectuum* (book three) and *Liber mysteriorum* (book six) contain illuminations. The first four diagrams are structured around their literal description as found in Ezekiel 1, whereas the remaining wheel diagrams engage more closely with their exegesis.

The colophon of the smaller and original copy (290 x 220 mm), BN 12018, records the date of its composition: 1313 to August 1315.³⁹⁴ It was probably executed under the supervision of

³⁹² B. Smalley, 'Some Latin Commentaries on the Sapiential Books in the Late Thirteenth and Early Fourteenth Centuries,' in *Archives d'histoire doctrinale et littéraire du Moyen-Âge*, Vol. 18 (1951), pp.122-25.

³⁹³ *Explicit liber super visionem rotarum Ezechielis editus a fratre Henrico de Carreto Lucano episcopo ordinatus fratrum minorum completus licet non correctus tunc Anno Domini M. CCC. XV. die .xiiii. mensis augusti inceptus Anno Domini M. CCC. XIII. De mense february in castro Cessolarum Aquensis dyocesis. Correctus M. CCC. XXI, (fol. 271r).* Manzari, *La miniatura ad Avignone*, p.56. Manzari cited *Catalogue des manuscrits en écriture latine portant des indications de date, de lieu ou de copiste*, ed. C. Samaran and R. Marichal (Paris, 1974), p.265.

³⁹⁴ See n.392 above.

Henricus and includes autograph corrections from 1320-21, during which years he was in Avignon. The larger and more ornate copy of the *De Rotis*, BN 503, was also made in 1320-21. The manuscript opens with a dedicatory letter to Pope John XXII: *...visionem glorie Dei in rotis et curribus Ezechielis plene distinctam proposui in hoc opere usque ad indivisibilia declarare. In eis enim constitit perfecta sacre scripture et totius divine providentie secundum rationem fidei plenitudo, cujus fidei fervor semper in romana ecclesia noscitur viginisse.*³⁹⁵ In this passage, Henricus revealed two significant features of the manuscript which are central to this study.

First, the manuscript was made for John XXII, which suggests that John was interested in Ezekiel 1 or perhaps in visionary texts more widely. This allows one to make more significant parallels between the works of Henricus and Opicinus as both render complex information into diagrammatic forms for their presentation to John. Perhaps this was symptomatic of their shared objective within John's intellectual project. Avignonese artistic patronage of the 1320s has more often been attributed to Cardinal Jacopo Stefaneschi (1270-1343).³⁹⁶ As suggested above, however, the process of commissioning manuscript diagrams was distinct from that of monumental art at the Avignon court. Secondly, the dedication shows that Henricus believed the vision of Ezekiel to signify *perfecta sacre scripture*: the entirety of scripture. Henricus did not conceive the wheels to be relevant only to Ezekiel 1, but to the whole bible and thus Christian salvation history. The multifaceted meaning of these diagrams and what they can reveal about how such biblical *rotae* were understood during this period are central to the interpretation of both Henricus's and Opicinus's drawings.

Each of these diagrams must be understood within its set. Many of the illuminations of BN 503

³⁹⁵ Bergeron-Foote, 'The Wheel of Ezekiel,' p.3.

³⁹⁶ Stefaneschi is famously associated with Simone Martini and the wall paintings of the Chapels of St Martial and St John within the Avignon palace. Girard, *L'Aventure gothique*, p.79. For more on Simone Martini's activity at the Avignon Court, see Laclotte, *L'école d'Avignon*, pp.15-23; A. Martindale, *Simone Martini* (Oxford, 1988), ch. VII.

are separate from the manuscript, but BN 12018 still has a full cycle of illustrations consisting of twenty-five full page illuminations and four miniatures within its text (excluding the illuminated initials, see table 2). BN 12018 is hence invaluable to the reconstruction of the later manuscript, which is important in this chapter for the purpose of recreating an impression of the diagrams which is as close as possible to how Opicinus would have seen them. The first eight diagrams (tables 4 and 5) are found in the second book, the *Liber oculorum*, but can be divided into two groups: the wheels-within-wheels (such as fig. 37) and the pre-eminence of each Gospel (such as fig. 38). The next four illuminations in the *Liber aspectuum* are smaller and found within the manuscript text. Each image (such as fig. 39) depicts one of the four wheels as shown together in the previous set of four.

The rest of the images are found together at the end of the manuscript. The majority concern typological interpretations and moral commentaries on scripture, including the Fall of man in relation to the New Testament mysteries and the good and bad people of societies and cities in relation to the reception of the truth. The final four diagrams (folios 267-270, such as fig. 40) are more closely related to the first twelve diagrams. In these, the different configurations of the wheels are aligned with the four mysteries of Christ (the same as those found in the centre of the wheel-within-wheels): the Infancy, Passion, Mission of the Apostles, and Last Judgement.

Two diagrams are missing from the set. At the top of each folio which contains an image there is a Roman numeral untidily scratched in brown ink. These indicated to the illuminators where their work was required. As noted by Stones, the first illumination (fol. 116^r) has a 'II' above, which indicates that the first ('I') is missing.³⁹⁷ The imprint of pigment on fol. 112^v, only a few leaves before the diagram folio marked 'II', shows evidence of a similarly formatted diagram to

³⁹⁷ Stones, *French Gothic Manuscripts, Part 2*, 1, p.144.

that of fol. 116^r. There is also no 'XXII' label (between the illuminations of folios 265 and 266), indicating that another diagram has been removed from near the end of the manuscript.

The current state of BN 503 presents a problem as it is not in the same form as when Opicinus would have seen it. Thankfully, a comparison of the codicological structure of both BN 12018 and BN 503 and their remaining images (the separated leaves and manuscript illuminations) allows one to reconstruct the original appearance of BN 503. This is the form in which Opicinus would have seen it (for their comparison, see appendix II). The reconstruction indicates that BN 503 included more diagrams which were identical to those in BN 12018, if not the entire set. Opicinus would have therefore seen diagrams that no longer exist in BN 503 but whose original forms are still included in BN 12018. When an element of BN 503 is not available, therefore, the images in BN 12018 have been consulted.

The Illumination of BN 503: The St George and *Queste* Masters

An analysis of the illumination of BN 503 reveals more about the practices of the manuscript workshops and patronage at the Avignon papal court before and during Opicinus's time there, revealing that Pope John was closely involved with certain manuscript workshops and had a particular interest in the production of diagrams. More has been written on the making of the later *De Rotis* manuscript. This could be explained by its larger size (390 x 270 mm), by the higher quality of its illuminations and gilding, or by the dispersal of its full-page illuminations. The majority of the secondary scholarship regarding BN 503 has focused on an art-historical interpretation of the first two illuminated initials, depicting Pope John and Ezekiel in what is an undoubtedly Italianate style. The artist of the initials has been identified as the Florentine Master of the St George Codex (referred to below as the 'St George Master') who takes his pseudonym

from the attribution of his hand to the manuscript of the life and office of St George, composed by Cardinal Stefaneschi around 1325-30.³⁹⁸

In addition to this example, Stefaneschi and the St George Master collaborated on at least three manuscripts, demonstrating their close working relationship.³⁹⁹ This led Marie-Thérèse Gousset to hypothesise that BN 503 was actually made for Stefaneschi rather than John XXII.⁴⁰⁰ Yet the question of when exactly the St George Master was active is contentious. Bryan Keene argued that the master himself was active from approximately c. 1315-35,⁴⁰¹ whereas Howett argued that the workshop was active from approximately 1325 to the early 1340s (no later than Cardinal Stefaneschi's death in 1343).⁴⁰²

In any case, the role of the St George Master in the illumination of the *De Rotis* has been overemphasised. The study of the Avignonese illuminators is of great significance to BN 503, and the study of the St George Master is valuable to understanding the stylistic character of the papal court. But the emphasis upon the Master's role has entirely overshadowed the study of the diagrams themselves. François Avril recognised that, unlike the initials, the diagrams were executed by a French hand.⁴⁰³ As was conventional in Parisian illumination, the background is diapered blue, red and white, and the figures' faces are not three-dimensionally modelled like

³⁹⁸ BAV, MS Arch.Cap.S.Pietro.C.129. M. T. Gousset, 'MS Lat. 503,' in *Bonifacio VIII e il suo tempo: anno 1300 il primo giubileo*, ed. M. Righetti Tosti-Croce (Milan, 2000), p.148, cat. no. 87.

³⁹⁹ Stefaneschi was believed to have commissioned (c. 1320-21): the *temporale* of a missal (Pierpont Morgan Library, MS 713); a pontifical (BnF, MS Lat. 15619); and a ceremonial (Boulogne-sur-Mer, Bibliothèque des Annonciades, MS 86). See Keene's description of the St George Master in C. Sciacca, *Florence at the Dawn of the Renaissance: Painting and Illumination, 1300-1350* (Los Angeles, 2012), pp.74-75, cat. no. 18.

⁴⁰⁰ Gousset, *Bonifacio VIII e il suo tempo*, p.148.

⁴⁰¹ Sciacca, *Florence at the Dawn of the Renaissance*, p.74.

⁴⁰² J. Howett, 'Two Panels by the Master of the St. George Codex in the Cloisters,' *Metropolitan Museum Journal*, Vol. 11 (1976), pp.85-102, p.99. The St George Master's artistic and stylistic development happened in the same time and place as Opicinus's, so their most productive phases overlapped. It is tempting to consider whether Opicinus might have shared work space or even collaborated with the St George Master (which could be gleaned from the contextual study of manuscript production in Avignon broached in the first chapter). But there is no direct documentation of their collaboration, and a comparison between the ways in which they represented dragons (in Opicinus's depiction of St Margaret in the Vaticanus (fol. 52v) and in the St George Master's *base-de-page* scene of St George killing the dragon) demonstrates that there was no stylistic link between them.

⁴⁰³ Manzari, *La miniatura ad Avignone*, p.53.

those of the first initials, but are entirely white, with dots of pink highlighting their lips and the corners of their eyes.

It has been hypothesised by Manzari and Stones (following the study of Gousset) that the same French hand produced other manuscripts at the Avignon court which had been commissioned by Pope John.⁴⁰⁴ Stones referred to this artist or workshop as the *Queste* Master, named after their association with the illumination of a copy of the *Queste del saint graal*, written in Avignon in 1319.⁴⁰⁵ The *Queste* Master was an artist from Toulouse in the entourage of John XXII, and was heavily influenced by the Parisian school. Stones showed the workshop to have produced a substantial cluster of books in the southeast of France, some of which were likely to have been made for John.⁴⁰⁶ This includes, for example, the first part of BAV, MS Urb. Lat. 355, the first folio of which presents a schematised semi-circular theatre opposite a diagram of the earth (fig. 42) followed by blue and gold images of constellations.⁴⁰⁷ In addition to the stylistic similarity of its figures and captions to that of the diagrams of BN 503, the schematisation and inclusion of celestial imagery suggests that the *Queste* Master would have been familiar with depicting the same themes which underlie the vision of Ezekiel.

Stones believed the diagrams of both copies of the *De Rotis* to be illuminated by the *Queste* Master, but that BN 503 is distinguished from its model by the *Queste* Master's collaboration with the St George Master, thus making it a rare instance of Franco-Italian collaboration.⁴⁰⁸ It is certainly true that the diagrams of both manuscripts were influenced by Parisian workshops and

⁴⁰⁴ Building on the work of Gousset, Manzari and most recently Stones, the workshop of the *Queste* Master is currently a subject of much interest, with a study by Joanna Fronska forthcoming.

⁴⁰⁵ Florence, Biblioteca Medicea Laurenziana, MS Ash. 121(48).

⁴⁰⁶ Stones, *French Gothic Manuscripts*, Part 2, 1, p.149.

⁴⁰⁷ For a complete list of the manuscripts Stones attributed to the *Queste* Master, see Stones, *French Gothic Manuscripts Part 1*, Vol. 1, pp.74-75. On the basis of an initial study of the zodiac images of BAV, MS Urb. Lat. 355, there is no stylistic relation between the manuscript and Opicinus's drawings.

⁴⁰⁸ Stones, *Gothic Manuscripts 1260-1320 Part 1*, 1, p.74.

have Italianate features, but this is not enough to support Stones's argument that they were done by the same hand. A comparison between two diagrams of the same content in each manuscript (figures 38 and 41) demonstrates the extent to which they differ. The busts of the *animalia* vary in form and colour (as described in detail below and shown in table 1) and the colour in BN 12018 is far brighter than that of BN 503, using more vibrant oranges and pinks and a lighter dusty blue. The patterns within the ornamental flourishing also differ: the background of the vision in BN 503 is diapered blue with dots of red, whilst that of BN 12018 is fairly flat with curls of white. Beyond demonstrating that the artists were not the same but that they shared both French and Italianate features, it is not useful to dwell longer on a comparison of the colour of each copy of the *De Rotis*. For the purposes of comparison with Opicinus's drawings, composition is more important than colour, as colour is virtually absent from the Palatinus and Vaticanus.

One cannot be certain who was drawing which elements of the figures of the *De Rotis*. Yet it can be concluded, on the basis of visual analysis, that their diagrammatic structures were not composed by the *Queste* Master but by Henricus himself. This is demonstrated first, as the text of BN 12018 is in the same hand as the legends of the diagrams and secondly, as the legends were written before the manuscript was illuminated. This can be seen in the text of the top-right quadrant of figure 37 below the third eye from the centre, which reads *medio rotarum*. Despite Henricus's effort to heavily abbreviate the text in order to fill as little space as possible, the image and gilding is secondary to the text and has been drawn around it. The most likely explanation is that Henricus (at least in the case of BN 12018) sketched out the form of the diagram and the text, which the artist then drew and illuminated. This is supported by the nature of the text, which often describes the image next to it. This probably served as an indication to the

illuminator as to what to draw.⁴⁰⁹

Although this chapter is primarily focused on how Opicinus was influenced by the finished product of the *De Rotis* in order to evaluate how certain elements can be identified within the Palatinus, the study of the illumination of the two copies of the *De Rotis* reveals more about their patronage and purpose and thus the culture of manuscript production in which Opicinus was working. An evaluation of the making and commission of the *De rotis* shows that the final product was the result of a collaboration of Henricus's theological thinking and the illumination of the Avignon workshop(s), and that the team employed to make these momentous diagrams was in close communication with the pope.

The attribution of the diagrams themselves to Henricus and the *Queste* workshop is helpful in differentiating these images from the work of the St George Master and the patronage of Cardinal Stefaneschi.⁴¹⁰ They should therefore be more closely associated with the French style of the *Queste* workshop and the Parisian intellectual culture in which both Henricus and John XXII were theologically trained. This is not to say that Stefaneschi did not play a minor role in its commission, especially considering the St George Master's involvement in the illuminated initials of BN 503. But the style and content of these complex theological structures, as well as the close working relationship between Henricus and John, indicate that these were diagrams made in response to the interests of the French pope. Avril's postulation that Stefaneschi commissioned BN 503 as a presentation copy for John therefore seems unlikely. An analysis of

⁴⁰⁹ One cannot be certain without a complete transcription of the text, but the system of *capitula* indicates that the diagrams were described in detail in the accompanying text.

⁴¹⁰ In comparison to other studies concerning artistic patronage at Avignon, this chapter qualifies Stefaneschi's role in the production of these particular manuscripts. Yet his role as a patron of the arts in Avignon during the 1330s and 40s should not be underestimated. Julian Gardner described Stefaneschi as 'one of the greatest of all medieval patrons'. J. Gardner, 'Opus Anglicanum and its Medieval Patrons,' in *English Medieval Embroidery: Opus Anglicanum*, ed. C. Brown, G. Davies and M. A. Michael (New Haven, 2016), pp.49-59, p.53. For a detailed case study of Stefaneschi's patronage, see J. Gardner, 'The Stefaneschi Altarpiece: A Reconsideration,' *Journal of the Warburg and Courtauld Institutes*, Vol. 37 (1974), pp.57-103. Williamson noted that he was partly responsible for the great influx of Italian craftsmen at the Avignon court. Williamson, 'Site, Seeing and Salvation,' p.20.

the making of the diagrams of the *De Rotis* shows that one must acknowledge the theological interests of the University of Paris in the study of illumination in Avignon, and by extension, the study of Opicinus.

Ezekiel 1 at the Avignon Court

Diagrams certainly captured John's intellectual curiosity, but what about the subject of Ezekiel 1 itself? That BN 503 was commissioned at the Avignon court suggests that Ezekiel 1 was of specific interest there. The documentation of John XXII's patronage and theological consultations demonstrates his preoccupation with certain themes, some of which directly related to Ezekiel 1.⁴¹¹ On 31 January 1325, he commissioned a mosaic for the façade of San Paolo Fuori le Mura in Rome which depicted the *animalia* of Ezekiel (each Gospel creature with four wings). Following its destruction in a fire in 1823, what remains there now is a nineteenth-century mosaic. The best indication of its fourteenth-century appearance is a drawing now in Scotland's National Gallery (fig. 43), and Piranesi's mid-eighteenth-century engraving of the church (although the mosaic is less clear here).⁴¹² The latter shows how the rose window of the church had spokes like those of the southern-Italian churches, supporting Dow's interpretation that some rose windows alluded to the wheels of Ezekiel.

In the surviving letter of its commission from John, however, no detail is given of the *mosaicum* and so there is no explicit reference to Ezekiel. One cannot be certain to what extent John

⁴¹¹ Piron, 'Avignon sous Jean XXII,' pp.366-73.

⁴¹² The date of its commission is recorded in contemporary documentation: Archivum Secretum Vaticanum 78, no. 1, transcribed in P. Hetherington, *Pietro Cavallini: A Study in the Art of Late Medieval Rome* (London, 1979), p.154. The mosaic is discussed in C. Bolgia, 'Images in the City: Presence, Absence and Legitimacy in Rome in the First Half of the Fourteenth Century,' in *Images and Words in Exile*, pp.381-400, pp.381-84.

governed the content of his commissions in the visual arts.⁴¹³ Henricus, furthermore, wrote the treatise before his move to Avignon.⁴¹⁴ Yet like Opicinus's treatises addressed to John, which were aligned with his theological interests yet were possibly not commissioned by him, the numerous appearances of Ezekiel in art and manuscripts related to John are unlikely to be coincidental. In any case, the appearance of the creatures of Ezekiel in the mosaic in Rome, Henricus's *De Rotis*, the works of Opicinus and the fourteenth-century copies of patristic commentaries on Ezekiel in the Avignon library, show this to have been a prominent subject in the rich theological culture at the court.

This can be ascribed in part to the major theological controversy concerning the Beatific Vision which arose in the 1330s. The issues of sight and salvation central to that controversy strongly correlate to the vision of Ezekiel. From 1241, it had been accepted that those purged of sin in purgatory could experience the Beatific Vision prior to the Last Judgement. In the last years of John XXII's pontificate, from 1331, the pope began to question this, arguing that all must wait until the Last Judgement. He held on to this opinion until, under the pressure of contrary theological argument, he retracted it on his deathbed in 1334. From 1331-36, the controversy and its implications concerned all members of the Roman Curia and their visitors. Beth Williamson has argued that art produced at the Avignon court, particularly the two painted tympana which Simone Martini made in the cathedral of Avignon in the mid-1330s on the commission of Cardinal Stefaneschi, showed a particular interest in sight and salvation, which reflected the preoccupation with the Beatific Vision at the court. According to Williamson, these images of Christ and of the Virgin of Humility formed 'a network of pictorial ideas relating to sight and seeing, premised upon the concept that to receive the sight of God is indicative of a soul's purification, and thus that the progress towards the full vision of God is the path towards

⁴¹³ Hetherington, *Pietro Cavallini*, p.154.

⁴¹⁴ Boureau, *Satan the Heretic*, p.46.

an individual's salvation'.⁴¹⁵ Williamson acknowledged the possibility of a more generic link to ideas about vision and thought widely present in medieval culture (including the transcendent function of allegorical and anagogical thought which transported one from the visible to the invisible and heavenly, as well as Augustinian views concerning spiritual and intellectual vision). She concluded, however, that an emphasis on the combination of vision and salvation may have been nurtured by the specific theological context in which John XXII and Jacopo Stefaneschi were operating.⁴¹⁶

If one cannot be certain that this interest in vision and the sight of God was specific to Avignon, one can at least recognise that such ideas were under consideration there. The visionary and prophetic nature of the *De Rotis*, which in addition to illustrating the vision depicts the many eyes of the *animalia* and their gazes within the images, emphasises the role of vision and salvation in Ezekiel 1.

In summary, the newly conceived drawings of Henricus and Opicinus can both be understood as products of the intellectual and artistic milieu of the papal court. Intellectually, the theological priorities of the day, including the question of the power of images, can be detected in the works of the northern Italian clerics working at Avignon, such as Henricus and Opicinus. In the visual arts, workshops from both southern France and northern Italy, such as the *Queste* and St George Masters, were active there. With their shared influences and patron in mind, the next part of the chapter considers to what extent certain features of the *De Rotis* can be found in Opicinus's works.

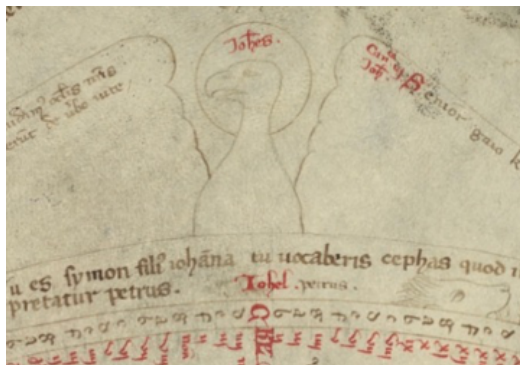
⁴¹⁵ Williamson, 'Site, Seeing and Salvation,' p.3.

⁴¹⁶ Ibid., p.19.

Part Three: A Comparison of *De Rotis* and the Palatinus

As the *De Rotis* and Palatinus each contain multiple complex diagrams, the comparison below does not compare the drawings in their entirety, but focuses on certain features. These have been categorised into representations of figures (the *animalia* and enthroned God) and the wheels. In order to define how Opicinus's and Henricus's images relate to one another, they are evaluated on different aspects, or levels, of their meaning: the features of the content (such as the number of wings or wheels), their style, and their function within the larger image. The comparison shows how Opicinus integrated certain features of the *De Rotis* into his own works, and why. It is clear that he was influenced to some extent by the visual strategies and iconography of Henricus's diagrams, the implications of which are explored. But the main purpose of this section is to consider the question: Did Opicinus's and Henricus's visual language share the same meaning, or did Opicinus use certain pictorial ideas from the *De Rotis* to achieve his own distinct cosmological aim? As will be shown, the two are not mutually exclusive.

The Representation of the *Animalia*: Et ex medio eorum similitudo quattuor animalium



Details of the Eagle of St John from:

Palatinus A (detail of fig. 1, top left);

BN 503 (detail of fig. 41, top right);

BN 12018 (detail of fig. 38, bottom).

The depiction of the Evangelists as animals is one of the most common motifs in Opicinus's drawings, as it is also in medieval visual culture broadly considered. Yet the ways in which the winged animals were composed are not only stylistically various, but carry different purposes. Those featured in the corners of the calendars of Pietro Vesconte, for example, look towards the *rota* but their wings do not interact with the structure or with one another, as described in Ezekiel 1. The full-page miniatures of both copies of the *De Rotis*, however, bear an impressive likeness to the almost incomprehensible details given in the text. Their *animalia*, in the number and placement of their wings, the relationship of the figures to one another and even the direction of their gazes, perfectly illustrate the description of Ezekiel 1: 5-6, 8-11, 18 and 23.

⁵ And in the midst thereof the likeness of four living creatures: and this was their appearance: there was the likeness of a man in them. ⁶ Every one had four faces, and every one four wings...

⁸ And they had the hands of a man under their wings on their four sides: and they had faces, and wings on the four sides, ⁹ And the wings of one were joined to the wings of another. They turned not when they went: but every one went straight forward. ¹⁰ And as for the likeness of their faces: there was the face of a man, and the face of a lion on the right side of all the four: and the face of an ox, on the left side of all the four: and the face of an eagle over all the four. ¹¹ And their faces, and their wings were stretched upward: two wings of every one were joined, and two covered their bodies...

¹⁸ The wheels had also a size, and a height, and a dreadful appearance: and the whole body was full of eyes round about all the four...

²³ And under the firmament were their wings straight, the one toward the other, every one with two wings covered his body, and the other was covered in like manner.⁴¹⁷

By following this description exactly, the image maker's intention was evidently to capture the vision as precisely as possible, with the consequence that both the structures as well as the figures upon them were laden with scriptural meaning.

The iconographic similarity of these *animalia* to those of the Palatinus (see table 1) indicates that Opicinus had seen Henricus's diagrams. In just under half of the surviving Palatinus diagrams, the haloed and winged *animalia* frame the corners of the circular and oblong structures (sometimes multiple times in one image). Most are depicted in profile, while a few face the

⁴¹⁷ Ezek. 1: 5-6, 8-11, 18, 23: ⁵ *et ex medio eorum similitudo quattuor animalium et hic aspectus eorum similitudo hominis in eis* ⁶ *et quattuor facies uni et quattuor pinnae uni...* ⁸ *et manus hominis sub pinnis eorum in quattuor partibus et facies et pinnae per quattuor partes habebant* ⁹ *iunctaeque erant pinnae eorum alterius ad alterum non revertebantur cum incederent sed unumquodque ante faciem suam gradiebatur* ¹⁰ *similitudo autem vultus eorum facies hominis et facies leonis a dextris ipsorum quattuor facies autem bovis a sinistris ipsorum quattuor et facies aquilae ipsorum quattuor* ¹¹ *et facies eorum et pinnae eorum extentae desuper duae pinnae singulorum iungebantur et duae tegebant corpora eorum...* ¹⁸ *statura quoque erat rotis et altitudo et horribilis aspectus et totum corpus plenum oculis in circuitu ipsarum quattuor...* ²³ *sub firmamento autem pinnae eorum rectae alterius ad alterum unumquodque duabus alis velabat corpus suum et alterum similiter velabatur.*

viewer directly. The direction of the gaze is particularly relevant in the *De Rotis* images, as it is integral to their function and relationship to one another, as described in Ezekiel 10:12: *et omne corpus earum et colla et manus et pinnae et circuli plena erant oculis in circuitu quattuor rotarum*. The framing wings touch one another according to Ezekiel 1:11, and in some cases (such as *Palatinus A*) encroach upon one another in the same line (figures 31, 38 and 41). This method of framing *rotae* and *tabulae* with the joined wings of the tetramorph is entirely unique to these three sets, showing that Opicinus engaged with the *De Rotis* images.

Beyond their iconographic features, a stylistic comparison of the *animalia* of the three allows one to be more precise as to which, of the two manuscripts of the *De Rotis*, Opicinus drew his inspiration from. The maker of each manuscript was different, but this is especially evident in the cases of the Palatinus and BN 12018. For example, the profile of the eagle of St John (see above details) in the Palatinus and in BN 503 follows a similar outline, with the point of the thick beak curving slightly downwards, whereas the thin beak of BN 12018 follows an almost jagged semi-circular curve downwards. The portraits of the other *animalia* in BN 12018 are also distinguished by their large, bulging eyes, which appear almost cartoon-like in comparison to the other two sets. Opicinus was clearly influenced, instead, by the *animalia* of BN 503. This can be attributed to the availability of BN 503 which, as postulated above, was probably made as a presentation copy. Its larger scale and more lavish aesthetic would have attracted more attention.⁴¹⁸ For this reason, the following comparison between Opicinus and the *De Rotis* focuses on BN 503, when possible.

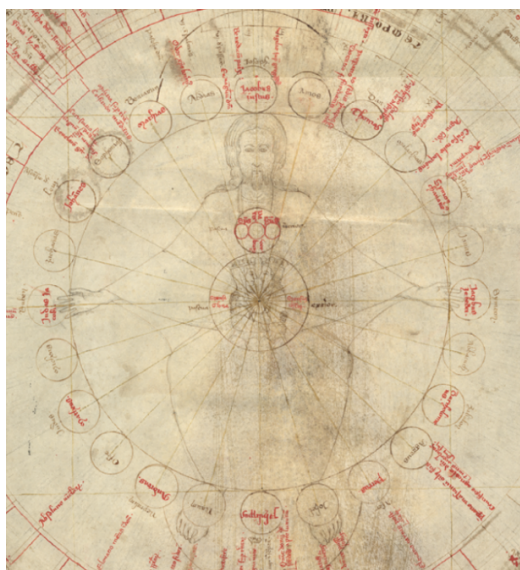
Even so, there are stylistic differences between the Palatinus and BN 503, such as the outline of the wings as they protrude from the creatures' bodies. Although the overall purpose of the wings of the tetramorphs as framing devices is the same in each set, the Palatinus *animalia* have just one

⁴¹⁸ Righetti Tosti-Croce, *Bonifacio VIII e il suo tempo*, p.148, cat. no. 87.

set of wings each and, with the exception of the angel of Matthew, do not have hands beneath them as required by Ezekiel 1:8. In addition, the Gospel beasts of the Palatinus are more Italianate. Opicinus's lion of St Mark, for example, is more naturalistic in its shaggy jawline of fur than the slicked-back hair of the grinning lion in BN 503. When in profile, the tongue of Opicinus's lion hangs out of his mouth playfully with the effect that it appears more animalistic, whereas the smirks of the *animalia* in the *De Rotis* series express a more humanoid quality. Such comparisons point to Opicinus's Genoese training.

Their iconographical analysis is enough to conclude that both sets of *animalia* represent the Evangelist animals. Yet the differentiation in the details of Opicinus's *animalia* from the minutiae of Ezekiel 1 suggests that his *animalia* carried a different meaning. Exactly why Opicinus depicted the *animalia* in this way, if not solely as an illustration of the vision, is significant to the interpretation of his drawings which follows.

The Representation of the Throne: *Similitudo Throni*



Details of the Throne: from *Palatinus A* (fig. 1, left) and BN 503 (fig. 41, right)

Another approach in deciphering the significance of Ezekiel's vision to Opicinus's cosmologies is to consider his use of other features which appear in the *De Rotis*. In addition to the *animalia*, a second iconographical similarity can be identified: the enthroned figure seated at the centre of Opicinus's *Palatinus A* and at the top of Henricus's diagrams of the vision (details above). With the same degree of accuracy as the depiction of the *animalia*, the details for the illustration of God enthroned are taken from Ezekiel 1: 26-28.

²⁶ And above the firmament that was over their heads, was the likeness of a throne, as the appearance of the sapphire stone, and upon the likeness of the throne, was a likeness as of the appearance of a man above upon it. ²⁷ And I saw as it were the resemblance of amber as the appearance of fire within it round about: from his loins and upward, and from his loins downward, I saw as it were the resemblance of fire shining round about. ²⁸ As the appearance of the rainbow when it is in a cloud on a rainy day: this was the appearance of the brightness round about.⁴¹⁹

Even the minutiae, such as the throne's fiery rainbow appearance (*speciem ignis splendentis... velut aspectum arcus*) and the use of pale blue and orange to capture the sapphire and amber from which is it made, were incorporated into Henricus's image.

Palatinus A has a similar figure enthroned at its centre, but as with his *animalia*, he did not include the unique details which directly associate the image to Ezekiel 1. He was arguably limited by the monochromy of the drawings. Perhaps he planned to illuminate his images later with rainbow colours and the appearance of fire. Perhaps the practical limitations due to the (potentially

⁴¹⁹ Ezek. 1: 26-28: ²⁶ *et super firmamentum quod erat imminens capiti eorum quasi aspectus lapidis sapphyri similitudo throni et super similitudinem throni similitudo quasi aspectus hominis desuper* ²⁷ *et vidi quasi speciem electri velut aspectum ignis intrinsecus eius per circuitum a lumbis eius et desuper et a lumbis eius usque deorsum vidi quasi speciem ignis splendentis in circuitu* ²⁸ *velut aspectum arcus cum fuerit in nube in die pluviae hic erat aspectus splendoris per gyrum.*

secret) nature of his project meant that he did not have access to the materials for illumination. His colour choices in his other drawings, however, with washes of reddish-brown and green, and red and green rhumb lines, suggest that this was not the case. This does not necessarily mean, however, that Opicinus was not drawing the enthroned figure of Ezekiel 1.

The identification of certain iconographic features, including the throne and *animalia*, is complicated by their appearance in multiple places within the bible. The description of the Divine Throne, as described in Ezekiel 1, is echoed in that of the throne in Revelation 4.⁴²⁰ Revelation also took its description of the *animalia* directly from Ezekiel.⁴²¹ As Carruthers showed in her survey of the biblical appearances of cherubim and seraphim, the angelic creatures appear on multiple occasions in both the Old and New Testaments.⁴²²

To the medieval theologian, the description of the Throne was often not a reference to one specific passage, because the events of the bible were perceived to be interconnected. Certain symbols consciously evoked multiple instances within scripture. This is demonstrated by the colophon of BN 503, which states explicitly that the vision refers to the entirety of scripture. The iconographical features shared between biblical narratives form a network of images which simultaneously illustrate multiple biblical moments and their interrelationship in order to represent scripture, and therefore Christian salvation history, as a whole. The similarity of the thrones in the drawings to that in Revelation does not create a difficulty in the identification of the image, but rather introduces the potential for the scene to have multiple readings. It is

⁴²⁰ It is tempting to read the twenty-four circles surrounding the throne in *Palatinus A* as the description of Rev. 4:4: '4And round about the throne were four and twenty seats; and upon the seats, four and twenty ancients sitting, clothed in white garments, and on their heads were crowns of gold'. The inclusion of the extra set of twelve names in *Palatinus A*, however, suggests that this is not the case.

⁴²¹ Rev. 4: 6-7: '6And in the sight of the throne was, as it were, a sea of glass like to crystal; and in the midst of the throne, and round about the throne, were four living creatures, full of eyes before and behind. 7And the first living creature was like a lion: and the second living creature like a calf: and the third living creature, having the face, as it were, of a man: and the fourth living creature was like an eagle flying'.

⁴²² See n.353 above.

therefore likely that Opicinus intended his enthroned figure to remain ambiguous, with the result that it could directly refer to the description of God from Ezekiel 1 in addition to his description in other biblical passages. This is important in the wider analysis of Opicinus's use of Ezekiel 1 considered below.

Although a stylistic and iconographic similarity has been demonstrated between Opicinus's drawings and BN 503, certain differences between the *animalia* and the enthroned figure of *Palatinus A* render their relationship more ambiguous. The iconography is similar enough to assert that Opicinus depicted the *animalia* surrounding the enthroned God, but this is not enough to suggest that Opicinus illustrated them for the same reason as the *De Rotis* images. The typological potential of the *animalia* as well as the multitude of other information in Opicinus's drawings show that he did not illustrate the vision with the same literalness as the *De Rotis*, and that he instead used the vision as a means by which to construct multivalent representations of biblical content. The implications of this are reconsidered after the representation of the rest of the vision (the wheels in particular) has been fully explored.

The Representation of the Wheels and their Movement: *Aspectus Rotarum*

Unlike the above visual analysis of the *animalia*, one cannot stylistically compare the wheels of Opicinus and Henricus, as in this case it is their form which varies. The wheels in the *De Rotis* are instead significant for the interpretation of the Palatinus as they provide a case study, available to Opicinus, in which *rotae* were illustrated in multiple dimensions. This section shows how, in the diagrams of the *De Rotis*, Henricus used different iterations of the wheels to represent different perspectives on the same subject. This section is less concerned with how the *De Rotis* may have

informed Opicinus stylistically or iconographically, but instead considers the diagrammatic strategies used in each set of drawings.

¹⁵Now as I beheld the living creatures, there appeared upon the earth by the living creatures one wheel with four faces. ¹⁶And the appearance of the wheels, and the work of them was like the appearance of the sea: and the four had all one likeness: and their appearance and their work was as it were a wheel in the midst of a wheel. ¹⁷When they went, they went by their four parts: and they turned not when they went.⁴²³

The varied details of the wheel which seemingly consists of four wheels, each divided by four yet also placed within one another (*rota in medio rotae*), prompted their illustrators to experiment with a variety of circular forms. The main tension derived from the challenge to depict these circles within circles, or even spheres, from different perspectives. Henricus and Opicinus were thus faced with the same issues as the makers of astronomical diagrams and instruments which illustrated the structure and movement of the cosmological spheres. Both aspired to map out three-dimensional space upon a two-dimensional plane.⁴²⁴

This parallel between the wheels of Ezekiel and the astronomical spheres is not a mere analogy, but can be attributed to the celestial features of the passage of the vision which mentions the firmament four times in its description of the enthroned God. This, as well as the diagrammatic potential of *rotae* to be superimposed with squares of opposition,⁴²⁵ presents the wheels as a form by which to structure the cosmological parallels which were drawn out of Ezekiel by the

⁴²³ Ezek. 1: 15-17: ¹⁵ *cumque aspicerem animalia apparuit rota una super terram iuxta animalia habens quattuor facies* ¹⁶ *et aspectus rotarum et opus earum quasi visio maris et una similitudo ipsarum quattuor et aspectus earum et opera quasi sit rota in medio rotae* ¹⁷ *per quattuor partes earum euntes ibant et non revertebantur cum ambularent.*

⁴²⁴ Later illustrations, such as Hans Holbein the Younger's woodcut in the Zurich bible, have shown the wheels as armillary sphere-like structures: moving within one another like the orbital paths of the planets.

⁴²⁵ See J. E. Murdoch, *Album of Science: Antiquity and the Middle Ages* (New York, 1984), p.62.

commentary of the Church Fathers.⁴²⁶ By understanding the various methods by which the wheels were visualised, the viewer can see how the creator struggled to draw three-dimensional content by experimenting with the circles, or *rotae*, in various formats.

The potential configurations of the wheels are clearly illustrated in the Bible Moralisée mentioned above. Like Opicinus's and Henricus's drawings, it does not show one interpretation of the passage but displays one idea in numerous ways. The Bible Moralisée shows the four wheels in three motifs: intersecting (fig. 35b), separated to make a square (fig. 35c), and circumscribing one another (fig. 35a). The diagrams in the earlier copy of *De Rotis*, which can be divided into five groups based upon the layout of the circles (see table 2), can be roughly categorised in the same way.⁴²⁷

The depiction of Ezekiel's wheels as a line of intersecting circles was not unique to manuscript illustration; it was also seen, for example, in the Romanesque apse fresco (from the late-eleventh to early-twelfth century) in the church of Santa Maria, Àneu.⁴²⁸ Many of the Palatinus and *De Rotis* diagrams use this basic structure. Even if one was to eliminate the oblong-shaped wheels in the Palatinus, many of the drawings would still be made up of lines of intersecting circles.⁴²⁹ An entire group of full-page illuminations in the *De Rotis* show large circles which are made up of two to six intersecting circles (such as fig. 40), usually containing biblical narratives or busts of biblical figures.⁴³⁰ Although these would be appropriate representations of Ezekiel 1, the absence of *animalia* and the variation in the number of circles imply that they are part of an entirely

⁴²⁶ Ezek. 1: 22-23; 25-26: ²²*et similitudo super caput animalium firmamenti quasi aspectus cristalli horribilis et extenti super capita eorum desuper* ²³*sub firmamento autem pinnae eorum rectae alterius ad alterum unumquodque duabus alis velabat corpus suum et alterum similiter velabatur...* ²⁵*nam cum fieret vox supra firmamentum quod erat super caput eorum stabant et submittebant alas suas* ²⁶*et super firmamentum quod erat inminens capiti eorum quasi aspectus lapidis sapphyri similitudo throni et super similitudinem throni similitudo quasi aspectus hominis desuper*

⁴²⁷ The use of the earlier manuscript is necessary here because, unlike BN 503, the entire manuscript is intact and thus its diagram set is complete.

⁴²⁸ The frescos have been transferred to the Museu Nacional d'Art de Catalunya, Barcelona.

⁴²⁹ See folios 3v, 15v, 16v, 18v, 19v, 21r, 21v, 23v, 24r, 25r.

⁴³⁰ See BN 12018: folios 258r, 259r, 260r (fig. 40), 261r, 262r, 263r, 264r, 265r, 266r.

different iconographic group, so they are not discussed further here.

Excluding this group of intersecting wheels, the other groups of diagrams in the *De Rotis* each exist in four iterations, one for the ascendancy of each Gospel animal. In those of 'the four wheels of the vision' (illustrated in table 5), the dominant *animal* of each image is placed on top of the wheel to make images of: the pre-eminence of the angel of Matthew (fol. 123^v); of the ox of Luke (fol. 124^r); of the lion of Mark (fol. 125^v); and of the eagle of John (fol. 126^r). This is also true for the wheel-within-wheels images, which are shown together in table 4. The individual images depict the wheels in various stages of movement. The landscape in which the vision takes place remains the same in the four images; only the rotation of the wheel changes. This same method of visualisation was used to show celestial movement in astronomical diagrams, and is discussed in the previous chapter in relation to Opicinus's *temporales*. The shift between each illumination is as if the wheels of Ezekiel had been turned like a volvelle.

The diagrams of each wheel (for example, see fol. 144^r in table 3) do not depict them in various stages of rotation, but focus on their individual meaning, functioning as an interpretative close-up. Each wheel is most easily identified through its colour. The first wheel-within-wheels images act as the key, as each *animal's* quadrant is labelled with its respective colour: man as chrisolite (*cristoliti*); lion as carbuncle (*carbunculi*); ox as hyacinth (*jacinti*); and eagle as the colour of the sea (*maris*). The colour-coding system allows the viewer to navigate the diagrams without the text (albeit with some difficulty) and to understand how the different iterations of the wheels relate to one another throughout the twenty-seven images. Each *animal* is also associated with a particular Christological meaning. For example, the ox is associated with dark red (*jacinti*) and sacrifice. This means that each time the wheel according to the ox is depicted, the rim contains the four colours with a dark red (*jacinti*) centre (see table 3) upon which a Crucifixion is drawn.

The Christological meaning of each *animal* is particularly significant as it directly connects the *De Rotis* to the patristic commentaries. According to these, the wheels were not the only means by which to understand the typological interrelation between Ezekiel 1 and the New Testament. Gregory's commentary on Ezekiel included many of Jerome's interpretations, such as the analogies of the *quattuor* mentioned above, but with a stronger emphasis on the beasts' likeness to man, as stated in Ezekiel 1:5. In Gregory's more explicitly Christological reading, he took this likeness to mean that they represented the Incarnation of the Lord, from which he concluded that the four beasts represented the four mysteries of Christ. This concept was recognised by Jerome and studied by Ambrose, but took its wording from Augustine: *Hominem nascentem, regnantem, et aquilam ad coelestia remeantem*. That is, according to Dow, 'Christ was, being born, a man; being sacrificed, an ox; reigning [raised from the dead], a lion; ascending into Heaven, an eagle'.⁴³¹ This concept is clearly depicted in the wheel-within-wheels diagrams of the *De Rotis*. The New Testament scenes in the centre of each wheel correlate to the dominant Evangelist of that wheel. For example, the wheel of the ox contained an image of the Crucifixion at its centre (see fig. 39). It is clear that the patristic commentaries on Ezekiel were the foundations of the images and text of the *De Rotis*.

Returning to the comparison, the diagrams of the wheels are similar to those in the Palatinus. In some, components move and rotate (as do the calendars discussed in the previous chapter), but more frequently, the perspective of the viewer moves in and out, to allow Opicinus to describe his content on micro- and macroscopic levels. This is most obviously apparent in his maps, which dramatically change in scale: from Pavia, to Europe, to the world, to the universe, but it also applies to his calendar rings. Fol. 3^v of the Palatinus, for example, zooms in to the intersection of two calendar rings over a map, allowing Opicinus to give an extended textual

⁴³¹ Dow, 'The Rose-Window,' p.275. Dow cited John's Apocalypse in BAV, MS Pal Lat. 35, fol. 2423.

commentary to the apocalyptic figure at its centre, which was aligned with the relevant data of the calendar rings and map.⁴³² The point of comparing Opicinus's and Henricus's depiction of multiple perspectives is not to imply that Opicinus emulated Henricus's visual exploration and use of scale, nor to demonstrate a relationship between Opicinus's wider corpus of sources and the wheels of Ezekiel. Instead the comparison shows how both, by using multiple images to experiment with similar iterations of their subjects, attempted to explore the potential meanings of the subject by visualising alternative viewpoints of the same content.⁴³³ By using diagrammatic forms and colour to schematise one biblical passage, Henricus focused on the diverse content of Ezekiel 1 from multiple perspectives. This is emphasised by his illustrations of the wheel-within-wheels (fig. 37) and the four wheels (figures 38 and 41).

The Representation of the Wheel-Within-Wheels (*Rota in Medio Rotae*)

The diagrams which focus on the wheel-within-wheels also capture a different perspective of the vision, but not in the same way as the micro- and macroscopic iterations of the above images. Instead of representing a physical description of Ezekiel 1, they view the vision from an interpretative, or spiritual, perspective. The first four full-page illuminations of the wheels in Henricus's *De Rotis* (table 4) show the wheels-within-wheels represented by the four concentric circles, as in the first Bible Moralisée medallion above (figure 35a). The images represent the same scene, as illustrated in cross section, of the vision (figures 38 and 41), but from a different physical perspective.

⁴³² For a description of fol. 3^v, see Salomon, *Weltbild und Bekenntnisse*, pp.160-65. The drawing is also mentioned in Piron, *Dialectique du monstre*, p.74.

⁴³³ Much has been gleaned from an interpretation of the diagrams alone, but further analysis would require a focused consideration of the accompanying treatise.

In the cross section of the vision, one views it as would have been seen from earth. Ezekiel is on the ground at the bottom of the image, the firmament is above, and the four wheels are shown separately in between. But if one then looks at the wheel-within-wheels view of the vision (fig. 37), the perspective is shifted so that the viewer sees the vision from above, so the wheels are shown within one another. While the cross section of the vision is seen from a terrestrial point of view, the wheel-within-wheels diagrams are envisaged from a celestial perspective, or God's eye view. The terrestrial vision shows the physical description as given in Ezekiel 1, whereas the celestial perspective reveals the spiritual vision of that passage and all which can be interpreted from it. This is further emphasised by the legends in the diagrams.

Fol. 116^r of the *De Rotis* (fig. 37) presents the vision from a spiritually superior and thus timeless perspective, so that multiple moments of time can be expressed simultaneously. This is emphasised by the relation between the Old Testament descriptions of Ezekiel's vision with the New Testament Passion narrative displayed in medallions around the edges of the diagrams. From the top left to right then bottom left to right, they are labelled: *oratio Christi*, *flagellatio*, *crucis portatio*, *resurreccio Christi*, *Marie aparitio* (or *noli me tangere*), *ascensio- Christi*, with the Crucifixion at its centre.⁴³⁴ This perspective not only shows how the wheels are described in Ezekiel 1, but also how the New Testament was understood to be signified within them. This is clarified by the text on the outer rims of the wheels: *figura* and *proprietas*, form and quality. As Henricus intended and as was stated in the incipit of BN 503, the *rotae* show the entirety of scripture.

⁴³⁴ Other examples of typological cycles, particularly those featured in cosmologies, are considered in the next chapter.



Details of the Lion from the wheel-within-wheels (detail of fig. 37, left) and terrestrial vision (detail of fig. 38, right)

The perspectival shift to a bird's eye view of the wheels is emphasised by the depiction of the *animalia* in each corner, which are in this case viewed from above. In the left-hand detail above, the wings of the *animalia* holding the wheels are on their backs and their arms are visible from the top, which in the other images (such as the right detail above) were shown from the side. This feature shows that the wheels are not simply stacked uniformly on top of one another. The feathers representing wings (labelled *penna*, one to four and which intersect at the Crucifixion) and the rims of the wheels covered in eyes (as described in Ezekiel 1:18) emanate from the circle's centre to show the wheels (or at least one of them) on their sides, so that only the rim is visible. The wheels-within-wheels together make a sphere, like the rings of an armillary sphere.⁴³⁵ These comparisons to astronomical instruments are not mere analogies, but demonstrate how the creator of these theological images was faced with the same representational issues as those who illustrated astronomical phenomena, such as in the makers of armillary spheres.

The *animalia* of Opicinus's calendars are more stylistically similar to those in the diagram of the vision as they are in profile, but their engagement with the *rota* is more similar to those of the wheel-within-wheels diagram. They support the circular *currus* from each corner, upon which the

⁴³⁵ See the Zurich bible in n.423 above.

God figure is depicted at the centre, rather than enthroned on top. Opicinus used this visual strategy for the same means as Henricus: to show an atemporal God's eye view of the cosmos. In viewing Opicinus's portolan charts and calendars, one sees space and time from a heavenly and atemporal view, as if from the perspective of God, thus revealing the timeless and spiritual dimension of the physical world. In the case of *Palatinus A*, these are the images of the crucified Christ which emerge from the Easter dates, similar in function to the New Testament scenes which frame the wheel-within-wheels diagrams. The Palatinus contains many instances of wheels-within-wheels.⁴³⁶ Like the wheels-within-wheels which show scriptural interconnection (between Old and New Testaments) in the *De Rotis*, Opicinus's wheels show the interconnection between all the material he included in his cosmologies: mappings of time and space (calendars and portolan charts), properties of the natural world, the cycles of time (to be evaluated in the next chapter) and holy scripture. Opicinus and Henricus used similar visual strategies in order to represent and link multiple sets of information.

Both Henricus and Opicinus explored scripture by rendering it from various perspectives, whether by zooming in and out of details or depicting it in a different spatial or spiritual dimension. It is no surprise, therefore, that they were working in the same intellectual spheres in northern Italy and Avignon and, as this chapter hypothesises, working for the same patron. The Palatinus is also intimately tied with the *De Rotis* as Opicinus's consideration of Ezekiel is informed by the same sources as Henricus's: the patristic commentaries on Ezekiel. The commentaries on Ezekiel, including the *De Rotis*, clarify how and why Opicinus integrated features of Ezekiel into his cosmologies. These commentaries provided Opicinus with the rationale to incorporate scripture, and therefore Christian salvation history, into his drawings of the physical universe.

⁴³⁶ Omitting the oblong wheels, this includes folios 11^r, 12^r, 14^r, 15^r, 27^r and 27^v.

It must be acknowledged, however, that the role of Ezekiel 1 in their respective works was different. Following the scriptural commentaries, Henricus's treatise and its diagrams were structured around the vision, whereas Opicinus rarely cited Ezekiel 1 directly. Other instances in his drawings and journal show that he was certainly aware of the Prophet Ezekiel, as he is mentioned in relation to other Old Testament figures in the text of his journal.⁴³⁷ On folios 64^v and 66^v, for example, Opicinus aligned himself with Moses, Abraham and Ezekiel through his experience of exile.⁴³⁸ Earlier in his journal (fol. 28^v), Opicinus mentioned Ezekiel as one of four Old Testament Prophets (Ezekiel, Isaiah, Jerome and Daniel) whom Opicinus related to other sets of four (the Gospels, the patriarchs of the Eastern Churches, the Doctors of the Church, the orders of canons regular and mendicant orders, and the exegetical methods).⁴³⁹ Despite this, Opicinus did not textually cite Ezekiel 1 in any of his drawings, and the representation of the vision was not so explicit or prominent in the Palatinus as it was in the *De Rotis*. The question therefore remains as to the extent to which Opicinus's drawings were influenced by Ezekiel 1 and its commentators. If they did not play the leading part in his scriptural cosmologies, as they did in the *De Rotis*, then what role did they play?

While Opicinus and Henricus differed in the degree to which they emphasised the wheels of Ezekiel in their works, they both used Ezekiel 1 to visualise the entirety of scripture. As the final part of this chapter shows, the wheels of Ezekiel in medieval visual culture formed part of a

⁴³⁷ This is also apparent in the Palatinus drawings. Roux and Laharie also noted how Opicinus related himself to Ezekiel through details in his autobiographical calendar: '...nous l'avons vu sur la planche autobiographique, un curriculum calqué sur celui d'Ezéchiél'. Roux and Laharie, *Art et folie*, p.302. Opicinus's awareness of the book of Ezekiel is also shown by its brief inclusion in a legend of fol. 5^r of the Palatinus (fig. 32). Here he inserted *Liber ezechielis et prophetorum* in line with the beginning of November in one of his more abstract calendars.

⁴³⁸ Laharie, *Le journal singulier*, 2. Fol. 64^v is translated into French on p.653: 'c'est l'actuelle Lombardie dont les semences permettaient de faire du pain pour alimenter Ezéchiél en Gaule cisalpine; ce qu'il faut comprendre comme un exil ou un transfert'. Fol. 66^v is translated into French on p.675: 'LOMBILIC DE L'EUROPE: De même, que le pape dispose du témoignage de l'homme immortel sans pareil, de même Pavie représente l'ombilic et la matrice de l'Europe toute entière, pour concevoir le fils d'homme (c'est-à-dire le peuple chrétien), jusqu'à Venise qui est la vulve où l'on vient au monde. Partout où il est dit a Ezéchiél: "fils d'homme", il s'agit du peuple chrétien, au nom duquel chaque cure de paroisse est pris comme éclairer de la maison d'Israël. Je dis cela en images: mais, fondamentalement, il s'agit du Christ'.

⁴³⁹ Laharie, *Le journal singulier*, 1, p.273.

multifaceted network of biblical imagery which brought together the numerous instances in scripture in which God was figured in the forms of incarnate mankind and the natural world. Although these images are more often associated with better-known passages, such as the vision of the Apocalypse (Revelation 4, described above in relation to the throne) or the description of the Ark of the Covenant (Exodus 25), the wheels of Ezekiel were also understood to mediate the pattern of divinity. This has been recognised by Herbert Kessler, yet the significance of Ezekiel 1 in medieval biblical iconography, even in his works, has been remarkably undervalued.⁴⁴⁰

The following analysis of fol. 86^r of Opicinus's journal shows how the Church Fathers' interpretation of the wheels of Ezekiel reveals a new dimension of Opicinus's drawings and clarifies his theological rationale, which until now has remained a mystery. Although the sole purpose of this image is not to picture Ezekiel's wheels, the commentaries on Ezekiel 1 provide the key to unlock an interpretation of some of Opicinus's more enigmatic figures.

⁴⁴⁰ H. Kessler, *Spiritual Seeing: Picturing God's Invisibility in Medieval Art* (Pennsylvania, 2000), p.188.

Part Four: The Entirety of Scripture (*Perfecta Sacre Scripture*)

The Wheels of the Gospels in Opicinus's Journal (Fol. 86^r)

On fol. 86^r of his journal (fig. 44), Opicinus depicted the four wheels of the Gospels together in a square and thus in the same basic composition as the vision from a terrestrial view point in the *De Rotis* (figures 38 and 41). Their interconnection (both symbolic and as described in Ezekiel 1) is shown by their overlap or by the lines drawn in between them. In the case of Opicinus's journal, lines are drawn in an X across the centre and two bands containing text connect the outer edges of the wheels. Their interconnection is also emphasised by the network of letters below the image, in which the concordances between the canons are visualised through a network of interconnected letters from the Gospel names.⁴⁴¹

In Opicinus's depiction of the four wheels, they function both as a square of complementary oppositions and as an illustration of the Church.⁴⁴² The four wheels clearly illustrate the four Gospels: the capitalised letters of their names run around their rims (*MATHEVS*, *IOHANNES*, *MARCVS*, *LVCAS*) with an illustration of the relevant animal bust at each wheel's centre with words beneath them denoting a verse from the opening book of each Gospel (Matthew 1:1; John 1:1; Mark 1:1; Luke 1:5). In the bands of the outer rims and in the centre are written various opposing concepts and objects. The legends read: master, student; with end, without end; the additional martyrs, the additional confessors; going from exterior to interior, going from

⁴⁴¹ The letters of the Gospels therefore read: MATHEUSMARCUSLUCASJOHANNES. Opicinus labelled this system thus: *NUMERVS CANONIS CONCORDANTIE, VT QVELIBET LITTERA DEBITA NOMINIBVS TOT EVANGELISTARVM SIT SIGNATA SIGNO CANONIS COMPETENTIS*. Transcribed by Laharie in *Le journal singulier*, 2, p.902.

⁴⁴² For an overview of the different squares of opposition used in the Middle Ages, see Murdoch, *Album of Science*, pp.62-71.

top to bottom; animal I, mortal II, rational III, spiritual IIII; who separates, who unifies; and with beginning, without beginning.⁴⁴³

The composition of the four wheels in relation to the two human figures shows that the diagram is not solely a square of oppositions, but part of a more complex biblical symbol. The image depicts the four wheels of the four Gospels, but Ezekiel is not mentioned in the diagram or its commentary. These wheels are not intended as an illustration of Ezekiel 1, but are directly relevant to the patristic commentaries on the wheels of Ezekiel and their medieval commentators. In the latter, the wheels of Ezekiel became symbolically associated with the Ark of the Covenant. This drawing reveals Opicinus's familiarity with the medieval commentators such as Walahfrid Strabo (a Benedictine monk, c. 808-49) and Honorius Augustodunensis (1080-1154), whose texts Dow showed can be traced back to the commentary of Jerome.⁴⁴⁴ In reference to the description of the Ark of the Covenant in Exodus 25, Honorius described the symbol of the Ark as being made of four rings which symbolised the four Gospels, as in Opicinus's journal.⁴⁴⁵ This built on the *Exposition of the Gospel* of Walahfrid Strabo, who likened the four Evangelists to the four golden circles which held the carrying poles of the Ark of the Covenant bearing the tablets of the Law. According to this, the Christian people carried the Ark of the Covenant, representing the Gospels, to protect the Church from heresy.⁴⁴⁶ This simultaneously referred to Exodus and Ezekiel.

⁴⁴³ MAGISTRI, DISCIPVLI; *sine fine, cum fine*; MARTIRES *suppletui*, CONFESSORES *suppletui*; *exteriorum ex interioribus, infimorum ex summis*; animalis I, mortalis II, rationalis III, spiritualis IIII; DISCRETIVI, CONIVNCTIVI; *cum principio, sine principio*. These are the legends of oppositions included in the image. Laharie also transcribed the longer phrases of opposition. See Laharie, *Le journal singulier*, 2, pp.900-03.

⁴⁴⁴ Dow, 'The Rose-Window,' p.274.

⁴⁴⁵ Exod. 25: 12, 16: '12And thou shalt cast four rings of gold for it, and put them in the four corners thereof; and two rings shall be on the one side of it, and two rings on the other side of it...16 And thou shalt put into the ark the testimony which I shall give thee'. Dow, 'The Rose-Window,' p.278.

⁴⁴⁶ Dow, 'The Rose-Window,' p.278. BAV, MS Pat. Lat. 114, fol. 862.

That Opicinus intended to refer to this symbol of the Ark is corroborated by the allegorical figures in the drawing which, when considered in relation to these commentaries, show that fol. 86^r signified the relationship between the Church, the Christian people and scripture. At the centre, the Christian people/person (labelled *populus* and *persona*) carry poles attached to the four rings of scripture, in front of an image of a woman in a mantle who signifies *Ecclesia*. The identification of the personifications is clarified by Opicinus's explanation at the base of the page. He described the figure of Christ (visually identified by his crossed nimbus) as both the Son of Man and the Christian community (*Ecce filius hominis et populus Christianus*), who are in the belly of the Church, like the child in the breast of its mother.⁴⁴⁷ This reflects the placement of the small *populus* figure over the stomach of *Ecclesia*. In this image, Christ and the Christian people use scripture as a shield to defend the Church.

Still, this is not the full extent of the image's meaning. Hildegard of Bingen's commentary on Ezekiel (specifically concerning the *animalia* and wheels-within-wheels) reveals yet another layer of the image. In letter 84R, she suggested that the wheels-within-wheels symbolised the eternity of virginity, which was *sine initio et sine fine*. This same phrase (frequently found in commentaries on John's Gospel) appears within the top and bottom sides of the bands between the wheels of Opicinus's drawing.⁴⁴⁸ The legend at the top right of the image (of which not all is still visible), *a sinistris integra confessione castita*, shows that the phrase is intended to be associated with chastity.⁴⁴⁹ This also seems to refer to the hidden *Ecclesia* figure in her habit behind the wheels.

⁴⁴⁷ *populus christianus in uentre Ecclesie quasi infans in utero matris*. Transcribed in Laharie, *Le journal singulier*, 2, p.902.

⁴⁴⁸ *Virginitas quippe uetera suffert et noua sustinet, et ipsa radix et fundamentum est omnium bonorum, quia semper et semper cum illo fuit qui sine initio et sine fine est*. Kienzle and Stevens, 'Intertextuality in Hildegard's Works,' p.142, n.26.

⁴⁴⁹ Opicinus and Hildegard differ in the details of their content, but they share the same sources and method of interpretation. Kienzle and Stevens have demonstrated how Hildegard drew heavily on the wheels of Ezekiel in her writings. Like Opicinus, she enhanced her claim to prophetic authority by establishing a link between herself and the prophet in her *Scivias*, *Liber vite meritorum*, *Liber diuinorum operum*, and her exegesis on the wheel-within-wheels. Kienzle and Stevens, 'Intertextuality in Hildegard's Works,' pp.137-39. Another point of similarity is their use of the *animalia* as symbols by which to align groups of four. Hildegard, for example, connected them topologically to a societal hierarchy in letter 84R. She argued here that the lion represented the monks, the calf the priests, the man the secular people with good intentions, and the eagle the secular people who repent. For an instance in which Opicinus does so, see the Vaticanus, fol. 43^v (translated in Laharie, *Le journal singulier*, 1, p.425). Hildegard's writings on Ezekiel

To explain the overlap between Opicinus's and Hildegard's interpretations, one must again return to the patristic commentaries on Ezekiel. St Ambrose's moral interpretation of Ezekiel 1:15 in *De virginitate*, *De spiritu sancto*, and *Expositio psalmi 118* presented the wheels as indicators of the unity of the two Testaments. Ambrose, as well as other exegetes, implied that the phrase *sine initio et sine fine* expressed the notion that the wheel represented eternity. Ambrose's *De virginitate* allegorised the wheel as the body. He claimed that the wheel touching the ground was the body suited for a life of virtue based on the Gospel, and that the wheel within the wheel was the life of the saints who moved towards eternity while still in the body.⁴⁵⁰ The connection between the body, virginity, and the wheels of Ezekiel was recognised in medieval patristic literature. The wheels here are just one component of a multivalent symbol which represented the relation between scripture, the Church, the Christian people, and the body.

The role of Ezekiel's wheels and their symbolic potential in this drawing is not immediately obvious, which could give the impression that the role of Ezekiel's vision was minimal in its rendering. This is not the case. In comparison to Henricus, Opicinus was less concerned with making a literal image of the vision according to its biblical description, and more with relating to the patristic tradition (later disseminated and augmented by medieval commentators) in which the wheels signified the whole of the bible. This is apparent in other drawings in which the wheels of Ezekiel are used as the foundational structure of cosmological diagrams, such as those of Joachim of Fiore and Hildegard of Bingen. It is not possible to conclude with any conviction whether Opicinus was aware of Joachim or Hildegard's drawings, or their use of the wheels. One can, however, be certain that they, together with Henricus de Carreto, each drew upon the same tradition of commentaries on Ezekiel. Without consulting the commentaries on Ezekiel and the

as well as her allegorical cosmologies manifest similarities with Opicinus, although as is argued in this chapter, this can be explained by their common use of patristic texts rather than by a direct relation between them.

⁴⁵⁰ Kienzle and Stevens, 'Intertextuality in Hildegard's Works,' p.154.

features of the *De Rotis*, these meanings would remain lost within a complex and multivalent network of symbols.

The Construction of the Truth through the Wheels

The potential of wheels-within-wheels to express multiple meanings made them an appropriate foundation upon which to represent the entirety of scripture. But what was the purpose of capturing all of scripture in one image or symbol? It has been argued by Kessler that according to patristic authors, the validity of these images to all moments in time and space rendered them universal images of truth. He pointed to the illuminated *Majestas Domini* in Romanesque manuscripts and other media, in which the enthroned deity was surrounded by the four Evangelists.⁴⁵¹ These images, he argued, ‘distill distinctive points from each book and tie them to the message of all Scripture’.⁴⁵² The *Majestas Domini* also featured in many of Opicinus’s and Henricus’s diagrams, including the main subject of this thesis, *Palatinus A*.

Kessler explained how Jerome's commentaries on Ezekiel cited the fours, including the wheels of Ezekiel’s vision (in addition to the rivers of paradise, the corners of the Ark and its rings, and the *animalia*) in order to vindicate the authenticity of the Gospels by aligning ‘various visible things described in the Old Testament which figure the unity of scripture derived from the eternal and invisible God’.⁴⁵³ This, Kessler argued, was embodied in the *Majestas Domini*. The four

⁴⁵¹ Kessler used the depiction of Christ in the Gospel book of Abess Hitda from Cologne (c. 1000, Darmstadt, Universitäts- und Landesbibliothek, Cod. 1640, folios 6^v-7^r) as his case study. On the verso of the depiction of the *Majestas Domini* is written *Hoc visibile imaginatum figurat illud invisibile veru(m), cuius splendor penetrat mundu(m), cum bis binis candelabris, ipsius novi sermonis*, which he translated as ‘The visible product of the imagination represents the invisible truth, whose splendour penetrates the world through the two-times-two lights of the new doctrine’. H. L. Kessler, ‘“Hoc Visibile Imaginatum Figurat Illud Invisibile Verum”: Imagining God in Pictures of Christ,’ in *Seeing the Invisible in Late Antiquity and the Early Middle Ages: Papers from “Verbal and Pictorial Imaging: Representing and Accessing Experience of the Invisible, 400-1000” (Utrecht, 11-13 December)* (Turnhout, 2003), pp.291-325, p.292.

⁴⁵² Kessler, *Spiritual Seeing*, p.188.

⁴⁵³ Kessler, ‘Imagining God in Pictures of Christ,’ p.292.

Gospels framing the enthroned God embodied a single truth, the events of which were 'merely realizations in time and place- "histories", as Jerome put it, which "construct truth"'.⁴⁵⁴ The vision of Ezekiel was just one instance of the *Majestas Domini*, an image in which God was made visible. This representation which could embody and express all moments in time was therefore a strategy, derived from patristic texts, to picture the essence of reality which Jerome defined as 'truth'.

The intention to express the totality of scripture is an extension of what Opicinus attempted with his depictions of time and space: to combine all information possible (all of time, all of space and all of God) in the most truthful and accurate way into a single image. By including the figures in which time and space were measured in addition to the timeless representations of God and Christian history, Opicinus's diagrams became universally valid. The depiction of all of scripture is therefore another feature of the category of diagrams, or image-instruments, which is discussed throughout this thesis and that was of particular interest at the Avignon court.

Conclusion

Illustrations of the vision of Ezekiel have been greatly underappreciated in the history of art, despite being an important component of the multivalent biblical iconography which the medieval viewer used to visualise God. This chapter has shown that it was of particular significance at the Avignonese papal court, as demonstrated by the works of Henricus and Opicinus. Each level of visual comparison between the diagrams of the *De Rotis* and the

⁴⁵⁴ Ibid., p.292.

Palatinus, including their style, iconography and meaning, reveals a different aspect of their relationship.

The form and style of BN 503 can be identified as the product of a collaboration between Henricus and a French illuminator, most likely the *Queste* master, indicative of patronage more closely associated to Pope John XXII than to Cardinal Stefaneschi. The *De Rotis* may not have included the latest portolan charts or calendars, but Henricus represented space in a highly sophisticated way, as shown by his three- and four-dimensional depictions of the vision. In terms of his contribution to the research at the court, he provided the most profound visual resource on scripture which has survived. This suggests that such a novel category of diagrams, or image-instruments, was of specific interest to Pope John, which in turn lends weight to the supposition that Opicinus tailored his drawings, in both content and form, to John's theological interests.

The *De Rotis* has provided the key to identify certain iconographic features of Opicinus's drawings, while leading back to the patristic and earlier medieval commentaries on Ezekiel 1 which reveal more fully how and why Opicinus integrated these features within his cosmologies. It was not his intention to accurately illustrate Ezekiel's vision, but instead to use certain iconographic features from the *De Rotis* to make multifaceted biblical symbols. This discovery is only the beginning of what can be found from their comparison. Only the first eight images of the *De Rotis* have been considered here, leaving a plethora of diagrams (following book six) virtually untouched.⁴⁵⁵

⁴⁵⁵ These have great potential for the interpretation of the civic content of Opicinus's drawings. For example, fol. 259^r of the *De Rotis* features reflective pyramids of figures which categorise communities as earthy, terrestrial, gentiles, Jews and converts, to make ethical commentaries on cities and societies (see Stones, *French Gothic Manuscripts, Part 2*, 1, p.147 for a description of these images). This surely relates to Opicinus's interest and pride in Pavia and his own symmetrical ecclesiastical hierarchies of the monastic orders. Just as the patristic commentaries unlocked multiple layers of interpretation in Opicinus's images above, the *De Rotis* and its related commentaries may hold the key to a fuller comprehension of the civic content of Opicinus's drawings.

The Church Fathers and their medieval commentators associated the wheels of Ezekiel with the rest of scripture and the features of the physical world. They presented the wheels-within-wheels of Ezekiel 1 as structures by which multiple sets of information could be amalgamated and meaningfully aligned, as in the volvelles of Llull discussed above. The commentaries explain the rationale behind Opicinus's integration of the entirety of scripture, and thus all of biblical time, into his renderings of the physical world. By combining all the most recent forms of time, space and scripture into one image, Opicinus attempted to present the physical and spiritual worlds together as a single truth.

Chapter Five: The Harmony of Time:

The Alignment of the Medieval Present with the Christian Past

The Categorisation of Time in the Middle Ages

Many modern scholars have attempted to categorise 'medieval time'. The ways in which time was categorised and measured in practice varied between period and place, as well as between the different sectors and classes of society.⁴⁵⁶ Le Goff, for example, in 'Au Moyen Âge: temps de l'Église et temps du marchand' (1960), organised the numerous types under three headings: Christian time, merchant time and Church time.⁴⁵⁷ The fourteenth century was particularly complex with regard to the multiple systems by which time was measured. The development of the mechanical clock introduced a new, precise way of keeping time and so the time of day could then be measured in twenty-four equal hours, forming the foundation of our current system of time reckoning.

The multiple time systems presented in the *Palatinus* drawings not only reflect the multifarious understandings of time in the Middle Ages, but also express the temporal flux of the fourteenth century in which these various systems coexisted. The previous chapters have looked at how Opicinus represented assorted categories of time, liturgical, astronomical, and biblical, in *Palatinus A*. This chapter widens the scope to evaluate how he used the liturgical calendar in his other drawings as a way to explore the complexities of time on larger and smaller scales. Aligned with many of the calendar rings, Opicinus inserted units of time from different systems of measurement so that in addition to the year, the cycles represented the day, the week, the human life span, and the history of humankind and of the world. This chapter shows how the calendar

⁴⁵⁶ A. Gurevich, *Categories of Medieval Culture* [1972], transl. G. L. Campbell (London, 1985), p.34.

⁴⁵⁷ Le Goff, 'Au Moyen Âge,' see n.260 above.

provided a framework through which Opicinus brought together the various and complex understandings of time which were discussed in the previous chapters.

Starting with the microscopic details of the calendar, the scope of this chapter gradually broadens to Opicinus's macroscopic representations of world history. Part one explains how he dissected the microscopic details of the liturgical calendar in what are referred to as his 'magnifications' (figures 45a, 45b, 46a, 46b, 48a and 48b), in order to show how different units of time interrelated.

Part two then evaluates how he situated these within his macroscopic representations of time which illustrate the world's progression from beginning to end. The zooming in and out of his perspective demonstrates his understanding of microcosm and macrocosm: an ancient theory, which resurfaced in the Middle Ages, that the same structures and patterns were to be found in physical beings of vastly different scales.⁴⁵⁸ According to this perspective, man could be seen as a microcosm of the universe. Whereas Whittington, in his focus on body worlds, considered this concept in relation to Opicinus's use of the zodiac man and thus the micro- and macro-scopic understanding of bodies, this chapter looks at Opicinus's micro- and macro-scopic representations of time.⁴⁵⁹ This part concludes by looking at how Opicinus integrated the events of the fourteenth century, specifically those concerning the Avignon papacy, into his macroscopic depictions of time.

Finally, part three considers one of the last Palatinus drawings to evaluate how time could be shaped in a way that was specific to the fourteenth century and how Opicinus integrated 'clock time' within his drawings. Together these parts show how Opicinus, through his meaningful

⁴⁵⁸ F. Saxl, 'Macrocosm and Microcosm in Medieval Pictures,' *Lectures*, Vol. 1 (London, 1957), pp.58-72, p.58.

⁴⁵⁹ Whittington discussed the relevance of the zodiac man to the Palatinus in *Body-Worlds*, pp.119-21, 128.

alignment of the various and detailed temporal systems of the past, present and future, created novel images of a singular, ordered, and holistic universe.

The contextualisation of the drawings reveals distinct circles of culture from which Opicinus drew his ideas about time, which are treated here in their chronological order: from early-medieval *computus* manuscripts; to twelfth- and thirteenth-century cosmological drawings; to the new ways of thinking about and measuring time which emerged in the fourteenth century. Opicinus was clearly influenced by previous traditions of time visualisation, yet certain features of his drawings reveal that he was responding to new forms of time, such as ‘clock time’, as well as new questions about time in relation to the history of the world, which were being posed at the Avignon court. In response to these questions he, like his predecessors, made visual tools. Through the creation of his image-instruments, Opicinus imagined unique forms into which he incorporated earlier ideas while presenting a partially new understanding of time.

Part One: Microscopic Time

The Magnification of the Calendar (Fol. 25^r)

There are three magnifications in the *Palatinus*: in folios 25^r, 24^v and 13^v. From a close inspection, one can see how Opicinus used this visual component to dissect the minutiae of the liturgical calendar and to connect the units of the hours and weekdays with New Testament events. Fol. 25^r (fig. 45) is a magnified detail of the inner calendar of *Palatinus A*. The relationship between the two drawings (figures 1 and 45) is accentuated by the striking similarity of the seated symmetrical figures at their centres.⁴⁶⁰ In each case, the figure's arms reach out to the edge of the calendar, their heads lightly touching the top and their feet protruding downwards into the lower semi-circle yet not quite reaching its edge. The augmentation of the movable calendar in fol. 25^r allowed Opicinus to insert more detailed calendrical information into these semi-circles (figures 45a and 45b), which are each drawn to frame a seven-day arc of the calendar ring. Opicinus drew red lines outwards from each day (labelled by the dominical letters (from b through to a)). Each line fans out to the edge of the semi-circle, where additional material is inserted. The outer end of each line is again labelled with the dominical letter but in a larger size, as if Opicinus had placed a magnifying glass over the arc of the calendar. For this reason these semi-circles are referred to as his magnifications.⁴⁶¹

The magnification of the hebdomad of the *temporale* emphasises the significance of this week while allowing the dissection and interpretation of the smaller units of time of the annual calendar. In each magnification, the days of the week, canonical hours, qualities and letters of the

⁴⁶⁰ Both calendars visually emphasise the Easter week through the uppermost and lowermost arcs: through the Crucifixions in *Palatinus A* and the magnifications of fol. 25^r.

⁴⁶¹ The function of this term is for clarity and does not imply that Opicinus used a magnifying glass. It would, however, have been possible, as magnifying glasses were used from the 13th century, as shown by Roger Bacon's description of their properties from that time. H. King, *The History of the Telescope* (Dover, 2003), p.27.

name of Christ, and names of the apostles and tribes of Israel are aligned in order to expose the interconnectedness of present liturgical time with the past of holy scripture, which is calculated through the *temporale*.

Before understanding how Opicinus visualised these connections, it is necessary to know exactly what information he aligned and why. If one was to judge why he chose to magnify this particular set of seven days, it would not be immediately apparent from the selection of the feast dates alone (written in the *temporale* dial system). It could have been expected that the week Opicinus fixated upon would be Easter Week: the culmination of the Christian year. Yet although the focus was on the Easter period, Easter Sunday does not in fact fall within the chosen days. However, this is not significant as the precise date of Easter was not fixed; and Opicinus appears to have highlighted this particular week in order to make the drawing as symmetrical as possible. This can be observed from the vertical line drawn through the centre of the circle which was used to assure the symmetry of the figure's face and which runs through the central day-letter, 'e' (*Feria quinta*, Thursday) of the magnified week. The two sets of seven days were identified because they are found on the uppermost and lowermost arcs of the calendar, which indicates that the decision was based on the visual aspects of the calendar.

The magnifications (figures 45a and 45b) contain temporal units of the day and week. To one not familiar with the medieval liturgical calendar, the order of the content might seem initially nonsensical. The units of the weekdays and hours do not run in the same direction (see fig. 45c): the *feriae* run anti-clockwise whereas the hours run clockwise. Each progress outwards and downwards from the top of the uppermost magnification and into the lower magnification. The cycle does not then continue into the other side of the circle, but upon reaching the bottom point returns again to the uppermost point.

The days of the week, or *feriae*, are consistent with the dominical letters of the indicated week and run down the left side from the top: *Feria quinta* (e), *Feria sexta* (f), *Sabbatum* (g), *Dominica* (a), *Feria secunda* (b), *Feria tertia* (c) and *Feria quarta* (d). On the right side of the magnification are the canonical hours in red which, starting from the top, are: *laudes*, *hora prima*, *hora tertia*, *hora sexta*, *hora nona*, *vespera*, *completorium* and *matutine*. The canonical hours are the units of the time of day used to order the Divine Office. They were established by the sixth-century Rule of St Benedict (c. 480-543) and were reckoned in relation to the unequal hours, which were governed by the duration of daylight. The magnifications thus consist of a cycle of one week proceeding counter-clockwise, and of one day, running clockwise. In addition to this confusion, the two sets of information do not share an obvious starting point according to our modern organisation of time, in which Sunday or Monday marks the beginning of the week. In addition, the canonical hours start at the very top with *laudes*, rather than the more usual matins, and the *feriae* start with *Feria quinta* (Thursday).

The rationale behind the organisation of the magnifications is elucidated by contemporary liturgical books in which the week days and canonical hours were made to correspond. These books often contained a liturgical calendar followed by a set of prayers called the Hours of the Cross, in which each of the canonical hours was aligned with an event from the Passion.⁴⁶² Opicinus was clearly aware of this as he aligned the weekdays, hours, and names of the apostles in order to illustrate this established connection. For example, at the very bottom of fol. 25^r is matins, which according to the Office of the Passion corresponds to the Betrayal. In the biblical narrative of the Passion, this happened on a Thursday (g; *Feria quinta*) upon which Christ was

⁴⁶² The most conventional alignments were: Matins: Betrayal; Prime: Christ before Pilate (or Christ mocked, Flagellation); Terce: Flagellation (or Christ crowned with thorns, Christ buffeted, Christ carrying the cross); Sext: Christ carrying the cross (or nailed to cross, Crucifixion); Nones: Crucifixion; Vespers: Deposition; and Compline: Entombment. As this draws on multiple sources, there is some overlap between the events and the hours (the Flagellation, for example). The parentheses are therefore used to indicate the less commonly used iconographic motifs. R. Wieck, *The Book of Hours in Medieval Art and Life* (London, 1988), p.90.

betrayed by Judas in the Garden of Gethsemane. The inclusion of this event indicates that the seven weekdays of the magnification represent Holy Week.

It can therefore be no coincidence that the names of the apostles and tribes of Israel connected with this set, although vertically aligned with both magnifications (see fig. 45c), are connected to the Betrayal. The names, moving vertically from the bottom, are written: *Judas*, *Mathheus*, *Jacobus Justus* and *Joseph*. The four names together reference the suicide of Judas and his replacement according to Acts 1: 22-6. Opicinus purposefully tweaked what is meant to be the tribe of *Judab* to *Judas* to fit this alignment. Matthias was chosen as the twelfth apostle,⁴⁶³ and Joseph Justus (a combination of the two written names *Joseph* and *Jacobus Justus*) was the other man nominated to take Judas's place according to Acts 1:23: 'And they appointed two, Joseph, called Barsabas, who was surnamed Justus, and Matthias'.⁴⁶⁴ This alignment reveals the interconnection of Christ's Passion with the liturgy and therefore the interconnection of past and present. In this instance, both the *horae* and the *feriae* coincide with the cycle of biblical names to show the complex interweaving of the liturgical calendar and its mirroring of the New Testament past as recorded in scripture.

The significance of the Passion events to the magnification is further emphasised by the centrality of the large, Christ-like figure. Red lines emanate from his head and feet, showing him to be Christ incarnate. The red lines which emanate from his head constitute a crown-like structure, upon which the Gifts of the Holy Spirit are (twice) written: *Consilium*, *Robur*, *Intellectus*, *Sapientia*, *Timor*, *Utilis pietas* and *Scientia*. Opicinus used less common synonyms of the Gifts in

⁴⁶³ This form of word play, in which Opicinus associated names and passages which are seemingly unconnected but sound similar to one another (in this case, Mattheus and Matthias), is a common feature in Opicinus's texts. See n.301 above for an example.

⁴⁶⁴ *Et statuerunt duos Ioseph qui vocabatur Barsabban qui cognominatus est Iustus et Matthiam*. The thematic relevance of sin and retribution to this particular Passion event may reveal a glimpse into Opicinus's personal motivations and anxieties, but an evaluation of such is out of the scope of this project.

order that their initial letters (written in a different colour from the rest of the word for emphasis) spelled *CRISTUS*.⁴⁶⁵ Salomon noted that this method of interpretation was not unique to Opicinus, but a standard example of Notarikon: the method of forming a sentence from a word, by ascribing to each letter a separate word beginning with that letter.⁴⁶⁶ In addition, Salomon identified three legends written in the rims of the magnifications which he interpreted as a common form of name mysticism (*gewöhnlicher Namenmystik*). Through these Opicinus drew a connection between the seven Gifts of the Holy Spirit and the three gifts offered to Christ during the Adoration of the Magi: *aurum, thus* and *myrrham*.⁴⁶⁷

These Christological elements within the magnifications of fol. 25^r, such as the Gifts of the Holy Spirit and biblical names, are seemingly less concerned with time measurement than those described above. Yet they are centred on a specifically Christological reading of the calendar which perceived the numerological features of biblical names and the qualities of Christ to be as significant to the calendar as the astronomical data used to quantify it. Within the semi-circular magnification of the calendar Opicinus meaningfully aligned the days of the week (*feriae* and dominical days), the canonical hours, certain names of the apostles, the seven Gifts of the Holy Spirit and the three gifts of the Adoration in order to illustrate what this magnified sector of the calendar revealed about *CRISTUS*.

The magnification is complicated and detailed but, contextualised within the medieval understanding of the calendar, the rationale for the connections Opicinus made can be logically

⁴⁶⁵ *Robur* is most often *fortitudo*, and *utilis pietas*, simply *pietas*. D. Patte, *The Cambridge Dictionary of Christianity* (Cambridge, 2010), p.459.

⁴⁶⁶ Salomon, *Weltbild und Bekenntnisse*, p.285; S. Steinmetz, *The Dictionary of Jewish Usage: A Guide to the Use of Jewish Terms* (New Jersey, 2005), pp.127-29.

⁴⁶⁷ Salomon transcribed the three legends as *Cris quasi crisis id est aurum, Tus id est incensum*, and *Compositio mirree unctionis*. He believed they were derived from Matthew 2:11: *obtulerunt ei munera: aurum, thus et myrrham*. Salomon argued *unctionis* to be a reference to the seven Gifts of the Holy Spirit. For example, John Balbi's Latin dictionary, the *Catholicon* (1286), reads *Christ ... qui fuit et chrismate unctus id est septem spiritus sancti plenarie delibitus*. Salomon, *Weltbild und Bekenntnisse*, p.286.

followed through its close reading. Although the way in which Opicinus visualised these connections is unique, the ideas he expressed were not. His method of calendrical exegesis belongs to a traditional understanding of the calendar which had been established in *computus* manuscripts long before. Bede's *De temporum ratione* is an eighth-century text in which the calendar is explained according to *computus* (the detailed astronomical principles which governed calendrical reckoning) in order to bring out its significance to the Christian view of the cosmos. One can be certain that Opicinus was aware of Bede's text as, in addition to its general popularity throughout the Middle Ages, many copies are recorded in the fourteenth-century papal libraries.⁴⁶⁸

In Bede's allegorical interpretation of the calendar in chapter sixty-four, he beseeched the reader to trust in the sevenfold Gifts of the Holy Spirit, and he used the number seven to align these to the week, to the Easter season and to Genesis (according to which God made the world in six days and rested on the seventh). Bede proposed that the significance of the number seven came from the seven days of the moon (or 'lunar days') as they 'openly proclaim the universality of the Church which throughout all the world is redeemed by the Paschal mysteries. For Scripture often denotes universality by the number seven'.⁴⁶⁹ For Bede, the calendar offered a numerical basis by which to interpret the paschal mysteries and thereby come to a true comprehension of scripture. Through its understanding, the grace of mankind could be restored. Bede continued to justify this method of calendrical exegesis by arguing that one must experience and remember Christ's age 'in this present time for Christ's sake, and in the hope of our future resurrection in Christ'.⁴⁷⁰

⁴⁶⁸ Faucon, *La librairie des papes d'Avignon*, 1: pp.34, 122-23; 2: p.102.

⁴⁶⁹ Bede: *The Reckoning of Time*, transl. F. Wallis (Liverpool, 1988; repr. 2004), p.153. Bede cited Augustine for the final part of this statement.

⁴⁷⁰ Ibid., p.155.

The magnification illustrates these same attitudes towards time, by which the calendar was used as a source of numerological (and in Opicinus's case, visual) interpretation in order to align astronomical, Christological and present liturgical time. This is not to say that his drawings are meant as a direct illustration of Bede's ideas, but instead that Opicinus shared a common method with Bede and the authors of the *computus*: to integrate time reckoning with biblical history in order to illustrate an explicitly Christian time.⁴⁷¹

Up until this point, one could have argued that Opicinus's understanding of the events of the Passion in relation to the liturgical present could have been derived either from *computus* or from liturgical books, in which the *horae*, *feriae* and liturgical feasts were used to celebrate the events of Christ's life in daily, weekly and annual cycles. Yet certain common features in Bede and the other iterations of Opicinus's magnifications, namely the ages of man and the world, show that he was more concerned with the history of the cosmos. This was not addressed in liturgical books but in *computus*. The *De temporum ratione* was cosmological in scope. It not only theorised the relation between the present and the age of Christ, but also the history of the universe since the Creation.⁴⁷² The other magnifications of the Palatinus show how Opicinus, too, situated the microscopic understanding of time within his larger macrocosms, thus aligning temporal units of the hours, the ages of the world and everything in between.

Before moving on, a word about the way in which this thesis refers to *computus* is necessary. Many surviving sources can tell us about the medieval perception of time, including histories, chronicles, hagiographies, business documents, letters, tracts, and poetry. Yet as demonstrated above, Opicinus's calendars show an ordering of time which was both cosmological in scope and concerned with the minutiae of astronomical calculation that is immediately traceable to *computus*,

⁴⁷¹ Ibid., p.lxvii.

⁴⁷² Bede's cosmological scope was well summarised by Wallis: 'In fusing computus and cosmology, Bede re-envisioned time in a theological light, encompassing both liturgy and providential history'. Ibid., p.lxvii.

illustrated clearly in the *De temporum ratione*. The concepts which underpin *computus* are central to Opicinus's drawings and therefore to their understanding. Yet one must be careful in evaluating the role that medieval *computus* played in Opicinus's visualisation of time, as it has previously caused more confusion than clarification.

The manuscript tradition of *computus* has been described in a variety of ways: a 'rolling snowball',⁴⁷³ an 'umbrella subject for general knowledge on the universe',⁴⁷⁴ and 'filing cabinets' for fragments of ancient science related to time.⁴⁷⁵ This emphasises an issue fundamental to the understanding of *computus*: it is nearly impossible to define on the basis of the various information contained in *computus* manuscripts, as their subjects were diverse and changed over time. Past interpreters have attempted to prove Opicinus's familiarity with the genre by identifying common elements with selected images in various Carolingian *computus* manuscripts.⁴⁷⁶ Numerous visual and textual motifs can be found in the Palatinus, including the diagrams of Christian and papal genealogy, lunar-zodiac tables, and illustrations of the ages of man and the world and the cosmology of Macrobius, which echo features also found in this earlier material.⁴⁷⁷ This is useful in demonstrating that Opicinus was in contact with this cosmological tradition, but the diversity of these themes, many of which were distinct from

⁴⁷³ C. Jones, *Saints' Lives and Chronicles in Early England* (New York, 1947), p.7.

⁴⁷⁴ I. Dobcheva, 'The Umbrella of Carolingian Computus,' in *La compilación del saber en la edad media*, ed. M. José Muñoz, P. Cañizares and C. Martín (Turnhout, 2013), pp.211-29, p.228.

⁴⁷⁵ Bede: *The Reckoning of Time*, p.xxii.

⁴⁷⁶ For example, previous interpreters of Opicinus have considered the cosmological diagrams found in *computus* manuscripts as a comparative source and have most often cited Byrhtferth's diamond-shaped cosmological diagram (Oxford, St Johns College MS 17, fol. 7v) and its visual similarity to fol. 26r of the Palatinus. For the most recent discussion of Opicinus in relation to St Johns College, MS 17 and a brief bibliography, see Whittington, *Body-Worlds*, p.113.

⁴⁷⁷ Macrobius's early-5th-century commentary on Cicero's *Dream of Scipio* was a common source of Neoplatonic cosmology and philosophy in the Middle Ages. A. Peden, 'Macrobius' in *Medieval Science, Technology and Medicine: An Encyclopedia*, ed. T. Glick, S. Livesey and F. Wallis (London, 2005), pp.317-18. It is an example of a text that was not conceived as part of *computus* but which became closely associated with the tradition as it provided an astronomical background for its understanding (in addition to many other things, including arithmetical theory and the study of the abacus and music). Opicinus was clearly aware of Macrobius's commentary, as shown by the direct references he made to it in his journal: in the text on fol. 46v and in the drawing on fol. 69r. The latter was the subject of Roux's study of Opicinus's use of Macrobius. Roux, 'Opicinus de Canistris, le Songe de Scipion et son *Commentaire* par Macrobe,' pp.271-85.

computus, problematises their identification as *computus* materials.⁴⁷⁸ When *computus* is mentioned in this chapter, it is not in reference to specific instances or images in the manuscript tradition but to the conceptions of time which underlie that tradition, as it was first expressed by Bede.

⁴⁷⁸ These issues are reflected in Whittington's description of *computus*, in which he conceived it to be a manuscript tradition which included cosmology, chronology, numerology and exegesis, and often contained 'a diagram of the seasons, equinoxes and solstices; a diagram of planetary orbits; drawings showing the phases of the moon; various calendars; a wind rota, a tidal rota, and a table or rota with the zodiac'. Whittington, *Body-Worlds*, p.119. The Palatinus drawings in fact contain even more computistical information than Whittington lists, if one were to take Edson's list (which follows) of the content of early (approximately 9th- to 12th- century) *computus* manuscripts as indicative: the *annus communis* (seasons, equinoxes, solstices and cardinal directions); the *annus-mundus-homo* (includes the seasons, elements, the qualities associated with those elements; the humours and the ages of man); the concentric orbits of planets with periods of revolution and, in some cases, corresponding musical intervals according to Pythagorean theory; the phases of the moon; the wheel of the months; the *borologium viatorum* portraying the length of a man's shadow at different hours during the day and on different days of the year; the sphere of Pythagoras (a diagram that was used to predict whether an ill person would live or die); wind rotas; tidal rotas; an Isidorian zone diagram; a consanguinity diagram; the solstices and equinoxes; and a zodiac rota. See Edson, 'World Maps and Easter Tables,' p.41. This led Whittington to refer to the influence of *computus* and cosmology on Opicinus almost interchangeably. The identification of these materials as computistical is not incorrect, but this method is not useful to define how Opicinus used *computus* in his own works.

Part Two: Macroscopic Time

The Ages of Man and the Ages of the World

Opicinus situated his magnifications within his macroscopic systems, where the smaller units of time were aligned with the larger, including the ages of man and ages of the world. The organisation of the magnifications of fol. 25^r was not an impromptu experiment or spontaneous brainstorm, but complex and deliberate. Opicinus clearly perceived it to be a successful alignment, as he repeated this cycle of units within other Palatinus drawings: in folios 24^v (fig. 46), 6^r (fig. 47), and 13^v (fig. 48). Each is distinct from fol. 25^r's model in a different way, yet they all situate their magnifications within a much larger world view. The magnifications of fol. 24^v, however, are an anomaly, as they are not attached to a calendar and so are not treated here.⁴⁷⁹ Like fol. 25^r, the other two cycles are attached to a calendar ring and are therefore more useful indicators of how Opicinus connected the various categories of time. By looking at how Opicinus incorporated his microscopic systems into the macroscopic frame, it becomes apparent that his drawings relate to a twelfth-century tradition of shaping history, in which the liturgical calendar occupied a prominent position.

The analysis of the time cycle of fol. 6^v and in the magnification of fol. 13^v shows how Opicinus, through his inclusion of the ages of man and the ages of the world, envisaged the place of the liturgical calendar within his broader conception of the history of the cosmos. Fol. 6^v contains the same temporal units as fol. 25^r but they are integrated with the ages of the world and placed around a portolan chart framed by a calendar. The semi-circular magnification structure is not

⁴⁷⁹ The red lines emanate instead from the heads and hearts of the figures which together form an ecclesiastical hierarchy, which Salomon argued 'enthält den Versuch einer konkreten Darstellung des Verhältnisses von Gottheit, Welt, Kirche und Christenheit'. The abbreviations of many of the labels of this magnification (apart from *Feria quinta*, *Feria secunda* and *hora prima*, Opicinus states only numbers, omitting the *feria* and *hora*) show that it is probably a later iteration of the magnification in fol. 25^r, and therefore repurposed to fit within the accompanying hierarchy.

used here. Instead, the temporal units which appeared in fol. 25^r (the canonical hours and week days) are written around the entire calendar in the same order and directions as in fol. 25^r (see fig. 47a). In addition to these two cycles, the ages of man are also included on the right side of the drawing, running anti-clockwise. This set was probably included as an additional temporal heptad, as man's life is here divided into seven stages (beginning in the bottom right corner): *infantia, pueritia, adolescentia, juvenus, senectus, senium* and (at the bottom of the drawing) *decrepitas etas*.

In the light of a contextualised understanding of the ages of man from their description in medieval *computus*, one can see how Opicinus understood the ages of man to be analogous to the ages of the world. This analogy was fairly commonplace in medieval cosmology, as it was a consequence of the belief that man was a microcosm of the macrocosm of the universe, often embodied in the Middle Ages in the zodiac man. In chapter sixty-six of *De temporum ratione*, Bede discussed what he counted as the six ages of the world and their correlation with biblical history, using the ages of man to describe the earth's maturation before the Last Judgement.⁴⁸⁰ The two sets of ages, in the words of John Anthony Burrow, 'integrate the life of man into the larger order of the natural world, as that was understood at the time'.⁴⁸¹ The affinity between man and world is visualised in fol. 6^r by the legends describing the ages of man which run around an image of the world, represented by the portolan chart. In reference to the same analogy, the ages of man appear in many of Opicinus's maps and calendars, such as fol. 5^r (fig. 19).⁴⁸²

⁴⁸⁰ First age/infancy: Adam to Noah (ten generations, 1656 years); second age/childhood: Noah to Abraham (ten generations, 292 years); third age/adolescence: Abraham to David (fourteen generations, 942 years); fourth age/youth: David to Babylonian exile (fourteen generations, 473 years); fifth age/maturity: Babylonian exile to Jesus (fourteen generations, 589 years); sixth age/senility: present world; and death. *Bede: The Reckoning of Time*, pp.157-58.

⁴⁸¹ J. A. Burrow, *The Ages of Man: A Study in Medieval Writing and Thought* (Oxford, 1986), p.2.

⁴⁸² Whittington analysed this drawing in *Body-Worlds*, p.104-08.

This again indicates Opicinus's use of computistical sources. Although most mythologies of history are defined as either cyclical or linear, the two coexisted in the medieval Christian understanding of time.⁴⁸³ Wallis argued that 'One of Bede's most remarkable innovations was to solemnize the link between chronology and *computus*. In his hands, chronology became applied *computus*'.⁴⁸⁴ By considering the progression of the ages of man and the world in relation to the astronomical cycles which governed time reckoning, Opicinus used the same methods as his computistical predecessors, including Bede, to fuse linear and cyclical time.

Scholars have tried to identify specific textual sources for Opicinus's cosmologies through the recognition of such systems. Denis Hue identified as a potential source the works of Pierre Bersuire (d. 1362), who was resident at the Avignon papal court in the 1320s.⁴⁸⁵ In Book III of his *Reductorium morale*, Pierre discussed the seven ages of man in a manner which corresponds to their depiction with the ages of the world in two of Opicinus's above-mentioned drawings (folios 5^r (fig. 19) and 6^r (fig. 47)). Beyond these two examples, however, the numerical division of the ages in the Palatinus drawings is inconsistent. His autobiographical calendar, for instance, contains illustrations of the four ages of man, each portrait gripping to a corner of the calendar. This inconsistency is also true of the ages of the world. In another drawing (fol. 24^r), Opicinus divided the world ages from Adam to the present into seven stages in a list of biblical names categorised by the first to sixth *etas*. Yet in fol. 13^v (considered in detail below) he divided the history of man into four ages: from Adam to the Last Judgement.⁴⁸⁶ Opicinus, like many others, did not adhere to one interpretation of the ages of man or the world, but was aware of the multiple and diverse patterns which were revealed in the unfolding history of the world.

⁴⁸³ M. Reeves, *The Influence of Prophecy in the Later Middle Ages: A Study in Joachimism* (Oxford, 1969), p.505.

⁴⁸⁴ Bede: *The Reckoning of Time*, p.353.

⁴⁸⁵ D. Hue, 'Tracé, écart: Le sens de la carte chez Opicinus de Canistris,' in *Terres Médiévales*, ed. Bernard Ribemont (Paris, 1993), pp.129-57, p.148.

⁴⁸⁶ *Prima etas*: Adam to Noah; *Secunda etas*: Noah to Abraham; *Tertia etas*: Abraham to David; *Quarta etas*: David to Johana; *Quinta etas*: Johana to Maria, then on other side of table: *Sexta etas nunc presens* followed by liturgical content discussed in chapter two.

As both Burrow and Elizabeth Sears demonstrated in their simultaneous studies of the ages of man, there were multiple methods and interpretations of the division of the life cycle.⁴⁸⁷ They most frequently consisted of three, four, six or seven stages, but there were many variants.

Burrow, who focused on the representation of the ages in texts, observed that the number of ages in each case often depended on the patterns of nature observed by its discipline. Natural philosophers, for example, generally believed there to be four (based on the four humours and seasons) and astrologers seven (aligning with the number of planets).⁴⁸⁸ Alternatively, the non-scientific authorities such as historians, preachers and exegetes sought to relate the ages of man to the temporal patterns observable elsewhere, such as the cycles of the year, month, and day and in the linear time of history.⁴⁸⁹ Opicinus's approach fits more comfortably in the latter group.

The inconsistency of such systems was not entirely unusual in medieval images of world history. Joachim of Fiore used multiple numerological systems of the ages of the world. Reeves explained how he used the pattern of double sevens, which divided history into seven parallel periods of each Testament; the three overlapping *status*, which in turn represented the Father, Son and Holy Spirit; and the twelve ages, which consisted of five parts in the second age of history, and seven in the third.⁴⁹⁰ Bernard McGinn convincingly argued that Joachim did not see these systems as opposed to one another, but believed that together they formed a complementary pattern of

⁴⁸⁷ Burrow, *The Ages of Man*; E. Sears, *The Ages of Man: Medieval Interpretations of the Life Cycle* (New Jersey, 1986).

⁴⁸⁸ Burrow is actually more specific than this and argued that 'biologists' believed there to be three ages, and 'physiologists' four. His use of modern academic disciplinary categories is, however, problematic. Burrow, *The Ages of Man*, p.2.

⁴⁸⁹ Ibid., p.2.

⁴⁹⁰ Joachim described multiple modes by which one should view history. According to one (in his *Liber concordie*) there were three *status* of the history of the world, but in another there were two *status*. Reeves, *The Figurae of Joachim*, p.7.

time which could be visually represented.⁴⁹¹ Large-scale drawings of time such as Joachim's are relevant to an understanding of Opicinus and will be invoked again later in this chapter.

Instead of determining a specific text which Opicinus may have used in his drawings, it is more useful to identify their common framework, which is revealed through their visual features.

Although the numerological systems he used often changed, the pattern by which time was expressed remained constant. Each diagram considered reiterates Opicinus's conception of time, in which the present mirrors the past. This is illustrated by his macroscopic depictions of the cosmos, such as fol. 13^v and the three diagrams associated with it. Together they depict the four ages of the world.

The Ages of the World (Fol. 13^v)

The final examples of Opicinus's magnifications are found at the top and bottom of the oblong calendar of fol. 13^v (figures 48a and 48b). In this instance, the magnifications are simplified. Like the magnification of fol. 25^r, small red lines are drawn out of the top arc of the calendar with the same small, empty circles at the end of each line and the identified week of the calendar is attached to the head of the Christ-figure, who stands in the centre of the calendar. In this instance, only the week days are included and they are abbreviated (*ii, iii, iv, v, F[eria].vi, sabbm* and *dnica*). The bottom arc of the oblong calendar (fig. 48b) is also labelled with the weekdays but the red lines are not drawn, probably because of the lack of space as the arc reaches the edge of the folio. In this drawing, Opicinus has once again zoomed out to capture an image of the world, making the magnification a much smaller component of the drawing and limiting the space

⁴⁹¹ B. McGinn, *Visions of the End: Apocalyptic Traditions in the Middle Ages* (New York, 1998), p.128.

surrounding it. The simplified magnifications in fol. 13^v therefore signify the same material as in fol. 25^r, but in this case Opicinus is less focused on explaining the interconnected microscopic details of the liturgical calendar and more concerned with showing how they fit within the macrocosm of world time. To understand why Opicinus did so, one must see fol. 13^v within its set of four drawings.

This particular image illustrates the time of Opicinus's present. It is the third in a set of four drawings which represent the cosmos at four separate periods of time (figures 49-51) and together illustrate the lifespan of the cosmos. Their relation to one another is made clear by the repetition of their distinctive format, in which a large circle fills most of the folio and is intersected on its left by a vertically aligned, rounded rectangle. In the bottom half of these rectangles are maps, which allowed Opicinus to depict how the state of the physical world changed over the four ages. In three of the drawings, the upper half of the rectangle contains a figure which reveals the period of time which the rectangle represents. This is a rare method of representing the world through time and has previously been described, in another context, by Chet Van Duzer and Ilya Dines as an 'Apocalyptic cartography'.⁴⁹² They argued that this form of map could be best understood as the earliest examples of what have been categorised as

⁴⁹² Dines and Van Duzer did not use this term to refer to Opicinus, but to a 15th-century manuscript in the Huntington library (MS HM 83). Their study is the only substantial analysis of HM 83 to date. This manuscript contains diagrams (or 'thematic maps') of the world from Christ's birth to the Apocalypse (folios 8^v-12^v), accompanied by a textual account of the Apocalypse written in Lübeck (c. 1486-88). Like Opicinus's focus on his hometown of Pavia, the author gives particular prominence to Lübeck's role in the Apocalypse. In this way, they can together be conceived as a genre of map. Van Duzer argued that this was common practice, and cited as an example the 11th-century St-Sever Beatus *mappamundi* (BnF, MS Lat. 8878, fol. 45) which gives prominence to France. The author of HM 83 divided time into seven ages, followed by an image of the relative diagrams of earth and hell (fol. 12^v). The chronology of this set of diagrams is as follows: fol. 8^v: the birth of Christ to the year 639 (when according to the author, Muhammad began his career); fol. 9^r: 639 to 1514 (illustrating the spread of Islam); fol. 9^v: 1514 to 1570 (when the sword of Islam conquered Europe); fol. 10^r: 1570-1600 (as the Antichrist grew); fol. 10^v: 1600 to 1606 (when the ten tribes of Israel travel to Jerusalem to join the Antichrist); fol. 11^r: 1606 to 1661 (the centre of earth is occupied by flag and law of Christ); and fol. 11^v: the Last Judgment, as shown by the gates of Paradise. I. Dines and C. Van Duzer, *Apocalyptic Cartography: Thematic Maps and the End of the World in a Fifteenth-Century Manuscript* (Leiden, 2016), pp.5, 8-9. These authors briefly acknowledged the similarity between the maps of HM 83 and the diagrams of Opicinus. Ibid., pp.145-46.

'thematic maps'.⁴⁹³ Although rare, these images (including Opicinus's) share a common purpose: they use a series of maps to depict the chronology of biblical events and hence the progression of linear history.⁴⁹⁴

Fortunately for his interpreters, Opicinus made the order and meaning of each drawing clear in their individual headings:⁴⁹⁵

- Fol. 9^r: *Prima etas ab Adam usque ad Christum sub exactione diaboli per hominem laborabat*
- Fol. 9^v: *Etas Christi in utero matris, ubi pes dexter in tenebris gentium superbiam deponebat et sinister in luce populi gloriam refrenabat*
- Fol. 13^r: *Exaltatio vicariatus Domini super iudiciis disponendis. Hec est preparatio sedis Domini ante faciem Domini descensuri*
- Fol. 17^v: *Revelatio iudicii Domini descensuri. Iudicium discernendi*

He divided the world into four ages between the Creation and the Apocalypse: from Adam to the birth of Christ; the life of Christ; the present (being the time of preparation for the Last Judgement); and the Last Judgement. If placed in sequence, they would tell the history of the cosmos from Old Testament time, to New Testament time, to the present and to the future. The images, together, represent the whole of time, and they allowed Opicinus to draw comparisons between each period.

⁴⁹³ Dines and Van Duzer used HM 83 to prove that this genre existed before the 17th century, against previous belief. They related HM 83 to the *Rudimentum novotiorum*, a world history printed by Lucas Brandis in Lübeck (1475), which combined scriptural and secular history through the depiction of cartographic space. Dines and Van Duzer, *Apocalyptic Cartography*, pp.1, 56.

⁴⁹⁴ Dines and Van Duzer also placed in this category Hugh of St Victor's *Arca Noe*, which is discussed below. Ibid., p.231.

⁴⁹⁵ Transcribed by Salomon in *Weltbild und Bekenntnisse*, p.194.

The diagram of present time (fol. 13^v) is the only one framed by liturgical calendars.⁴⁹⁶ For Opicinus, the liturgical calendar was a reference to the present age, partially because this was how time was ordered by the Church, and according to his own experience. The connection between the liturgical calendar and Opicinus's experience is demonstrated by his insertion of dates of personal significance into the liturgical calendar of fol. 13^v. On the dates on which his father and mother died, he wrote 'Forget your father, the year of the lord (1317) in the middle of the night', and 'Forget your mother, the year of expectation (1335), the third hour of the day'.⁴⁹⁷ That Opicinus measured his own life and experience of time by the liturgical calendar was also shown by his journal entries (headed with the liturgical dates upon which they were written) and his autobiographical calendar.⁴⁹⁸

Opicinus not only used the liturgical calendar to depict the present because it was the time system with which he was most familiar, but also because of its significance to the authority of the Church. Fol. 13^v depicts the state of the world as Opicinus understood it: the age in which the Church ruled supreme. Morse explained how the triumph of the Church was shown in the figural hierarchy placed within the oblongs (the habitable zone) to the left of the picture,⁴⁹⁹ but also through the liturgical calendar which framed time through 'a distinctly Christian version of

⁴⁹⁶ Fol. 17^v includes the names of the months and some entries for the fixed calendar, but no other calendrical information in addition to this (such as dominical letters).

⁴⁹⁷ *Obliviscere patrem tuum anno domini mcccxxij media nocte; Obliviscere matrem tuam anno expectationis hora diei tertia.* Transcribed and translated in Morse, *A Complex Terrain*, p.248, n.30.

⁴⁹⁸ A legend below the drawing reveals Opicinus's perception of the spiritual significance of the calendar, but the end has been trimmed: *Hec omnia nomina sanctorum in circumferentia posita sunt testimonia mortis e...* Morse translated the remaining text as: 'All these names of saints placed around the circumference are testimonies of [his] death...' She interpreted from this that 'Opicinus seems to be encouraging us to look beyond the saints themselves, who serve as testimony, perhaps to the death of Christ, who is the greater spiritual truth to which the saints bear witness'. Ibid., p.244, n.22.

⁴⁹⁹ Morse explained how the figures and hierarchies contained within the oblongs represent the ecclesiastical hierarchy. The smallest figure represents the chosen people (*genus electum*) and is surrounded by the twelve tribes of Israel. The medium-sized figure is labelled the apostolic body of the Church (*apostolicum corpus ecclesiae*) and is surrounded by the names of the apostles (note that the names are paired with the figures according to their historically relevant period). Morse determined that the figural hierarchy represents the authority of the apostolic Church over the habitable zone of the earth at the time during which Opicinus drew it. She noted that *genus electum* is most likely in reference to 1 Peter 2:9: *vos autem genus electum regale sacerdotium gens sancta...* (n.28). For more on the figures of fol. 13^v, see Morse, *A Complex Terrain*, p.247.

the year'.⁵⁰⁰ It should not be surprising that Opicinus, who made these drawings in response to the intellectual discussion at Avignon, presented the present as the time of the Church.

As has been demonstrated by the microscopic and macroscopic interpretations of the liturgical calendar, Opicinus considered time in multiple levels of detail: from the hours of each day to the span of worldly existence. Seen in the context of the other three drawings, the calendar of fol. 13^v does not only tell us how present time was ordered but, by placing it in relation to other periods, situates it within Christian history, which in turn imbues it with further ecclesiastical meaning. This understanding of the past was not unique to Opicinus, and can be explained through contemporary attitudes towards time: both those established since the early Middle Ages and those discussed at the papal court. To demonstrate this, the rest of part two focuses on how the liturgical calendar participated within macrocosms of time: both in the Palatinus and other medieval cosmological diagrams. After first looking at how the calendar was perceived in the Middle Ages as a mirror to the past, it considers how linear and cyclical understandings of time were incorporated into drawings which showed a symmetrical understanding of the history of mankind. From observing how these features formed an established shape of history which was specific to the Middle Ages, one can decipher how Opicinus moulded this shape to incorporate the new ideas about time circulating at the papal court.

The Liturgical Calendar: A Mirror of Time

The four drawings can immediately be accepted as one set thanks to the uniformity of their structures. Victoria Morse came to the same conclusion, arguing that Opicinus 'developed a

⁵⁰⁰ Ibid., p.244.

"visual grammar" of forms' and that 'By combining graphic and textual elements within a graphically fixed, but hermeneutically flexible, foundation Opicinus was able to create drawings with highly specific meaning, but which nonetheless shared a basic set of assumptions about various moments or aspects of Christian life and expectation'.⁵⁰¹ Morse explained how the large circle represents the cosmos and/or earth, with the oblong on the left representing the habitable zone.⁵⁰² Each period was set upon the same universal stage but could be tailored to a specific era through its detail. This reveals Opicinus's overarching perception of the shape of time. The liturgical calendars of fol. 13^v are in the same format as the other three diagrams (the past and future), showing that it mirrors the Christian past: both the Old Testament history between Adam and Christ and the New Testament history of Christ's life.

The core values which shaped Opicinus's diagrams were conventional within medieval perceptions of time. The mirroring of the Old and New Testaments, as explored in the previous chapter through the symbolism of the wheels of scripture, was central to medieval scriptural exegesis. It provided the basis for typology, in which types (events, figures or symbols in the Old Testament) prefigured or were superseded by antitypes (those of the New Testament). The typological conception of history was omnipresent in medieval visual culture, such as in the portal sculpture of ecclesiastical buildings, where Old Testament kings were paired with New Testament apostles.⁵⁰³

Analogous correlations were not limited to the biblical past, but could also be drawn to the present. For example, Aron Gurevich noted how the struggle between the Emperor Henry IV

⁵⁰¹ Morse, *A Complex Terrain*, pp.250-51. For her full interpretation of the four diagrams, see pp.241-51.

⁵⁰² Ibid., p.241. Morse focused on fol. 9^r (the age of Christ) to argue that in this instance, 'Opicinus thus presented the world before the coming of Christ as having been ruled by natural law and time, yet also clearly established within the framework of Christian history'.

⁵⁰³ Gurevich discussed how this conception of time was present in earlier medieval texts, such as the *Allegoriae in universam sacram scripturam* of Hrabanus Maurus. Gurevich, *Categories of Medieval Culture*, p.83.

and Pope Gregory VII was correlated to that between Judas Maccabeus and King Antiochus.⁵⁰⁴

Opicinus clearly understood time in this way. For example, he used specific feast dates to interpret the correspondence of Old Testament, New Testament and present events in his journal. Harding discussed an example of this in one of Opicinus's journal drawings (Vaticanus, fol. 71^v), in which he investigated Boethius's *Consolation of Philosophy*. Upon it, Opicinus wrote the dates on which he made the drawing: 'Act begun on the XVII kalends of November [16 October], finished on the day of St Luke the evangelist [18 October], who wrote [his] Gospel in parts of Achaia, and of Boethius, the true philosopher'.⁵⁰⁵ Harding argued that Opicinus drew a connection between Boethius and St Luke as both men had been arrested. Opicinus believed that he shared their experience of suffering similar conditions of trial and tribulation: Luke in Achaia (southern Greece), Boethius in Pavia, and himself in Avignon. The feast dates on which Opicinus drew this was significant in connecting his own actions in the present with those of the figures venerated during those days. As Harding argued, 'In establishing lines of significance that might otherwise not seem related logically, Opicinus was able to elevate the most mundane of worldly details, and ascribe a higher, spiritualised value to the analogies which he perceived within the universe'.⁵⁰⁶ Like the medieval historians before him, Opicinus saw the cycles of different ages (of the world and of biblical time) repeating and interrelating, so that the past continued to intersect in always new ways with the present.

This conception of time was clearly well established in the Middle Ages, but there is still the question of how it was visualised. When describing the past, historians (medieval and modern) have often used shapes to describe patterns, such as the circle for the cycles of seasonal time and

⁵⁰⁴ Ibid., p.129.

⁵⁰⁵ *Actum inceptum XVII kalendas novembris et consumatum in die sancti luce evangeliste quae evangelium scripsit in partibus achaie et boetie versus philosophus*. Harding, 'Opening to God,' p.38, n.62.

⁵⁰⁶ Ibid., p.38. After this initial mention of St Luke in Harding's translation, she began to refer to Luke as 'Paul'. Although St Paul's arrest in Jerusalem thematically ties him to this group, he is not mentioned in Opicinus's drawing and Harding incorrectly referred to Paul's arrest as taking place in Achaia, where Luke was arrested. The mention of St Paul is thus probably an error.

lines for chronological sequences. These have been variously described as the 'shape of history'.⁵⁰⁷ In the case of the four drawings above, Opicinus drew the four periods of time with identical cyclical structures, which invited the viewer to make comparisons to see how the world changed over time and how certain events in the present mirrored those of the past. By placing the cyclical images in a chronological succession, time's shape was shown to be both cyclical and linear.

As shown by macroscopic diagrams drawn prior to Opicinus, previous cosmologists struggled with the same issues of visualising history. The following interpretation of the drawings of history considers how they were shaped by a specifically medieval understanding of time before focusing on how each incorporated the liturgical calendar. A comparison between Opicinus's drawings and this group has a twofold outcome. First, the identification of the underlying principles which governed the forms of such diagrams, which has been recently furthered by the art-historical analysis of Andrea Worm and Laura Cleaver, sheds some light on how Opicinus shaped his own drawings. Second, by identifying the distinguishing characteristics of the twelfth-century tradition, it becomes easier to gauge which aspects of Opicinus's drawings were novel or unique.

Drawing History

Images which sought to capture the entirety of history from a Christian perspective within a single image began to emerge in the twelfth century. Within this tradition, the large-scale drawings of Joachim of Fiore, Hugh of St Victor, and the anonymous author of the Vercelli

⁵⁰⁷ Penelope Corfield, *Time and the Shape of History* (London, 2007), reviewed the subject.

manuscript can be better understood. The drawings of Hugh and Joachim are well known, but the Vercelli drawings, made in northern Italy in the early-thirteenth century, have only recently become the subject of investigation.⁵⁰⁸ They consist of a genealogical roll (which has a similar format to the *Compendium historiae* of Peter of Poitiers, and includes similar schemata), a *Wheel of Sevens* framed by cycles of time, a *mappamundi*, and the figure of *Ecclesia*.

Reeves, in her study of Joachim's *figurae*, concluded that 'The obsession with the discovery of shape in events is surely an outstanding characteristic of man's relation to history. Medieval interpretations of history are very largely mythologies of pattern and shape, and perhaps the basic reason for the popularity of Joachim's doctrine was his skill with the symbolism of patterns and the visual imagination which could translate history into *figurae*'.⁵⁰⁹

The schematisation of temporal patterns was of importance to other drawings of the cosmos. In her study of the *Libellus de formatione arche* of Hugh of St Victor and the *Compendium historiae in genealogia Christi* of Peter of Poitiers (c. 1130-c. 1215), Worm argued that a new kind of illustration came out of the Parisian schools in the twelfth century, in which there was a particular interest in history and the situation of the present in relation to it.⁵¹⁰ Distinct from textual narrative, in which events must be reported successively and thus in a 'one-dimensional' continuum, the inclusion of images solved this dilemma 'by using the two-dimensional body of the page to display the data in a way which allows for a simultaneous perception of diachronicity and synchronicity'.⁵¹¹ The rise of these 'diagrammatic chronicles' in the twelfth century was

⁵⁰⁸ The Vercelli drawings are currently in the Archivio Capitolare and are the subject of the forthcoming Oxford University doctoral dissertation of Jenny Shurville. This will include a full transcription of the diagrams, which she has kindly shared with the author. Whittington briefly mentioned the Vercelli drawings in *Body-Worlds*, pp.123-24.

⁵⁰⁹ Reeves, *The Influence of Prophecy*, p.505.

⁵¹⁰ The *Compendium historiae* of Peter of Poitiers can also be considered within this category, and Cleaver and Worm's work on the *Compendium* is useful to this discussion. However, he is not considered in the present study as Peter's images span multiple pages in a linear fashion, rather than capturing time in a single image as the discussed examples do.

⁵¹¹ A. Worm, 'Diagrammatic Chronicles,' in *Encyclopaedia of the Medieval Chronicle*, Vol. 1, ed. G. Dunphy (Leiden, 2010), http://dx.doi.org/10.1163/2213-2139_emc_SIM_000823 (consulted 10/11/2017).

connected to the increased interest in both the *sensus historicus* of the bible and the attempt to order and structure knowledge.⁵¹² It was not only their texts but the shapes themselves which functioned as a visual exegesis of history. Within these drawings of history, form was directly related to content and thus their visual features were intrinsic to their meaning.⁵¹³

As the visual features directly expressed the makers' conception(s) of time, their visual analysis provides rich potential to tell the viewer more about the medieval understanding of the past, present and future. Broadly speaking, the images of Joachim and the Vercelli manuscript include chronologies in linear lists in addition to depictions of the year in a circular form, and are united with Opicinus by their struggle to merge linear and cyclical time into one coherent image of the Christian cosmos. As each of the following images considers numerous and complex systems of time, a comprehensive comparison of all the ways by which they represent time is not within the scope of this chapter. In line with the rest of this thesis, it focuses on the component with which this interpretation of Opicinus's drawings began: the calendar. Each set of diagrams contains or contained a calendar: in the square border of the *Wheel of Sevens* (fig. 52, northern Italy, early-thirteenth century) of the Vercelli manuscript, within a spiral depiction of the *Mysterium Ecclesiae* (fig. 53, southern Italy, early-thirteenth century) by Joachim of Fiore, and as the circular frame of the cosmos in the *Arca Noe* of Hugh of St Victor.⁵¹⁴ Each of the calendars bears a different

⁵¹² Ibid.

⁵¹³ Peter of Poitiers's *Compendium*, for example, is described by Worm as a 'time map' in which history is 'turned into a visually suggestive, self-evident image'. A. Worm, 'Visualising the Order of History: Hugh of Saint Victor's *Chronicon* and Peter of Poitiers' *Compendium Historiae*,' in *Romanesque and the Past*, ed. J. McNeill and R. J. Plant (Abingdon, 2013), pp.243-63, p.259.

⁵¹⁴ The diagram of Hugh of St Victor's *Arca Noe* does not survive, but was reconstructed from Hugh's textual description by Conrad Rudolph in 2014. It is known that the *Arca* contained a circular calendar as Hugh gave specific instructions for how to draw the zodiac-calendar ring: 'The Twelve Signs of the Zodiac are joined to the Twelve Months in such a way that a sign should always start in the centre of its month, and conversely a month always starts in the centre of a sign. These signs are marked off above into thirty degrees, with the starting point beginning above at the first section of Aries'. Rudolph, *The Mystic Ark*, pp.491-92. As this is the only evidence we have concerning the calendar, the present interpretation of liturgical calendars in diagrams of time does not include the *Arca*.

meaning, yet conforms to the same broad understanding of history and its significance to the present.

The *Wheel of Sevens* in the Vercelli Manuscript

The theological diagrams of the Vercelli manuscript share many similarities with the Palatinus, particularly the *Ecclesia* drawing. Founded upon a large figure, it is surrounded by a rich variety of material including the virtues and vices, the apostles, narrative scenes and a hierarchy of the Church. The large figure is an embodiment of the Church, upon which information concerning the history of the Church is given. This includes a papal chronology listed within the blade of the double sword: a symbol of the pope's temporal and spiritual authority. The drawing is covered in short legends as well as more lengthy texts (often commenting on the content of the drawings but also including excerpts from the texts of Joachim of Fiore).⁵¹⁵

If Opicinus did not see the Vercelli manuscript of *Ecclesia*, he undoubtedly saw another like it. Pavia is close to Vercelli (forty miles distant) and Opicinus had certainly been there. In fact, he recorded in his autobiographical calendar that he and his sister were confirmed there by the Bishop of Vercelli near the end of April 1304.⁵¹⁶ A comparison between the two sets of diagrams invites a fuller discussion, particularly in respect of their use of papal iconography, but this study focuses on the cycles of time as they appear in the Vercelli diagram of the *Wheel of Sevens* (fig. 52).

The square border which frames the wheel includes three lines of temporal information on the top edge, two of which continue to be written around the remaining three edges.⁵¹⁷ The top

⁵¹⁵ My thanks to Jennifer Shurville for her explanation of the drawing.

⁵¹⁶ Morse, 'Opicino de Canistris: Confessions,' p.413.

⁵¹⁷ All transcriptions of the Vercelli manuscript in this dissertation are by Shurville.

frame horizontally records biblical history from Adam to Christ,⁵¹⁸ the seven ages of the world, and the liturgical calendar.⁵¹⁹ Apart from the seven ages, which are only written in the top edge of the frame, the other two sets run in a cycle around the border. The liturgical calendar starts in the top edge of the frame, where the Prelent and Lenten seasons before Easter are indicated:

Septuagesima. Sexagesima. Quinquagesima. Quadragesima. Dominica. vacans. The liturgical events continue into the next two edges and the final side contains future events: *Resurrectio; Ascensio; Spiritus Sancti missio; Dominica de sancta trinitate; Sequitur. XXIII.*⁵²⁰ *dominice de sanctae ecclesie peregrinatione; Antichristus. XLC [sic] dies penitentie.; Conversio reliquiarum; dies iudicii.*

The frame consists of a cyclical representation of the history of the world through the seven ages, the events of the Old and New Testaments (from Adam to the Resurrection), and events of the present liturgy and forthcoming end of the world. As summarised by Cleaver, who worked on a later copy of the Vercelli manuscript in the British Library which contains an almost identical *Wheel of Sevens*, 'the frame brings together the history of the world, past and future, with the annual cycle of the church calendar'.⁵²¹ In this case, as with Opicinus's drawings, the liturgical calendar is situated in relation to the past and future through the configuration of the cycles in a way which illustrates the linear progression of past and future to be celebrated on a cyclical basis.

⁵¹⁸ Starting from the top left, the first line is concerned with biblical chronology, and runs around the entire frame to divide the time from Adam to Christ's Resurrection into four. This begins with the roundel at the top left of the drawings in which *Adam* and *Eve* are written (probably as a note to the illuminators), followed by the period of Adam to Moses (*Tempus devotionis ab Adam usque ad Moysen*).

⁵¹⁹ All seven ages are written in the top border: *Prima etas. Secunda etas. Tercia etas. Quarta etas. Quinta etas. Sexta etas. Septima etas.*

⁵²⁰ The *XXII* seems to be an error. In another copy of the *Wheel of Sevens* in BL, MS Royal 14. B. ix (southern England, c. 1250-1300), the legend in the corresponding position gives thirty-three (*XXXIII*) Sundays. J. Krochalis and E. Peters, *The World of Piers Plowman* (Philadelphia, 1982), p.172.

⁵²¹ L. Cleaver, 'Past, Present and Future for Thirteenth-Century Wales: Two Diagrams in British Library, Cotton Roll XIV.12,' *Electronic British Library Journal* (2013), art.13, pp.1-26, p.15.

The *Mysterium Ecclesiae* of Joachim of Fiore

A similar approach to the reconciliation of cyclical and linear time was also shown in Joachim's *Mysterium Ecclesiae* from his *Liber figurarum* (fig. 53). Instead of placing the temporal information into a circle or square frame, Joachim modified the circular calendar (*quod servat annuatim Ecclesia*) into a shape which incorporated the progression of history with the result that he represented the liturgical year as a spiral. The spiral, somewhere between a line and a circle, allowed Joachim to show how different historical ages (which he refers to as *status*) overlapped yet were still distinct.⁵²²

Opicinus struggled with the same issue. In his set of the four ages of the world, each picture is cyclical but if one were to place them in a line, they would form a chronological sequence.

Although Joachim's use of the spiral was unique, the cyclical alignment of different historical systems is similar to that of the Vercelli example. Joachim's spiral also begins with Septuagesima (the ninth Sunday before Easter, and named so because it falls within the seventy days before Easter), which is aligned with the seventy years of the *transmigratio Babilonice* and the exile of Adam from paradise.⁵²³ Joachim continued to align the liturgical calendar (in which Septuagesima is followed by Sexagesima, as in the Vercelli frame) with the generations of man and Old Testament history.

Reeves clarified how Joachim came to this method by interpreting a passage from Book V of his *Liber concordie* (a separate text from that which included the *Mysterium Ecclesiae*). In the passage,

⁵²² See n.489 above.

⁵²³ Septuagesima was used to commemorate the seventy years of Babylonian Captivity long before Joachim. For example, see Aelfric, *The Homilies of the Anglo-Saxon Church: The First Part, Containing the Sermones Catholici, or Homilies of Aelfric*, transl. B. Thorpe (London, 1844), p.85.

Joachim wrote at length about the numerical symbolism of the seventy years of Babylonian Captivity in relation to Septuagesima. The text reinforces Joachim's use of lengthy and complex historical calculations, which were based on a historical numerology that considered chronological calculations in relation to biblical content.⁵²⁴

As in the Vercelli diagram, which Shurville has shown to be heavily influenced by Joachimite theory, the spiral aligns Old Testament history with the liturgical calendar. Here the liturgical calendar signifies both history according to scripture and the medieval present.⁵²⁵ It was the duty of the present Church to reflect on the past in order to prepare for the second coming of Christ. This reflection was structured by the liturgy, so the liturgical calendar became a mirror of Christ's life.⁵²⁶ Although the way in which the liturgical calendar is depicted in the Palatinus is dissimilar to these two examples, their alignment to the other cycles of time and their place within the shape of history are wholly familiar. In conformity with the prevailing medieval view and visualisation of history, Opicinus used the liturgical calendar, the present structure of time, as a mirror by which to understand the past.

⁵²⁴ Reeves explained Joachim's calculation: 'From the beginning of David's reign down to the thirteenth year of Josias in which Jeremiah prophesied was 420 years, i.e. six times seventy; the seventh seventy which begins at this point can be split into forty years to the end of the reign of Sedechias, last king of Judah, and thirty years thence to Cyrus who first sent the Jews back to Jerusalem. If a similar calculation is made starting from the building of the Temple by Solomon, 420 years brings one siege of Jerusalem under Sedechias and the seventh seven runs to Darius who completed the work of Cyrus. This double numeration symbolized the work of the Son and the Holy Spirit'. Reeves, *The Figurae of Joachim*, p.249. Opicinus also practised a similar method of historical numerology by taking numbers derived from the chronological calculation of Eusebius of Caesarea (c. 260-339/40, a leading authority on the chronology of the Church), astronomy and the bible in order to make connections between these categories of time. In an astrological table of the zodiac and planets on fol. 8^r of the Palatinus, for example, Opicinus multiplied the 144 squares in the table with the 1000 years since the age of Constantine, to make 144,000: the number of people from the tribes of Israel set apart by the angelic seal according to Revelation 7:3-8. Salomon, *Weltbild und Bekenntnisse*, p.187-88. This is not treated at length here as it is a primarily textual representation.

⁵²⁵ Reeves, *The Figurae of Joachim*, pp.49-52. This will also be discussed in Shurville's forthcoming dissertation.

⁵²⁶ S. C. McCluskey, *Astronomies and Cultures in Early Medieval Europe* (Cambridge, 2000), p.27.

The Symmetry of Time: Papal Chronology (Folios 26^r and 10^v)

Yet there was an issue in the exact mirroring of time, as expressed by the distinction between each coil of Joachim's spiral calendar, as it would imply that each period of time was equally valuable. This was not the case in the Middle Ages, as Christ's Incarnation on earth was the pinnacle of human existence. The Old Testament was a period of preparation for the coming of Christ, and all that had transpired since Christ's Ascension had been devoted to celebrating the unique acts of his Incarnation and Passion. This rendered the past more significant than the present, whilst giving meaning to the present. Within the understanding of history, which was structured around the story of Christian salvation, man had become the protagonist and life had been given meaning by his enhanced awareness of God. The centrality of Christ within time rendered history before and after his birth symmetrical.⁵²⁷

One can find this illustrated on multiple occasions in the Palatinus where Opicinus manipulated events in recent history to fit them into the symmetrical shape of history. This is best illustrated by his papal chronologies which, in addition to showing how Opicinus incorporated recent historical occurrences, also indicate his objective to serve a papal agenda. Opicinus included a chronological list of the popes in three of his works: twice in the Palatinus (folios 10^r and 26^v) and once in his journal (fol. 4^r).⁵²⁸ In the two Palatinus examples, he employed a numerological method to measure pontifical and biblical chronology against one another. In doing so, he not

⁵²⁷ Gurevich, *Categories of Medieval Culture*, p.129; Le Goff, *Time, Work & Culture*, p.31. This concept gave rise to many theories concerning the coming of the Apocalypse (many of which are found in diagrams of the history of the earth), but it is not addressed further here.

⁵²⁸ In another instance, the names of the popes are not listed, but are divided into four groups. Panofsky noted that in fol. 11^v, Opicinus divided the chronology of 200 popes into quarters in order to align them to four ages of man: the first fifty (from Peter onwards) formed the *adolescentia* of the Church, the next fifty the *iuventus*, the next the *senectus*, and the last fifty the *senium*. Panofsky argued that this division into quarters was chosen as it corresponded to tetrads of the natural world, such as the four seasons, elements and humours. As has been shown in the case of Opicinus, however, he used multiple numerical systems for the ages. E. Panofsky, *Meaning in the Visual Arts: Papers in and on Art History* (Chicago, 1955), p.216, n.105; Salomon, *Weltbild und Bekenntnisse*, p.221.

only mirrored the history of the Church with that of mankind, but also strategically placed the Incarnation in a way which implied that certain pontificates were more important than others.

Thanks to the inclusion of Clement VI (pope from 1352) on fol. 26^r (fig. 54), the drawing can be dated to 1352 onwards, indicating that it must be one of Opicinus's final drawings. Down the centre of the diagram is a chronological list of names. In the first segment (from the letter C at the top of the diamond down to the image of the pope) are listed the names of biblical figures from Adam to Christ. Below the roundel containing an image of the pope are two concurrent lists. On the left is an exhaustive list of popes from Peter, and on the right is the genealogy of Jesus from Abraham to Joseph. As the biblical list of names is shorter, only the name of every fifth pope is written. The choice to align the names in such a way is not for visual clarity but instead to represent the numerological significance of the popes after Boniface VIII (r. 1294-1303), including Benedict XI (whose pontificate lasted under a year from 1303-04). The Avignon popes (and Benedict XI) are mirrored with Joseph, implying that Christ is the next to be listed and thus making Clement the final pope.

This method of calculation was not unique to Opicinus. As was shown by Paravicini-Bagliani, Jacopo Stefaneschi used this method of calculation (taken from Ptolemy of Lucca) to establish Boniface VIII as the 200th pope.⁵²⁹ Opicinus updated his calculation by listing the Avignon popes after Boniface to make Clement VI the 205th pope. Paravicini-Bagliani demonstrated this to be just one example of papal symbolism in Opicinus's drawings, which showed that they were not wholly original, but part of a tradition.⁵³⁰

⁵²⁹ Paravicini-Bagliani, 'Opicinus de Canistris et la symbolique pontificale,' pp.428-30.

⁵³⁰ Ibid., p.435.

Opicinus illustrated a similar chronology in fol. 10^r (fig. 55). Much like in the Vercelli *Ecclesia* diagram, the chronology is listed down the torso of a figure representing the body of the Church. In this instance, he established Benedict XII (the pope at the time of its making) as the 200th pope, thus imbuing his pontificate with historical significance. Unlike fol. 26^r, in which the lists of names run side by side, both chronologies of biblical names and popes in fol. 10^r begin respectively at the top and bottom of the structure and are listed horizontally towards the centre. There they meet at an illustration of the Virgin and Child, labelled as the principle or origin of the corporeal Church (*principium ecclesiae corporalis*). Adam's name is written above the head of the image of Christ, below which 110 biblical names are vertically listed.⁵³¹ The papal chronology begins at the other end of the drawing, from the head of the first pope (*Petrus*), and requires the drawing to be turned upside-down to be read. Every tenth pope is listed and their chronological position identified by the Roman numeral which precedes their name.

The effect of having both chronologies read toward the centre is twofold. The lists of the history of Christian salvation and the papacy mirror one another from the centre of the page, thus portraying biblical and papal history as symmetrical and implying that Benedict's papacy, or that of the Avignon popes more generally, held particular significance. By aligning the period of time from the first man to Christ's birth with the period between the first pope and Benedict XII, Opicinus again implied that the second coming of Christ was nigh. The Incarnation, as represented by the Virgin and Christ child, is placed at the centre of history and acts as the conclusion of both chronologies. The shape of history in fol. 10^r expresses the medieval conception of time, in which Opicinus could present history in a way that amplified the importance of the Avignon papacy.

⁵³¹ The 110 names include Adam, Cain and Abel in the halo of Christ.

The shape of Opicinus's drawings was clearly informed by the earlier tradition of diagrams representing history in which multiple time systems were integrated into a single harmonious image, and in which the liturgical calendar was used to situate the present within macroscopic representations of time. The calendar consequently became a mirror through which one could compare other time periods with the present. Yet this is not to say that Opicinus's drawings were simply continuations of these forms. In them, Opicinus invented new ways to integrate different ideas about time into these existing epistemological systems. These novel perceptions of time can be contextualised within two circles of culture contemporary to Opicinus: that in which new forms of time-keeping were being developed, and that of the Avignon court. The latter is considered first.

The links between Opicinus's papal chronologies and the court are obvious. This chapter does not, like previous chapters, visually compare the Palatinus with another source made in the penitentiary. There is, however, another manuscript produced there which, while it does not visually correspond with the Palatinus, proves that the place of the Roman Church in history was at the forefront of discussion within Pope John's intellectual network. The *Satirica Historia* (1321-25) of Paolino Veneto, as mentioned briefly in the introduction, was composed in the penitentiary under John's pontificate. Through its integration of maps and chronologies (from the Creation to Pope Clement V), the *Satirica Historia* attempted to show the viewer the history of the world 'at a glance'.⁵³² Stefaneschi's calculations further demonstrate the significance of papal chronology within this discussion. The novel aspects of Opicinus's drawings can thus be attributed to the questions posed at the Avignon court, and the ways in which his immediate predecessors had tried to answer them.

⁵³² See n.142 above.

Part Three: New Forms of Time in the Fourteenth Century

There was another cultural shift in the fourteenth century which governed the forms of Opicinus's drawings: the introduction of new mechanical ways of keeping time. The inclusion of the most accurate forms of time- and space-measuring technologies in the Palatinus situates them within a particular moment in the history of thinking about time and space during the first half of the fourteenth century. As discussed in chapter two, the form of liturgical calendar which Opicinus drew upon was a product of the latest developments in time-keeping and so could only be found in the newest images and objects. These were not the only horological objects developed during this time which informed Opicinus's visualisations.

The relationship between astronomical clocks and the drawings has occasionally been considered in this thesis, but their connection has more to reveal. Besides the calendar forms, certain features of Opicinus's drawings demonstrate how ideas about time had changed during the period in which the mechanical clock was introduced into society. These ideas, which this thesis hypothesises were affected by the changing forms of time-keeping instruments, altered the way time was visualised in other elements of visual culture. Part three focuses on one Palatinus drawing and contextualises it within an overview of the appearance and reception of contemporary time-keeping devices. Their similarities show how Opicinus's drawings can be understood as symptomatic of a broader change in time perception and thus connected to the history of time-reckoning technology. In addition to showing how the function of Opicinus's drawings partook of both images and instruments and thus responded to the kind of images commissioned in Avignon during this time, this analysis provides a case study in how ideas of time were affected by changes in its technological visual culture.

'Clock Time' in the Palatinus (Fol. 1^r)

Fol. 1^r (fig. 3), one of Opicinus's last diagrams, provides a clear and polished overview of the many themes and visual components experimented with in his earlier drawings. This is exemplified by its attempt to introduce a calendar reform.⁵³³ In the words of Roux and Laharie, it is '...en effet d'une clef de voûte, d'un couronnement de la vision cosmique d'Opicinus, d'une apothéose finale'.⁵³⁴ The calendar year is signified by a ring of dominical letters demarcating each day of the year, as in the other calendars in the Palatinus. It runs through the centre of a ring of twenty-four overlapping circles which include the signs of the zodiac, personifications of the months, and busts of biblical figures. As in most of the other Palatinus drawings, the body of the diagram is framed by the outstretched wings of the Gospel animals.

The diagram, in many ways, looks like a medieval clock face and its similarity to the liturgical calendar of the Prague astronomical clock (c. 1410, fig. 56) is easily recognised.⁵³⁵ The rings of pictorial representations of the zodiac especially appeared on many fifteenth-century clocks, such as the public clocks in Padua (1434 onwards) and Venice (1493), and in churches outside Italy, such as St Mary's Church in Rostock (fig. 57, c. 1472) and the hours dial of the clock in St Mary's Church in Gdańsk (fig. 14, 1463).⁵³⁶ A detailed visual comparison between fol. 1^r and surviving clock faces is unfortunately limited as most of these date from over a century after Opicinus was

⁵³³ See nos 121-24 above. At the top of the folio, Opicinus titled the drawing: *Descriptio universi celestis supra capita nostra in exempla terrestres sub pedibus nostris. Ecce descriptio triumphantis ecclesie, non tamen patrie facialis*. Salomon, *Weltbild und Bekenntnisse*, p.152.

⁵³⁴ Roux and Laharie, *Art et folie*, p.301.

⁵³⁵ Inside the calendar of the Prague astronomical clock are two circles (one enclosing the other), each of which is made up of a ring of twelve circles containing the personifications of the months (in the outer ring) and the zodiac symbols (in the inner). While the similarity to this particular clock is intriguing, it is not useful to pursue it as the calendar has been dated by stylistic analysis to the 17th century. For more on the commission of the Prague astronomical clock, see B. D. Boehm and F. Jiří, *Prague: The Crown of Bohemia, 1347-1437* (New York, 2005), p.99; E. Ramirez-Weaver, 'Reading the Heavens: Revelation and Reification in the Astronomical Anthology for Wenceslas IV,' *Gesta*, Vol. 53, No. 1 (2014), pp.73-94, pp.77-78.

⁵³⁶ For the history of the Venice and Padua clocks, see R. Zamberlan and F. Zamberlan, 'The St. Mark's Clock, Venice,' *The Horological Journal*, Vol. 143, No. 1 (2001), pp.11-14; Bedini, Madison and Silvio, 'The Mechanical Universe,' pp.17-19.

active. One curious feature of fol. 1^r, however, offers a more solid foundation with which to suggest that Opicinus was affected by the changing perception of time during the fourteenth century, owing to the introduction of what will be referred to, in the following discussion, as ‘clock time’.

In fol. 1^r the cycle of the day is divided into twenty-four hours (two sets of twelve) as distinct from the canonical hours which feature in Opicinus’s other drawings.⁵³⁷ Opicinus inserted the numbers equidistantly around the circle in the gaps between the circles of the zodiac and labours of the months, which together made twenty-four. Below the personification of September at the top of the circle is written *hora dies prima*, followed by the numbers *ii* to *xii* running anticlockwise to the bottom of the circle, where Opicinus has written *hora noctis prima*, followed again by *ii* to *xii* running anticlockwise to complete the cycle. The *hora dies prima* lies under a legend above the calendar which reads *oriens*, where the sun rises, and the *hora noctis prima* is just after the marked *occidens*, where the sun sets.

The cycle clearly represents the day and night divided into twenty-four, which from a modern perspective might lead one to recognise it as a clock face. Before delving deeper into this analysis, one must be cautious in assuming that this was Opicinus’s intention. The twenty-four-hour system was not exclusive to mechanical clocks, as the division of the day into twenty-four hours predates its invention. In the early Middle Ages, the organisation of the day was taken from the Roman hours (a twenty-four-hour system which divided the day into two sets of twelve hours) before it gave way to the canonical hours.⁵³⁸ In fact, Dohrn-van Rossum called the Roman system the ‘old’ system, as it can be traced back to Babylonian time reckoning.⁵³⁹ But if

⁵³⁷ Roux and Laharie briefly noted that Opicinus had denoted the hours of the day here, but did not recognise their significance. See Roux and Laharie, *Art et folie*, p.325.

⁵³⁸ Dohrn-van Rossum, *History of the Hour*, p.29.

⁵³⁹ Ibid., p.19. The Roman hours are often found on sundials prior to the 14th century.

this twenty-four-hour system was not new, then why did Opicinus, in one of his last diagrams, suddenly represent the day in this way after he had used the canonical hours in his earlier drawings?

The contextualisation of the drawing within the practices of mid-fourteenth-century time-keeping indicates that Opicinus was indeed influenced by 'clock time'. Despite the establishment of the twenty-four-hour system centuries before, it was rarely used in the Middle Ages before the mechanical clock, and the canonical hours were most commonly used instead.⁵⁴⁰ Although there is no decisive evidence of exactly when, the invention of the clock seems to have brought the twelve- and twenty-four-hour system back into general use. In addition, Opicinus's system (which divides daylight and darkness and begins with 'I' at sunset) conforms with contemporary Italian practice, in which the day was divided into twenty-four equal hours starting from the evening.⁵⁴¹ This was also the most common system used for mechanical clocks at that time. There are also visual similarities between Opicinus's composition and the earliest clock faces. Like fol. 1^r, they often ran anticlockwise and were made up of twenty-four (rather than twelve) Roman numerals.⁵⁴²

⁵⁴⁰ Ibid., p.29.

⁵⁴¹ Ibid., p.114. Whether Opicinus intended to depict the equal or unequal hours cannot be certain, but the equidistant placement of the numerals of each hour around the calendar ring is formally representative of equal hours.

⁵⁴² The anticlockwise movement of the hours, while different from the direction of the modern clock face, was conventional in the Middle Ages. For example, see the early-15th-century Italian models in G. Brusa, 'Early Mechanical Horology in Italy (The first Dingwall-Beloe lecture delivered at the British Museum on the 1st November, 1989),' *Antiquarian Horology Society* (1990), pp.485-513, pp.496-97. The numbers on Paolo Uccello's wall-painted clock in the Duomo in Florence (1443), for example, run anticlockwise from 'I' (at the lower-most point of the clock face) to 'XIV'. Following its conservation, one can be certain that its current form is how it originally appeared: U. Baldini, 'L'Orologio Dipinto da Paolo Uccello nel Duomo Fiorentino: Nuovi Studi e Precisazioni per la Sua Lettura,' in *Gli "Orioli Meccanici" di Filippo di Ser Brunellesco Lippi: Documenti e Notizie Inedite sull'Arte dell'Orologeria a Firenze/L'Orologio Dipinto da Paolo Uccello nel Duomo Fiorentino: Nuovi Studi e Precisazioni per la Sua Lettura* (Florence, 2000), pp.35-70. Other fragments of mid-15th century visual culture show that this was not an anomaly. The clock on the campanile in the tempera painting on panel, *St Bernardino Preaching in the Campo*, by Sano di Pietro (1445, Museo dell'Opera del Duomo, Siena), for example, shows a clock of similar construction.

This thesis has repeatedly emphasised the similarities between components of clocks and Opicinus's diagrams, including a detailed comparison of the liturgical calendars of the earliest astronomical clocks and *Palatinus A*, and the placement of the four Gospel animals which frame the calendar or hour dial at each corner. Considered by themselves, these shared elements do not establish a definitive connection between Opicinus and *horologia* as they (particularly the Gospel animals) also appear in multifarious other circumstances. Yet considered together, this link is strengthened. This does not necessarily imply that Opicinus directly emulated a clock dial but indicates, rather, that the new forms of time-keeping affected the way in which he visualised time. The change within Opicinus's drawings, from the canonical hours in his earlier images considered at the beginning of this chapter to the twenty-four hours in his latest, is indicative of this period of flux in time perception in which the systems of the hours were changing.

But why would Opicinus incorporate this new system? Was it, as in the cases of his calendars, maps, and complex scriptural iconography, to incorporate the latest and most accurate information into his drawings? This was only a part of the reason. Opicinus's other reasons for doing so are less concerned with the integration of the latest time systems, and more with the perception of 'clock time'. The depiction of 'clock time' in the theological drawing of fol. 1^r shows that it was not indicative of an altogether new and 'secular time', as has been suggested in the past. In fact, the following discussion contributes to a recent turn in the history of medieval clocks, which has questioned the previously assumed categorical distinctions between different ways of counting time. The rest of part three considers what else this image tells us about the perception of time in the fourteenth century by relating it to the contemporary use and understanding of 'clock time'. This demonstrates how the medieval clock was not only a practical time teller, but that it was perceived as a theological and cosmological object and thus a new form of temporal microcosm. Opicinus's incorporation of 'clock time' was therefore

symptomatic of the introduction of the monumental clock, the new encyclopaedia of time, as a new model of God's cosmos in the fourteenth century.

'Clock Time' in the Fourteenth Century

It used to be thought that the invention of mechanical clocks introduced secular time, measured by the equal hours, into late-medieval society.⁵⁴³ This encouraged a binary categorisation of time systems, such as those discussed at the beginning of this chapter. For example, Le Goff divided 'church time' and 'merchant time', and asserted that in the cities, merchant time came to replace that of the Church.⁵⁴⁴ According to this framework, the impact of 'clock time' was primarily measured through socioeconomic change. Le Goff cited the state of the French textile trade in the mid-fourteenth century to support his claim that as commercial networks became more organised, 'le temps devient objet de mesure'.⁵⁴⁵ Following Le Goff's hypothesis, Gurevich argued that the clock caused a shift in temporal perception from 'biblical time' towards a practical 'time of the merchants',⁵⁴⁶ concluding that: 'From being the possession of God, time had become a possession of man'.⁵⁴⁷ As has been argued more recently, however, this division between sacred and secular time is a gross oversimplification. Dohrn-van Rossum has shown that the transition between modes of time-keeping was not sudden and that, in fact, diverse temporal systems such as the canonical hours and 'clock time' not only coexisted, but were in some cases harmonised.⁵⁴⁸

⁵⁴³ Le Goff, for example, referred to mechanical clocks as tools 'de domination économique, sociale et politique des marchands qui régissent la commune'. Le Goff, 'Au Moyen Âge,' p.425.

⁵⁴⁴ Ibid., p.426.

⁵⁴⁵ Ibid., p.424.

⁵⁴⁶ Gurevich, *Categories of Medieval Culture*, p.34. He cited Le Goff (*Time, Work & Culture*, p.36) and subscribed to his idea that 'clock time' was the time of the merchant or 'urban time'.

⁵⁴⁷ Gurevich, *Categories of Medieval Culture*, p.150.

⁵⁴⁸ Dohrn-van Rossum, *History of the Hour*, pp.13-14. Dohrn-van Rossum's re-interpretation shows that Le Goff himself was in fact more careful in his approach than has been assumed by some of his readers. His study was not intended as the definitive text which it became, but was instead meant as invitation for more thorough research into

Medieval European horological devices were not harbingers of secular time nor purely practical tools of time-keeping. They became compendia of time, present, past and future, rendering them instruments of cosmological time.⁵⁴⁹ This is emphasised, first, through extant evidence of the ornamentation of astronomical clocks and secondly, by fourteenth-century texts which describe them as theological analogies for the creation and movement of the universe: mechanisms of the *machina mundi*.⁵⁵⁰ Although it would be wrong to deny that the mechanical clock had social and economic consequences over time, it was also an intellectual and theological artefact of the fourteenth century and a new form of macrocosm, in which all temporal systems could be coordinated.⁵⁵¹

Many of the monumental clocks of the Middle Ages not only measured the time of day, but also displayed Christian salvation history through their (occasionally mobile) figural decoration. There is evidence for such decoration on fourteenth-century models, such as the Strasbourg clock considered in chapter two. Dasypodius built a detailed image of the original mid-fourteenth-century clock which included the astronomical content and figures of Christian salvation history. If Dasypodius was correct that the appearance of the clock when he recorded it was the same as in the fourteenth century, it consisted of a large astrolabe dial, above which there was a carillon which played the tunes of hymns. Below this was a circular wooden dial with a liturgical calendar

the modes of time reckoning following the appearance of the mechanical clock. Le Goff, *Time, Work & Culture*, pp.13, 9. Even more recently, Matthew Champion has challenged Le Goff's assumption, showing that the timing of bells on the basis of 'clock time' was often distinctly theological, as they marked the times for prayer. Champion, *The Fullness of Time*, p.14. Chris Humphrey also noted that these different time systems continued to coexist in 'Time and Urban Culture in Late Medieval England', in C. Humphrey and W. M. Ormrod, ed., *Time in the Medieval World* (York, 2001), pp.105-17.

⁵⁴⁹ Price and Dohrn-van Rossum have both convincingly argued that monumental clocks were primarily constructed as models of the motions of the heavenly bodies, and that the keeping of the daily hours was a mere by-product of the astronomical clockwork. Price, 'On the Origin of Clockwork,' pp.81-112; F. C. Haber, 'The Clock as Intellectual Artifact,' in *The Clockwork Universe: German Clocks and Automata 1550-1650*, ed. K. Maurice and O. Mayr (Washington D.C., 1980), pp.9-18, p.11; Dohrn-van Rossum, *History of the Hour*, p.28.

⁵⁵⁰ John of Sacrobosco (c. 1195-c. 1256) referred to the universe as the *machina mundi* in his *De Sphaera* (c. 1230). McCluskey, *Astronomies and Cultures*, p.196.

⁵⁵¹ The categorisation of the clock as an 'intellectual artifact' is taken from Haber, 'The Clock as Intellectual Artifact'.

(discussed above). Underneath was a table indicating the planets and their characteristics which was long believed to have been accompanied by a bloodletting man (*Aderlassmännchen*) or zodiac man, but the latter detail has since been argued to be a misunderstanding of Dasypodius's text.⁵⁵² According to the text, it contained figures of the Virgin and Child, the three Magi and the (still surviving) cockerel, in reference to the Denial of Peter as described in all four Gospels.⁵⁵³ The second version of the clock made in 1574 is even larger, inserting more information into the cosmologies, such as maps and the ages of man, but it is unclear which if any of these features were included in the first model.⁵⁵⁴

This picture of the Strasbourg clock's ornamentation is supported by accounts of other monumental clocks which were adorned with biblical figures and automata that would jump to life at certain times. The earliest known record of automata on a monumental astronomical clock (1322-25) exists in the sacrist's rolls of Norwich Cathedral priory, written around thirty years after the record of their first astronomical clock.⁵⁵⁵ The roll describes fifty-nine automata, including personifications of the days of the month and a procession of choir monks, in addition to an astronomical dial and models of the sun and moon.⁵⁵⁶ Elly Truitt argued that they

⁵⁵² Ungerer, *L'horloge astronomique de la cathédrale de Strasbourg*, p.11; King, *Gearred to the Stars*, pp.43-44; F. C. Haber, 'The Cathedral Clock and the Cosmological Clock Metaphor,' in *The Study of Time II: Proceedings of the Second Conference of the International Society for the Study of Time, Lake Yamanaka, Japan*, ed. J. T. Fraser and N. Lawrence (Berlin, 1975), pp.399-416, pp.399-400. Oestmann has since argued that Ungerer's assumption that there was a zodiac or bloodletting man was an unsupported and 'sehr freien' interpretation. Oestmann, *Die astronomische Uhr des Straßburger Münsters*, p.18.

⁵⁵³ See n.285 above.

⁵⁵⁴ The second version is recorded in a print made by Tobias Stimmer immediately following its construction, and was emulated in a small domestic clock made by Habrecht in 1598. For more concerning Habrecht's model, see N. MacGregor, *Germany: Memories of a Nation* (London, 2016), p.64; 'The Strasbourg Clock,' *The British Museum: Collection Online*, http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=55501&partId=1 (consulted 10/07/2017).

⁵⁵⁵ For more examples of 14th-century automata on clocks, see Dohrn-van Rossum, *History of the Hour*, p.107. There is documentation which suggests that automata existed in the 13th century, but it is less stable. Bedini cited the drawing of an angel in the sketchbook (c. 1225-35) of Villard de Honnecourt, which seemed to have been designed to blow the trumpet on the hour, to argue that automata existed since the advent of clockmakers. Bedini also noted that there are textual descriptions of talking heads constructed by Albertus Magnus, Roger Bacon and Robert Grosseteste, which he suggested could have been automata. S. A. Bedini, 'The Role of Automata in the History of Technology,' *Technology and Culture*, Vol. 5, No. 1 (1964), pp.24-42, pp.29-31.

⁵⁵⁶ E. Truitt, 'The Incarnation of Time,' in *L'automate: modèle, métaphore, machine, merveille*, ed. A. Galliard, J. Goffi, B. Roukhomovsky and S. Roux (Bordeaux, 2013), pp.365-78, p.336.

embodied and enacted Christian allegory and proclaimed Gospel truth and so ‘Together, astronomical clocks and their automata yoked sacred and secular time; measuring out the minutes and hours of human lives while also showing the power of divine creation and the mercy of divine salvation’.⁵⁵⁷

In the same way as the macroscopic drawings of time in part two, these clocks re-enacted Christian salvation history in tandem with the reckoning of the present. Through the incorporation of Christian iconography into these objects, biblical time was aligned with ‘clock time’. This is not to suggest that these clocks were made with the intention of re-enacting Christian salvation, but that their makers incorporated this iconography into their decoration in order to emphasise the relevance of certain times of the day, week and year to the celebration of the Christian past.⁵⁵⁸

Different time systems were not only gathered in clocks but, as in Opicinus’s drawings, they were also meaningfully aligned. Just like Opicinus’s configuration of various time systems (as in the magnifications of fol. 25^f) and the alignment of the biblical figures with relevant parts of the liturgical calendar, astronomical clocks connected different time systems, keeping both the canonical hours and ‘clock time’ whilst correlating these systems to the Christian past.

Monumental clocks were not only timekeepers, but models of the cosmos.

⁵⁵⁷ Ibid., p.342.

⁵⁵⁸ The connection between New Testament narrative and the mechanical clock became more pronounced in 15th-century devotional art and literature, in which Christ’s body became closely associated with the clock face. For visual examples, see the clock faces found in 15th- and 16th-century Books of Hours in K. Rudy, ‘Ihesus-Maria Clocks and Wounds,’ in *Postcards on Parchment: The Social Lives of Medieval Books* (New Haven, 2015), pp.141-55. For literary examples, see the *L’Orloge de la Sapience* by the German mystic, Heinrich Suso (d. 1366), who described a vision (now dated to 1334) in which Christ was in the form of an elaborate monumental clock which chimed the hours. J. Scattergood, ‘Writing the Clock: The Reconstruction of Time in the Late Middle Ages,’ *European Review*, Vol. 11, No. 4, (2003), pp.453-74, p.463. For an illuminated late-15th century copy of this text, see E. P. Spencer, ‘L’Orloge de la Sapience, Bruxelles, Bibliothèque Royale, MS IV. iii,’ *Scriptorium*, Vol. 17, No. 2 (1963), pp.277-99; H. Michel, ‘L’horloge de sapience et l’histoire de l’horlogerie,’ *Physis* 2, (1960), pp.291-98.

The conception of the clock as a model of the universe and an instrument of cosmological time is reinforced by fourteenth-century theological literature. Francis Haber argued that four main aspects were singled out for analogy: the clock as a simple time keeper, the astronomical clock as cosmos, the automata as re-enactors of historical narratives, and the metaphor of the creation of the clock and the world according to Genesis.⁵⁵⁹ Nicole Oresme (c. 1320-82) used the mechanical clock as a metaphor of the creation and movement of the cosmos in his *Livre du ciel et du monde* (1377). This was inspired by the mechanical clock which his patron, King Charles V of France, had erected in his palace in 1362.⁵⁶⁰ Henry of Langenstein, one of Oresme's followers and a lecturer at the University of Paris, frequently evoked the clockmaker and clock as models for God and the ordered universe in his lectures on Genesis, arguing the ordered harmony of the cosmos to be evidence of its design.⁵⁶¹ As the concept of God as maker was so central to Christianity, the clock became intimately tied with ideas concerning the mechanical arts and divine creation. Haber believed this to be the foundation of the analogy of the clockwork universe, which would remain a central tenet of natural philosophy from the Middle Ages until William Paley's *Natural Theology* in the nineteenth century.⁵⁶²

Opicinus can be classified within this group of theologians who were inspired by the clock and its keeping of cosmological time. Like them, he showed God as the creator of quantifiable time. This is emphasised through a legend in fol. 1^r inside the calendar ring on the arc above the personification of September, in which he cited the book of Wisdom: *trapezita in numero, pondere et mensura*.⁵⁶³ This, as Crombie argued, was a concept borrowed from Platonic philosophy in which

⁵⁵⁹ Haber, 'The Clock as Intellectual Artifact,' pp.12-14.

⁵⁶⁰ E. Truitt, *Medieval Robots: Mechanism, Magic, Nature and Art* (Pennsylvania, 2015), p.148.

⁵⁶¹ Haber, 'The Clock as Intellectual Artifact,' p.14.

⁵⁶² Haber, 'The Cathedral Clock and the Cosmological Clock Metaphor,' p.408.

⁵⁶³ Transcribed by Salomon, *Weltbild und Bekenntnisse*, p.150. Wisdom 11, 21: *sed omnia mensura et numero et pondere dispositi.*

the universe was understood to have been rationally, mathematically and geometrically created by God and was therefore comprehensible through the rules of mathematics and geometry.⁵⁶⁴

Opicinus may not have intended to emulate a clock dial, but considering fol. 1^r within this culture in which the systems of hours were changing, and in which the clock was now regarded as a model of God's universe, shows that the drawing belonged to a specific moment in which the introduction of the clock changed how time was perceived.

Conclusion

The visualisation of Christian time, in which the most accurate methods of time-keeping were aligned with biblical history, changed over the course of the Middle Ages. From its roots in *computus* manuscripts, this temporal conception shaped the cosmologies of the twelfth and thirteenth centuries before emerging as mechanical compendia of time from the fourteenth century onwards. This chapter has shown how Opicinus's drawings were shaped, to a large extent, by the multiple temporal systems in the visual culture (including both diagrams and instruments) which governed his own experience of time.

Yet his visualisations, whilst greatly informed by earlier and contemporary representations of time, are not purely the by-products of these systems. The drawings themselves are unique in their instrumental form and in the way in which they address the place and significance of the Avignon popes within world history. The novel features of Opicinus's drawings can, like the components analysed in earlier chapters, be ascribed to the intellectual and visual culture of the Avignon court. His drawings were a response to the current conversation in Avignon concerning

⁵⁶⁴ A. C. Crombie, 'Quantification in Medieval Physics,' *Isis*, Vol. 52, No. 2 (1961), pp.143-160, p.145.

the place of the Roman Church in the spectrum of time, other examples of which survive in the texts of Jacopo Stefaneschi and the chronologies of Paolino Veneto. While the instrumental aspects of his drawings can be partially explained by the changes in his technological context, their form was also governed by the types of images, or image-instruments, made by his predecessors in the penitentiary which were made to inform the same conversation. Through these, Opicinus developed new and inventive ways by which to communicate an altered understanding of history and the present, which were tailored to the concerns of the court.

The functionality of these innovative creations, which partook of both diagrams and instruments of time, distinguished his calendars from those in the cosmological drawings of his twelfth- and thirteenth-century predecessors. A select few of the liturgical feasts were indicated in Joachim's *Mysterium Ecclesiae* and the Vercelli manuscript, but Opicinus's content-rich calendar allowed for more specific exegesis. The microscopic detail of the calendar, as illustrated in the magnifications of fol. 25^r, allowed the viewer to observe the interrelation of the mechanisms of the diverse temporal systems, which had before only been roughly aligned in obscure simplifications. Through the precise configuration of these systems, Opicinus sought to demonstrate their harmonious interconnection and thus the divine unity of God's cosmos. The natural philosophical concepts which supported this world view are explored in the next chapter.

Chapter Six: The Measurement of Christ's Body within 'Time

The chapters of this thesis have journeyed through the layers of Opicinus's drawings: from the calendars, to wheels of scripture, to cycles of microscopic and macroscopic time, to show how he constructed models of the cosmos. Yet significant content, perhaps the most significant, which is incorporated into his calendars has not yet been considered: the figures of God. In both the Palatinus and Vaticanus, the drawings are laden with figurative images, most frequently representing the signs of the zodiac, monks of various orders, the Gospel animals discussed in chapter four, the pope and Mary/*Ecclesia*. But the most frequent and central figure is that of Christ, the focus of this final chapter.⁵⁶⁵

It was not uncommon for Christ to feature in astronomical and cosmological diagrams in the Middle Ages. In some, he is enthroned above the planetary spheres, such as in the fourteenth-century *De Lisle Psalter* (fig. 58). Accompanying the opening of the thirteenth-century text of John Peckham (Archbishop of Canterbury, d. 1292) within the Psalter is a diagram of the geocentric model of the universe, upon which Christ is enthroned. His presence is explained in the accompanying text, which begins, 'In the present essay I intend to explain the number, form and movement of the principal heavenly bodies to the extent sufficient for the understanding of the words of Holy Scripture', before quoting Aristotle's *De Caelo* (Book I): 'Beyond and above [the planets and stars] is the dwelling of the spirits and gods'.⁵⁶⁶ Knowledge of the physical world is presented here as a pathway to the understanding of God. This interpretation, most often based on Aristotelian principles, became contentious during the thirteenth and fourteenth

⁵⁶⁵ The anthropomorphised continents or 'body worlds' (to use Whittington's term) are clearly significant within Opicinus's drawings. They are not included in this discussion as they belong to a different representational strategy which has been acknowledged to a great extent in the secondary literature on Opicinus. For the most extensive study, see Whittington, *Body-Worlds*.

⁵⁶⁶ L. Freeman Sandler, *The Psalter of Robert de Lisle in the British Library* (London, 1999), p.38.

centuries in scholastic thought and was undoubtedly known to the philosophers at the Avignon court.

In other medieval images of the cosmos, the members of Christ's body frame the diagram. In Hugh of St Victor's *Arva Noe*, and in the large-scale wall painting of the universe at the moment of Creation by Piero di Puccio in the Camposanto in Pisa (1389-90, fig. 59), for example, Christ stands behind a diagrammatic representation of the cosmos as if he were presenting it to the viewer. For this reason, both images have been compared to Opicinus's diagrams by Whittington.⁵⁶⁷ The appearance of Christ within these older-established diagram types, which had previously existed in scientific manuscripts for centuries without his presence, shows a specific interest, roughly from the twelfth to the fourteenth centuries, in the visualisation of God within discourse related to the physical world. This has prompted questions which are profound but which are too often presented in binary terms. Most simply expressed: How did theology and science relate to one another in the Middle Ages? Opicinus's drawings present an illuminating case study which not only sheds light on this large question, but permits attention to be focused on aspects of scientific and theological thought which were particularly significant during the fourteenth century.

An investigation into the relation between the calendar rings of the Palatinus and the figurative drawings of the Crucifixion shows how Opicinus visualised sacred concepts by using the calendar as a scale to measure the body of Christ. Although Christ appears in Opicinus's diagrams in a similar manner to the other figures noted above, his depictions of the crucified body engage differently with the diagrammatic structure. The geometrical alignment of the stigmata with relevant components of the diagram binds Christ's body to the world in specific

⁵⁶⁷ Whittington, *Body-Worlds*, pp.121, 176. Whittington's consideration of images like this in relation to the Palatinus is discussed below.

and significant ways.

Through a final review of the intellectual culture in which Opicinus was active and of its impact on devotional-image making, this final chapter shows that while Opicinus's representation of Christ was novel, his method can be traced to changing attitudes towards empirical measurement which are documented during the fourteenth century. It begins with an overview of various notions of universal structure during the thirteenth and fourteenth centuries, focusing on the extent to which the physical and spiritual worlds were believed to be related. Second, it considers how the growing tendency to quantify physical and spiritual forces can be detected in different domains of culture, including natural philosophy, economics and theology.

The remainder of the chapter focuses upon the way in which this cultural phenomenon affected the making of theological images. Opicinus is situated within this shift through comparison of his representations of Christ in *Palatinus A* to contemporary images in which God interacted with astronomical diagrams. This demonstrates that scale and measurement were integral to the function of the Palatinus drawings. Finally, fifteenth-century schematic representations of parts of Christ's body, often referred to as 'metric relics', are used to assess the growing interest in measurement in devotional images, which became more pronounced in the later Middle Ages. Considered in relation to the Palatinus, they show how the quantification of divine concepts, which were previously perceived to be beyond human powers of reckoning or representation, were formative of a select group of medieval theological images which came to function as both images and instruments.

Image-instruments, including metric relics, *Palatinus A*, and by extension other diagrams made at the papal court, are contextualised within their wider intellectual culture. This explains the conditions in which the measurement of the physical world was deployed to make pictures

which achieved devotional precision and, in the case of Opicinus, accurate models of the Christian cosmos.

Truth(s): The Physical and Spiritual Worlds

Throughout this thesis, we have encountered images (by Opicinus and others) in which their makers strove to illustrate the Christian cosmos. The previous chapter demonstrated how Opicinus adhered to the ancient concept of microcosm and macrocosm, according to which the composition and structure of the cosmos were reflected in smaller bodies, such as that of man. Yet, as was indicated in chapter one, the methods by which Opicinus compiled and integrated the constituents of his cosmological structures -which were treated separately at the beginning of the thesis- need to be framed within the golden age of the reorganisation of knowledge in the thirteenth and fourteenth centuries. During this time, rival ideas were formed by scholastic thinkers concerning how natural philosophy could be understood within a Christian world view.

These consisted of two main schools of thought: the Aristotelians of Paris and the Platonists of Oxford. To characterise Christian thought of the period in this way is inevitably to over-simplify; but the following brief sketch helps to contextualise the project of Opicinus. In thirteenth-century Paris, an Aristotelian natural philosophy crystallised which saw itself as distinct from, albeit complementary to, the study of theology. Through a Christian reception of the Aristotelian programme, particularly that concerning metaphysics, Albertus Magnus and Thomas Aquinas argued that the differences between the methodologies of theology and natural philosophy proved the two domains of human knowledge to be distinct. The outcome was the development of a concept widely referred to as the 'double truth', according to which the truth of the physical

world as it appeared to human perception was not necessarily true in the sight of God.⁵⁶⁸ This vindicated the work of the natural philosophers, whose conclusions did not threaten those of theologians, as their discourses were seen to be separate. For a theologian such as Aquinas, it allowed the continued pursuit of Aristotelian research on the basis that, if at times this appeared to result in conclusions discordant with scripture or theology, this could be explained by human weakness of understanding.

The Aristotelian conception of the universe was a subject of contentious debate at the University of Paris throughout the thirteenth century: from the ban of the teaching of Aristotelian philosophy in 1210, to the new curricular statutes of the Faculty of Arts in 1255 which required the teaching of all available Aristotelian books, to its renewed condemnation in 1277.⁵⁶⁹ Yet in 1323, John XXII elevated Aquinas to sainthood, demonstrating that his reputation had by then recovered, and in 1325 the articles of the condemnation of 1277 relating to his teaching were revoked by the Bishop of Paris.⁵⁷⁰ After more than a century of dispute, Aristotelianism, and by extension the concept of ‘double truth’, was accepted at the University of Paris. But this was by no means conclusive.

According to a rival perspective, the existence of a single divine truth (which adherents of the first position certainly did not contest) required that the study of the physical world should be inextricably bound to that of the spiritual. This school of thought has been categorised as ‘Oxford Platonism’, and included English philosophers such as Grosseteste, Kilwardby and

⁵⁶⁸ For Aquinas’s metaphysical argument concerning this, see Wood, ‘The Aristotelian Science of Metaphysics,’ pp.614-16.

⁵⁶⁹ The ban had been renewed in 1231 by Pope Gregory IX (c. 1145-1241) as it was believed that the correction of Aristotle’s works was necessary before they could be studied. There was still concern over the pantheistic tendencies manifested by some readers of Aristotle’s texts, but the demand for their correction shows that they were a respected source. D. Lindberg, ‘The Fate of Science in Patristic and Medieval Christendom,’ in *The Cambridge Companion to Science and Religion*, ed. P. Harrison (Cambridge, 2010), pp.21-38, p.30.

⁵⁷⁰ Lindberg, *The Beginnings of Western Science*, p.246.

William of Ockham (c. 1287-1347).⁵⁷¹ Bacon argued for this stance in his *Opus Maius*, in which his perception of the relationship between the physical and the spiritual could be defined by two features. First, he adhered to a holistic conception of the universe in which there was ‘only one perfect wisdom, which is totally contained in sacred scripture and expounded by canon law and philosophy’.⁵⁷² Secondly, he presented one science as the mistress to the others: theology. According to Bacon, the natural sciences were the handmaiden of theology. This meant that natural philosophy was not only in agreement with the spiritual universe, but could be used as ‘an instrument of biblical exegesis and theology’.⁵⁷³ Bacon supported his argument with a list of all the sciences necessary for the Church, including calendar reform, which, as has been seen, was a priority of the Avignon court.⁵⁷⁴ As shown throughout this thesis by the analysis of images made in Avignon, including maps and calendars, scientific learning was actively encouraged and used within theological investigations in the context in which Opicinus was working.

This ‘handmaiden’ relationship of theology to science was not a novel conception in the thirteenth century. Lindberg has traced this view back to the patristic understanding of cosmology, examples of which were encountered in chapter four in Jerome's presentation of the Wheels of Ezekiel as multivalent symbols both of the physical universe and of scripture. Lindberg emphasised St Augustine's use of the ‘handmaiden formula’ in the *De doctrina christiana* (397 AD), in which Augustine argued that the invisible spiritual God could be understood through the visible physical world: ‘so that by means of corporeal and temporal things we may

⁵⁷¹ For an overview of ‘Oxford Platonism’ see Weisheipl, ‘Classification of the Sciences,’ pp.72-81. For an explanation of Ockham's reasoning behind this branch of metaphysics, see Wood, ‘The Aristotelian Science of Metaphysics,’ pp.620-21. In this article, she also recounts the arguments of Avicenna, Averroes, Richard Rufus of Cornwall, Thomas Aquinas, and John Duns Scotus on the subject.

⁵⁷² D. Lindberg, ‘Science as Handmaiden: Roger Bacon and the Patristic Tradition,’ *Isis*, Vol. 78, No. 4 (1987), pp.518-36, p.534.

⁵⁷³ *Ibid.*, p.530-32.

⁵⁷⁴ Lindberg, ‘The Fate of Science,’ p.34.

comprehend the eternal and spiritual'.⁵⁷⁵ On this argument, God could be deciphered through the visible world.

If the description of the natural world informed that of the spiritual, then a modification in the representation of the physical world also affected the way in which theological ideas could be expressed. One of the most significant changes in the conception of the physical world during the fourteenth century was the attitude towards measurement, as properties which were previously understood to be qualitative began to be quantified. The extent to which the shift from qualitative to quantitative expression in natural philosophy had an impact on theological thought can be ascertained by devotional texts and images.

Measurement in the Thirteenth and Fourteenth Centuries

There have been numerous attempts to chart a growing emphasis on accuracy and precision during the later Middle Ages: attempts which have presented changes in numerical expression in texts or new developments in technology as benchmarks of 'innovation'. For example, Alfred Crosby dated the increasing prominence of concepts of quantity between 1250 and 1350 ('maybe even 1275-1325'), because it was during this period that the first mechanical clock was documented. Around that supposedly key moment of technical breakthrough, Crosby believed that the larger trend could be detected in all areas of society in diverse artefacts made with increasingly demonstrative precision, including portolan charts, perspectival painting, musical notation and literary chronicles.⁵⁷⁶ Other studies have prioritised different catalysts of change at

⁵⁷⁵ For the Augustinian roots of the 'handmaiden theory', see Lindberg, 'The Fate of Science,' p.25. Lindberg quoted this Augustinian passage in Lindberg, 'Science as Handmaiden,' p.524, for which he cited Augustine, *On Christian Doctrine*, transl. D. W. Robertson Jr. (Indianapolis, 1958), p.10.

⁵⁷⁶ A. W. Crosby, *The Measure of Reality: Quantification and Western Society, 1250-1600* (Cambridge, 1997), p.19. Alexander Murray also identified the desire at this time to quantify, or in his terms to 'reason'. He argued that there

this time, such as Joel Kaye's evaluation of the impact of economic standardisation and the acceleration of monetisation, and Anneliese Maier's (d. 1971) and Alistair Crombie's (d. 1996) diverse analyses of fourteenth-century natural philosophical texts.

Crombie situated his discussion within a teleological history of science by celebrating the fourteenth-century thinkers whose work, as he argued, laid the foundation for the practice of physics as it came to be understood in the modern world. This included the roots of theorems on velocity, acceleration and instantaneous velocity which would be undertaken in the seventeenth century.⁵⁷⁷ Maier, on the other hand, worked with individual texts in order to analyse scholastic theories 'in their own terms from the inside out'. She believed that this allowed her to 'establish the history of scholastic science on firm conceptual foundations', without making anachronistic judgments concerning their relation to modern science.⁵⁷⁸

Maier identified the change which is in question here as a curious shift between qualitative and quantitative thinking, which she defined by a paradoxical lack of precise measurement:

Time after time fourteenth-century philosophers were content to understand the manner of knowing without pursuing the knowledge itself. The attitude produced - or perhaps derived from - an unusual deficiency in the 'new physics' of the fourteenth century: no one ever measured anything. They were satisfied with

was a decisive shift between the 'numerical reticence' of 12th-century texts (such as Theophilus's *De diversis artibus* and Suger's *De administratione*) towards an invasion of numbers, demonstrated in 13th- and 14th-century Italian literature. In addition to noting the inventory-like detail of some texts, such as the *De magnalibus urbis mediolani* (1288) of Bonvesino della Riva, he drew attention to the specification of time in the *Chronica* (1347) of Giovanni Villani, the biggest thesaurus of figures in medieval historiography, and the chronicle of Fra Salimbene of Parma (finished late 1280s), in which each entry is accurately dated by year, month and day. Murray argued the interest in apocalyptic calculation, as popularized in 13th-century Italy by Joachim of Fiore and still fervently pursued in the 14th century, to be further symptomatic of numerical awareness. A. Murray, *Reason and Society in the Middle Ages* (Oxford, 1978), pp.181-85.

⁵⁷⁷ Crombie, 'Quantification in Medieval Physics,' p.154.

⁵⁷⁸ A. Maier and S. D. Sargent, *On the Threshold of Exact Science: Selected Writings of Anneliese Maier on Late Medieval Natural Philosophy* (Philadelphia, 1982), p.13.

approximate quantitative values in their experiments and inductions, and in their *calculaciones* they either used arbitrary magnitudes determined a priori or stayed on the abstract level of computation using letters alone.⁵⁷⁹

She identified these texts to be on the 'threshold' of the 'exact sciences'. Her conclusion leaves two problems. First, Maier's methodology was originally intended to avoid a teleological reading of these texts, but the eventual comparison with the 'exact sciences', in which the shift from qualitative to quantitative thinking was framed as a development towards modern conceptions of science, was at risk of falling into precisely such a preconceived narrative. Secondly, although it was apparent from the texts she studied that 'no one ever measured anything', these were not necessarily representative of the entire fourteenth century. In fact, studies of other fourteenth-century texts have proven her statement to be false.

A relatively well-known group who experimented with measurement in the second quarter of the fourteenth century were the so-called 'Oxford calculators' of Merton College. This group of natural philosophers included Thomas Bradwardine (the author of *On the Ratios of Velocities in Motions*), William Heytesbury (*Rules for Solving Sophismata*), Richard Swineshead (*Book of Calculations*) and John Dumbleton (*Summa of Logic and Natural Philosophy*). These scholars have often been celebrated in the twentieth-century narrative of the history of science as the first to quantify physical forces.⁵⁸⁰ Marshall Clagett argued that the 'exact sciences' were fully realised in their 'application of quantitative considerations to the description of physical reality'.⁵⁸¹ Although Maier's summarising statement was incorrect overall, she seems to have divined the increasing

⁵⁷⁹ Maier, *On the Threshold of Exact Science*, pp.168-69.

⁵⁸⁰ Edith Sylla produced the most extensive study on the topic: E. Sylla, 'The Oxford Calculators in Context,' *Science in Context*, Vol. 1 (1987), pp.257-79.

⁵⁸¹ M. Clagett, 'Richard Swineshead and Late Medieval Natural Physics,' *Osiris*, Vol. 9 (1950), pp.131-40. Quoted from J. Kaye, 'The Impact of Money on the Development of Fourteenth-Century Scientific Thought,' *Journal of Medieval History*, Vol. 14 (1988), pp.251-70, p.254.

interest in numerical measurement which was not apparent in the texts she studied but had begun to crystallise elsewhere.

Unlike these studies, it is not the aim of this project to interpret intellectual change during this period as a transition between medieval natural philosophy and a modern conception of science. It is, however, significant that these various studies on the medieval history of measurement converge in agreement that the material culture of this period reveals a shift in mentality, marking a definitive trend in the history of thought in which concepts previously perceived as qualitative were beginning to be quantified.⁵⁸²

These ‘quantitative processes’ were not applied solely to the physical world, but were used in other realms of theoretical thinking, including theology. The increasing emphasis on number and quantification was evident in both secular and theological outlooks in the later Middle Ages. As Marie-Dominique Chenu argued, ‘Numbers were like the thoughts of God, and in decoding their meaning one discovered the secret of the world whose harmony derived from “measure and number and weight” (Wisd. 11:21) ... They loaded their neo-Pythagorean speculations with biblical arithmetic and their calculations on the cosmos were shot through with Christian mystery and so sanctified’.⁵⁸³ Such biblical numerology, studied extensively by Wallis, existed in exegetical writing from the early Middle Ages.⁵⁸⁴ It is therefore unsurprising that in the fourteenth century, as at the Avignon court, new and more accurate methods of measuring time and space were applied to theology.

⁵⁸² Crosby, *The Measure of Reality*, p.xi.

⁵⁸³ M. D. Chenu, *Nature, Man and Society in the Twelfth Century* (Chicago, 1968), p.106.

⁵⁸⁴ F. Wallis, “Number Mystique” in Early Medieval Computus Texts,’ in *Mathematics and the Divine: A Historical Study*, ed. T. Koetsier and L. Bergmans (Boston, 2005). Chenu presented the *Analytica numerorum in theographiam* of Odo of Morimond as an example. Chenu, *Nature, Man and Society*, p.106.

Kaye argued that the Mertonians created a new language of measurement, which extended from quantifying the size and height of physical realities into other realms of medieval knowledge. Building on the arguments of Clagett and John Murdoch, he explained that: 'Every "quality" that could be imagined in some way as an intensive magnitude (that is, capable of increase or decrease), whether physical or mental in nature, was considered just as measurable as a spatial magnitude. Such qualities as love, faith, grace, and strength of the will, the power of the intellect or even the depth of religious vision were all seen as "divisible according to intensity" and thus measurable in the same way as a physical quality, such as heat'.⁵⁸⁵ This methodology is demonstrated in the Mertonians' writings on the 'latitude of forms', in which their quantitative methods were applied to the physical experiments noted above, and also to issues of divine grace and sin.⁵⁸⁶

The extension of the method of measurement from the study of natural philosophy into that of theology conforms to the holistic perception of the universe presented by such an earlier theologian and natural philosopher as Roger Bacon. By first learning how to quantify the visible world, one could then move on to measure the invisible. The quantification of theological ideas was dependent on accepting that theology and natural philosophy were part of a single truth. From this perspective, if the invisible mechanisms which governed the physical constitution of the universe could be measured, then surely those concerning theology could also be quantified, as they were part of the same system of reality. Whilst this is not the place to determine exactly when and to what extent this 'near frenzy' took hold, it is important to identify which domains were affected by the shift. In doing so, it becomes clear that the tendency to quantify was not confined to the study of natural philosophy and theology.

⁵⁸⁵ Kaye, 'The Impact of Money,' p.255; where he cited Maier, *On the Threshold of Exact Science*, p.149.

⁵⁸⁶ Crombie, 'Quantification in Medieval Physics,' pp.154-55.

The impetus to quantify intangible concepts can be read in other domains of culture apart from natural philosophical texts. Kaye acknowledged the role of such texts, but believed that it was not necessarily a high literary and philosophical culture alone which had fostered this development. He attached significance to the increasing use of 'money as an instrument of measurement and exchange - a model that served to open up new ways of looking at the world and so new possibilities of thought'.⁵⁸⁷ He identified the Avignon papal court as one of the centres most heavily affected by the new economic reality, as the papacy committed itself simultaneously to an expensive war in Italy and to the wholesale reconstruction of the city of Avignon. The complexities of papal finance necessitated the creation of an unprecedentedly vast administrative system: a bureau which Guillaume Mollat and Bernard Guillemain showed to be the most powerful of its kind.⁵⁸⁸ Although the economic situation was just one aspect of the phenomenon under consideration, it is undeniable that the expansion of papal administration at this time fostered a general increase in habits of quantification.

It was in the penitentiary office of this very system that Opicinus was tasked with financial administration. This included the organization of indulgences: a transaction which entailed the quantification of moral virtue. Although the history of indulgences originates around the time of the First Crusade, William Lunt argued that the 'commercial character of the [indulgence] transaction' in Clement V's bull of 1308 demonstrated how the process was made more explicit in the fourteenth century.⁵⁸⁹ Opicinus's routine experience included the measurement of sin and its absolution. In his immediate intellectual environment, virtue and vice were regularly measured and translated within a graduated system in what Murdoch described as the 'mechanics' of merit,

⁵⁸⁷ Kaye, 'The Impact of Money,' p.256.

⁵⁸⁸ Mollat, *Les papes d'Avignon*, pp.449-53; Guillemain, *La cour pontificale d'Avignon*, pp.442-95.

⁵⁸⁹ W. Lunt, *Papal Revenues in the Middle Ages*, Vol. 1 (New York, 1965), p.116.

demerit, sin, reward and conscience.⁵⁹⁰

Certain aspects of late-medieval visual culture reflect this growing interest in counting for the sake of absolution. Whilst images of Christ's Passion carried indulgences from the thirteenth century, the increasing emphasis on their scale in the fourteenth and fifteenth centuries formed what have been referred to as 'metric relics'.⁵⁹¹ Kathryn Rudy has defined these as 'images that in their very dimensions correspond to a prototype and thereby summon the power of their referents'.⁵⁹² They most often take the form of measured (that is, supposedly to scale) images of relics of the Passion or of the body of Christ (*mensurae Christi*). Surviving *mensurae Christi* can be roughly divided into two groups: those found in fifteenth-century English scrolls, and those in late-fourteenth- or early-fifteenth-century French Books of Hours.⁵⁹³ In both, the image is accompanied by prayers and indulgences. For example, the text accompanying a diagram of Christ's height in HM 1104, a fifteenth-century French Book of Hours in the Huntington Library (fig. 60), states that those who look upon it will earn indulgences, according to Pope Innocent. As further explained below, the indulgence was activated by the viewer's imagining of the physical appearance of Christ, which was made as accurate as possible using the to-scale metric relic. Christ's body was rendered into an instrument, the efficacy of which depended upon the perceived correspondence between the image's measurement and Christ's body as it existed

⁵⁹⁰ J. E. Murdoch, 'The Unitary Character of Late Medieval Learning,' in *The Cultural Context of Medieval Learning*, ed. J. E. Murdoch and E. Sylla (Boston, 1969), pp.271-348, p.294.

⁵⁹¹ R. N. Swanson, *Indulgences in Late Medieval England: Passports to Paradise?* (Cambridge, 2007), p.258.

⁵⁹² Rudy, 'Kissing Images,' p.45.

⁵⁹³ On *mensurae Christi* see C. F. Bühler, 'An Orazione della misura di Cristo,' *La bibliofilia*, Vol. 39, No. 10/11 (1937), pp.430-33; idem., 'Prayers and Charms in Certain Middle English Scrolls,' *Speculum*, Vol. 39, No. 2 (1964), pp.270-78; G. Llompart Moragues, 'Longitudo Christi Salvatoris: Una aportación al conocimiento de la piedad popular catalana medieval,' *Analecta sacra Tarraconensia*, Vol. 40 (1967), pp.93-115; D. C. Skemer, *Binding Words: Textual Amulets in the Middle Ages* (Pennsylvania, 2006), pp.142-43, 151-52, 171, 247-49, 266-69; *Lexicon für Theologie und Kirche*, Vol. 4 (Freiburg, 1962), p.785. For 'metric relics' and the visual culture of the *arma Christi*, see *The Arma Christi in Medieval and Early Modern Material Culture*, ed. L. H. Cooper and A. Denny-Brown (Farnham, 2014); M. Morse, "'Thys moche more ys oure lady mary longe": Takamiya MS 56 and the English Birth Girdle Tradition,' in *Middle English Texts in Transition: A Festschrift Dedicated to Toshiyuki Takamiya on his 70th Birthday*, ed. S. Horobin and L. R. Mooney (York, 2014), pp.199-219; Rudy, 'Kissing Images,' pp.42-56.

in physical reality. Such images indicate how the shift in the practice of measurement was not a purely theoretical nor a simply practical matter, but also affected devotional practices.

But to what extent was the measurement of such images directly informed by natural philosophical ideas? Certain pictures of Christ in the *Palatinus*, in which his body is structured in relation to the relevant parts of calendars and maps, show how Opicinus did not only apply scale to cartographic renderings of space, but also to theological images. Following a description of how Christ is drawn in *Palatinus A*, this section analyses first: Opicinus's theological reasoning behind the alignment of Christ's body with the other material in the diagrams; and secondly: how he expressed this alignment and to what extent it was exceptional. This insight as to how Opicinus represented Christ contributes to the larger understanding of the importance of scale in fourteenth-century devotional images.

Measuring Christ's Body in *Palatinus A*

The depiction of Christ crucified is one of the most ubiquitous images of the Middle Ages, yet those in *Palatinus A* are distinct in the alignment of Christ's body with relevant units of measurement, by which the Crucifixion becomes an extension of the diagram. Starting with the uppermost Crucifixion (fig. 61a): Christ, whose crucified pose is shown through his open arms and side wound highlighted in red, is structured upon three lines which emanate from the centre of the drawing. The central circle is divided into twenty-four sections in order to delineate each half month of the calendar rings. Three of the lines emanate beyond the second calendar ring and into Christ's stigmata and the centre of his chest. Visible traces of the central line continue past Christ's chest to the top of his halo, at which point the lines from each of Christ's stigmata intersect. The figure is thus framed within the form of a kite.

This may have been a practical technique to ensure the symmetry of Christ's bodies and their alignment with the crucified figures above and below. Yet the red highlighting of the two lines which extend into Christ's stigmata outside of the calendar ring shows that they are a conscious continuation of the red lines separating each month of the outer calendar, which purposefully connect Christ's stigmata to the calendar itself. This is emphasised by the relevance of the calendrical data to the stigmata, as is further explored below. Christ's outstretched arms delineate the month of September in the outer calendar, but also extend over March of the inner calendar. The mirror image of Christ at the bottom of the calendar (fig. 61b) is structured identically to that at the top, so the lines from the stigmata delineate March on the outer calendar ring and September on the inner.

The Crucifixions are not ornamental, nor are they random insertions of devotional imagery to imbue a vaguely theological meaning into the drawings. As the figures were drawn after the calendars (this is demonstrated by their structural dependence on the lines which measure the calendar), they act as an extension of the calendrical data and thus function as a form of visual exegesis. In the same way in which automata of biblical figures on astronomical clocks would re-enact scriptural narratives at a specific time of the day, the figures of Opicinus's drawings are measured against a temporal scale (the calendar ring), showing their relevance to particular parts of the liturgical year, thereby using the calendar as both a temporal and a physical scale by which to measure Christian history.

Figural representations of biblical and saintly figures often appeared in medieval time reckoning images and instruments as a means of relating the measurement of human time to Christian history. An example from a fourteenth-century farmer's almanac shows another case in which figurative images are aligned with feast dates. The almanac consists of six detached pieces of

parchment kept inside a parchment pouch.⁵⁹⁴ Part II (fig. 62) contains a saints' calendar, in which each day is accompanied by a figurative rendering of the relevant feast. This most frequent type is a saint with their identifying attribute(s). In the detail of May, Philip and James are drawn above the first dominical letter b with ciphers (which represent numerical-astronomical data) written below. The space containing the figures for each date is limited and spatially inconsistent due to the variation in size between the illustrations, with the result that the figure is not always directly above its relevant date. To clarify which figures relate to which date, they are connected by red lines. In this instance, Philip and James each have one foot tethered to the dominical letter b, like floating humanoid balloons.

This method of alignment bears comparison with that of *Palatinus A*, yet the forms of the figures in the almanac are not modelled on the calendar's content. Rather than forming part of a geometrical framework, as in *Palatinus A*, each figure in the almanac is its own separate form, and is only attached to the calendar by a single line. Similarly, the appearance of Christ's body in earlier medieval cosmological diagrams, such as Hugh of St Victor's *Arca* discussed above, expressed his relationship with the calendar and therefore the temporal world, but his body parts did not visually correspond with particular units of the calendar.

There is a group of images, mostly found in mid-fourteenth-century wall paintings in northern Italy, in which the figure of God intersects a specific point on a circular zodiac calendar. Within this group, God almost invariably touches the sign of Aries.⁵⁹⁵ In the wall painting by Giusto de' Menabuoi at the cathedral baptistery in Padua (1376-78, fig. 63), for example, God enthroned is

⁵⁹⁴ P. Binski and J. G. Alexander, ed., *Age of Chivalry: Art in Plantagenet England 1200-1400* (London, 1987), p.288, cat. no. 222.

⁵⁹⁵ Lippincott's evaluation of this collection of images, including medieval examples and others, showed that while the convention was long-lived, it reached its peak during the mid-14th century. K. Lippincott, 'Giovanni di Paolo's 'Creation of the World' and the Tradition of the "Thema Mundi" in Late Medieval and Renaissance Art,' *The Burlington Magazine*, Vol. 132, No. 1048 (1990), pp.460-68, p.467.

surrounded by angels as he looks over the cosmos. This is represented as a diagrammatic image in which the movement of the planets is circumscribed by the zodiac ring, signifying the celestial sphere. The divine figure intersects with the zodiac ring at the point at which Aries is situated.⁵⁹⁶

Whittington acknowledged the relevance of this image group to Opicinus's drawings, as they 'testify to the enduring interest in using astrology to deal with explicitly theological questions, and are rare examples of images which, like Opicinus's, combined multiple cosmic discourses'.⁵⁹⁷

The idea that Opicinus combined multiple conceptions of the universe in his drawings is also supported by Harding, who came to the same overall conclusion: Opicinus combined 'various late medieval diagrams, zonal charts and *mappaemundi*, to suggest how Christian hearts and minds could be turned from the visible, material world to a recognition of a higher, spiritual truth'.⁵⁹⁸

Although this argument is broadly correct, these descriptions of the way in which diverse types of diagrams were combined in the Palatinus drawings are vague, as both Whittington and Harding underestimated the importance of precision and detail in the drawings. Whittington did not cite any particular drawing of Opicinus's in his generalised comparison with cosmological wall paintings, and he confined himself to emphasising how both expressed the overlap between theological and astronomical conceptions of the universe. This relationship calls for further analysis. The details of the Palatinus drawings, and in particular the point at which Christ engages with the calendar in *Palatinus A*, demand a closer comparison with this group of wall paintings. This shows exactly which cosmic discourses Opicinus engaged with, and thus what he was trying to achieve.

⁵⁹⁶ As accurately summarised by Whittington, Salomon's interest in the *thema mundi* in relation to his study of Opicinus was primarily concerned with how Opicinus used astrology to formulate ideas concerning the Antichrist. Salomon, *Weltbild und Bekenntnisse*, pp.125-29; Whittington, *Body-Worlds*, p.196, n.50.

⁵⁹⁷ Whittington, *Body-Worlds*, p.121.

⁵⁹⁸ Harding, 'Madness, Reason, Vision and the Cosmos,' p.202.

The two prevalent interpretations of why God gestures to Aries in this set of paintings are also applicable to *Palatinus A*. They offer two potential reasons for Opicinus's alignment of the Christ figure at this point of the zodiac (and/or) calendar: to emphasise Christ's Incarnation, or to represent the *thema mundi*, an astrological depiction of the disposition of the stars at the moment of Creation. In order to gauge the intended meaning of Opicinus' Christological alignment, each of these interpretations is considered in relation to *Palatinus A*, and a third possibility is presented.

In Giovanni di Paolo's painting (1455, fig. 64), God points towards a cosmological diagram and gestures between Aries and Taurus (the signs through which the sun passes in early spring). In Laurinda Dixon's astrological reading of this painting, she argued that the artist must have intended to indicate the most important feast of that time of year: the Annunciation (25 March).⁵⁹⁹ The celebration of the moment in which Christ became flesh essentially emphasised the importance of the Incarnation. That Opicinus also intended to accentuate the Incarnation is signified by his placement of Christ's body against an earthly temporal system (the calendar).⁶⁰⁰ This is a visualisation of a central belief of Christianity: that God became present in the realm of man's sensory perception.

Yet this is not the only applicable explanation. Kristen Lippincott's reading of the same picture, which also considered two similar mid-fourteenth-century wall paintings, suggested that the depiction of specific dispositions of the stars was also used to represent other moments in time. According to Lippincott, these images represented, rather, the *thema mundi*.⁶⁰¹ The depictions of

⁵⁹⁹ L. S. Dixon, 'Giovanni di Paolo's Cosmology,' *Art Bulletin*, Vol. 67, No. 4 (1985), pp.604-13, p.611-12.

⁶⁰⁰ The feast date is present in Opicinus's *sanctorale*, but it was likely to have been included in any case.

⁶⁰¹ Lippincott, 'The Tradition of the "Thema Mundi,"' p.462. Although Lippincott's interpretation focused on Giovanni di Paolo's painting (*The Creation of the World and the Expulsion from Paradise* (1445), Robert Lehman Collection, Metropolitan Museum of Art), the other two wall paintings from the mid-14th century are closer to Opicinus in date: *Come dio creò il mondo* (1367) by Bartolo di Fredi, which is in a lunette of the Collegiate Church of San Gimignano, and the Creation scene in the Baptistry of the Duomo in Padua (1376-78) by Giusto de'Menabuoi.

the *thema mundi* are not only significant for their similarity to Opicinus's diagram, but also in their witness to a holistic world view, widely disseminated at this time, in which astronomy and biblical history were combined. As a potential source, Lippincott cited Macrobius, 'perhaps the most popular source for the *thema mundi*' and an author who has been shown to have influenced Opicinus's cosmological outlook.⁶⁰² According to what Macrobius himself called 'the birth chart of the Creation', Aries was at the mid-Heaven (top), and Cancer at the ascendant (meaning that when the zodiac signs run clockwise, Cancer is found on the left-most point).⁶⁰³ This is exactly how Opicinus rendered his zodiac rings. In *Palatinus A*, Christ's body intersects with Aries: the very point at which God gestures in the *themata mundi*.

The zodiac ring supports the interpretation that Opicinus depicted the stars at the moment of Creation, but one important detail is cause for hesitation; he did not explicitly state the positions of the stars (including the sun, moon and planets) in *Palatinus A*. According to the majority of the fourteenth-century *themata mundi*, the world was created when God placed the sun in Aries; the sun is therefore always shown in Aries. It is likely, however, that Opicinus intended the image of Christ to represent the sun, whose outstretched arms over the sign of Aries showed that he, the sun, was in that sign. Observing the recognised symbolism of Christ as the sun in the Middle Ages, Opicinus employed this analogy in a drawing in his journal (fig. 65). Using a diagram of the lunar phases, he explained the visibility of the sun (Christ) in relation to the moon (a mirror of the Church).⁶⁰⁴ Not only does this lunar diagram suggest that Opicinus depicted the

⁶⁰² Lippincott, 'The Tradition of the "Thema Mundi",' pp.462-63; Roux, 'Opicinus de Canistris, le Songe de Scipion et son *Commentaire* par Macrobe,' pp.271-85.

⁶⁰³ Abel, 'Intellectual Projection, Liminal Penetration,' p.457. Abel cited Macrobius, *Commentarii*, as translated in J. Tester, *A History of Western Astrology* (Suffolk, 1987), pp.118-19. Lippincott noted other authors' discussions on the subject, such as that of Bede, who believed that the universe began on the fourth day of Creation with time, when God placed the sun on the vernal equinox in the zodiacal sign of Aries. Lippincott, 'The Tradition of the "Thema Mundi",' p.464.

⁶⁰⁴ Vaticanus, fol. 51r. For the transcribed text accompanying the diagram, see Laharie, *Le journal singulier*, 2, p.505. McCluskey noted that the coming of the Messiah as the *Sol Justitiae* (Mal. 4:2) was widely referred to in Christian art and literature. McCluskey, *Astronomies and Cultures*, p.38-39. For more on the history of this interpretation, see F. J. Dölger, *Die Sonne des Gerechtigkeits und der Schwarze* (Munich, 1919), pp.83-110.

stars at the moment of Creation in *Palatinus A*, it also provides another example of how Opicinus presented knowledge of the physical world (the sun and moon) as a pathway to the understanding of God and the Church.

There is a third possible reason for Opicinus's alignment of the Crucifixion with the calendar which, although the most obvious, has, remarkably, not previously been discussed. He aligned the image with the part of the calendar which was most relevant to the cross of the Crucifixion. This is shown by two features. The first is manifest in the *sanctorale* entry below Christ's heart (see fig. 61a): the feast of the Exaltation of the Cross (14 September). The line of text, *Exaltatio crucis domini*, runs up towards Christ's body as if shaping the cross behind him. The second is the red lines running between the centre of the calendar and Christ's stigmata, which delineate the month of March and therefore the majority of the Easter season, to which the Crucifixion is central. In this way, the crucified figures are sophisticated and measured insertions of Christian linear history into astronomical time, as indeed had been indicated long before in Bede's discussion of Christian salvation history in his *De temporum ratione*.

Which of these interpretations did Opicinus intend? An exploration of the three meanings expressed by the alignment shows how Opicinus amalgamated them all to demonstrate the interconnectedness and divine harmony of the cosmos, just as he did with the multiple time systems in his magnifications.⁶⁰⁵ He drew upon the significance of Aries to the astrological understanding of the Creation, in addition to the relevance of the feast dates of both the inner and outer calendars (in mid-September and mid-March, or Aries and Libra), in order to emphasise the significance of Christ's Incarnation and Crucifixion. By illustrating Christ's presence within mankind's mundane and temporal existence, and thus the direct correlation

⁶⁰⁵ This supports Whittington's argument that Opicinus combined multiple cosmic discourses to demonstrate the 'multiplicity and unity' of the universe. Whittington, *Body-Worlds*, p.121.

between time reckoning and theology which has been explored throughout the thesis, Opicinus conformed to the same conception of the universe as was postulated in the *thema mundi*, in which the theological and astrological worlds were understood to be the same. All three together illustrate the overlap between the sensible and spiritual worlds, which was revealed to Christians by God's Creation of the universe, as shown in the *thema mundi*, and his Incarnation as Christ.

The alignment of Christ's body with the structures of the natural world further illustrates how Opicinus sought to reconcile the two spheres of philosophical and theological knowledge. He used the temporal mechanisms which governed the physical world to visualise the spiritual. Building on the Augustinian conception of the divine cosmos, Opicinus used the visible world, which was accessible to human sensory perception, to comprehend the invisible divinity. In addition to expressing his world view, this shows that the enterprise of the Palatinus drawings reached beyond a scientific aim, to a spiritual one. The technologies for rendering time and space in his drawings were tools in the service of an overall theological pursuit. For Opicinus, science was the handmaiden of theology.

The Measurement of Christ in the Palatinus

The individuality of Opicinus's drawings of Christ is not that he aligned the divine body with certain ideas, but the nature of that alignment. His bodies are geometrically modelled in proportion to the units of the calendar.⁶⁰⁶ The exact measurement of Christ by means of the technological aspects of his drawings was, for Opicinus, not only a way to show there was a

⁶⁰⁶ It should also be noted that Opicinus aligned the Crucifixion throughout the Palatinus with the same calendar dates as he did on *Palatinus A*. The two Crucifixions in fol. 16^v, for example, show that despite the complicated intersection of three calendars, Opicinus went to great trouble to align them in the same way.

correspondence between the body of Christ and the time and space of the physical world, but a means to measure them against each other in a meaningful way. Like the metric relics in which, on a smaller scale and in a less thorough way, Christ's body was spatially quantified, Christ was measured by Opicinus on a numerical-temporal scale. There is no evidence of a direct relationship between Opicinus's diagrammatic images of Christ and metric relics, and this is not what is suggested here. Yet both can be traced to the perspectival shift in the history of thought in which qualities came to be quantified. Opicinus sought to define salvation in the language used to measure the physical world, which in this case consisted of the most accurate forms of technology that measured time and space which were available in the fourteenth century.

This is reinforced by other Palatinus drawings in which Opicinus aligned Christ with geographically significant places. In fol. 6^r (fig. 66), he incorporated a portolan chart within a calendar, which in this case includes both a *santorale* and *temporale* (as studied in chapter three). As in the calendar of *Palatinus A*, the map and calendar were clearly drawn before the figures. Within the top right corner of the calendar, there is a small drawing of Christ crucified with the (abbreviated) legend 'Jerusalem' running through the centre of his body. Just as Opicinus temporally framed the Crucifixion in *Palatinus A*, he here situated it spatially by placing the image of the Crucifixion upon the geographical place in which scripture recorded it to have happened.⁶⁰⁷ Instead of being quantified against a temporal scale, Christ is in this case aligned with accurate spatial coordinates according to the portolan chart.

As is illustrated by the *themata mundi* and the earlier 'spiritual maps' evaluated by Edson, the reconciliation of the 'Christian theological view of the world and the hard facts of physical reality' was not novel, but Opicinus's drawings were unique in their application of technology to

⁶⁰⁷ The Gospels record Christ's Crucifixion at Golgotha, just outside the walls of Jerusalem (Mark 15:22; Matthew 27:33; Luke 23:33; John 19:27).

this end.⁶⁰⁸ But what was the desired effect of integrating these technologies into his images? Why not, as in previous cosmological drawings of God and the physical world, simply show their relationship through certain visual correspondences, such as God's gesture to Aries in the *thema mundi*? Here, the understanding of Opicinus's activity within the history of measurement becomes important. During the period in which he drew his cosmologies, there was a growing tendency towards accuracy and precision. It is no wonder that Opicinus, with the most accurate renderings of time and space at his disposal, would use these to create the most precise renderings of Christ.

As has been shown throughout this thesis, Opicinus did not work in a vacuum. If the theological aspects of his drawings were informed by the shift from the qualitative to quantitative expression of values, this phenomenon was certainly apparent in other aspects of contemporary visual culture. Of particular relevance are the Christological images whose size and proportion were a crucial component for their activation. Their scale was the root of their relic-like potency because the information concerning Christ was represented in the same visual language of number and scale which was used to model the physical world. By considering a certain way of representing Christ's body which began to emerge in the fourteenth century, one can observe the extent to which the growing importance of mensuration, and therefore ideas concerning the perception of the physical world, affected not only Opicinus's drawings themselves, but image-making more widely.

⁶⁰⁸ E. Edson, *Mapping Time and Space: How Medieval Mapmakers Viewed Their World* (London, 1997), p.163.

Devotional Precision: Christ's Body, Maps and Clocks

In lieu of Christ's ascended body, metric relics provided visual and material traces of Christ and the instruments of his Passion (most often the cross and nails). Their evocation of the original body was based on the conception that the medieval images were to scale to his body and the instruments as they had existed in history. David Areford analysed printed editions of the measured side wound of Christ from the fifteenth century onwards. He argued that scale was essential to the image's devotional function as it 'allowed a highly corporeal and spatial understanding of Christ's body', thus imbuing it with a relic-like potency.⁶⁰⁹ Although the majority of extant Christological metric relics are found accompanying prayers in fifteenth-century scrolls and Books of Hours, Areford traced the tradition further back, to early-fourteenth-century manuscripts in which the isolated side wound was depicted 'as if it were interchangeable with the body of Christ'.⁶¹⁰ This is apparent in both the *Image du monde* by Gautier of Metz (fig. 67, c. 1320) and the Prayer Book of Bonne of Luxembourg (fig. 68, b. 1349), in which the side wound measures the same height as the cross of the Crucifixion and the pole of the Flagellation. Here scale plays a dominant role in signifying the relationship between Christ's body and the *arma Christi*, which is not yet expressed by a quantified measurement but by the proportion of the images in relation to one another.

It was not until the later examples, such as that of HM 1104 mentioned above, that the *arma Christi* were imbued with numerical quantities.⁶¹¹ Christ's side wound is here depicted beside a

⁶⁰⁹ D. S. Areford, 'Printing the Side Wound of Christ' in *The Viewer and the Printed Image in Late Medieval Europe* (Farnham, 2010), pp.229-67, p.232. Whittington employed Areford's interpretation of 'metric relics' in his analysis of Opicinus's use of allegory in the 'body worlds' of his journal. Whittington, *Body-Worlds*, p.70.

⁶¹⁰ Areford, 'Printing the Side Wound of Christ,' p.240.

⁶¹¹ In addition to metric relics, this impetus can also be detected in numerological texts in which the amount of Christ's suffering was quantified through the application of formulaic methods which had been derived from liturgical routine. For example, the number of Christ's wounds, often found to be 5,475, was derived retroactively from the number of Paternosters and Ave Marias said during the year (fifteen daily x 356). Areford, 'Printing the Side Wound of Christ,' p.234, citing C. Brown, *Religious Lyrics of the XVth Century* (Oxford, 1939), p.323.

fragment of the cross accompanied by a prayer concerning the height of Christ. The text states that the cross fragment multiplied by twenty makes the height of Christ (*Hec linea vigesies multiplicata Christi longitudinem representat*), and that those who look upon it shall be safe from harm.⁶¹² The pairing of the prayer and the measured *membra Christi* claimed to provide the image with a physical power, transforming the drawing into a protective amulet: an instrument activated by prayer. Although this example is part of a broader tradition of metric relics in manuscripts and incunabula, the Huntington diagram is particularly revealing in its ruler-like depiction of the fragment of the cross, which emphasises the process of precise measurement in its activation.⁶¹³

The size of the cross-fragment image itself (93 mm long) is significant in that it is not an arbitrary quantity, but when activated using the instructions in the accompanying texts, helps the viewer imagine the height of a tall man. Following the prayer's direction, 93 mm multiplied by twenty makes 1.86 m (just over 6 ft 1 in.). The image is not only a realistic indication of a man's height, but also conforms to contemporary beliefs concerning Christ's physical appearance. He was described in what is most often referred to as the Lentulus letter, purportedly written by Publius Lentulus, the governor of Judea who claimed to be the predecessor of Pilate.⁶¹⁴ It is now, however, accepted to have been written in Italy in the thirteenth or early-fourteenth century,

⁶¹² Parts of the following transcription are taken from *Digital Scriptorium*, whereas italicised words are the author's transcription: Oratio ad staturam Domini nostri ihesu christi, Adoro te Domine Ihesu Christe salvator et sacratissimam staturam corporis tui Qui orationem precentem ad vulnus Domini Nostri Ihesu Christi devote dixerit IIIII^m milia annos indulgentiarum a papa innocentio consequetur. Et hec linea vigesies multiplicata christi longitudinem representat. *Hec mensura dei quam dampnaverunt pharisei, visa malum pellit quequam nociva repellit* (HM 1104, folios 215^v-216^r). 'HM 1104,' *Digital Scriptorium*, <http://bancroft.berkeley.edu/digitalscriptorium/huntington/HM1104.html> (consulted 01/08/2016). The consultation of this manuscript was made possible by a one-month Dibner Fellowship in the History of Science and Technology at the Huntington Library, California (August, 2016), for which I am grateful.

⁶¹³ For more on *mensurae Christi*, see n.592 above. It is not clear when rulers began to be used to measure (and not solely as tools to draw straight lines). A measuring ruler is depicted in a 15th-century copy of Richard of Wallingford's description of his own instrument, the *Rectangulus*, originally composed around 1326. Bodleian Library, MS Laud Misc. 557, fol. 48^r.

⁶¹⁴ *The Image of Christ: Catalogue of the Exhibition 'Seeing Salvation'*, ed. G. Finaldi (London, 2000), pp.94-96.

when the earliest manuscripts containing the letter were written.⁶¹⁵ It reads: 'He raises the dead and cures all manner of diseases; he is somewhat tall in stature and has a comely and reverend countenance, such as the beholders both dear and love'.⁶¹⁶ Like the detailed description and commentary of the vision in Ezekiel 1, the appearances of Christ in the Lentulus letter and metric relics take their devotional power from the realistic representation of physical attributes as given in biblical and exegetical literature. Number imbued these physical descriptions in which God appears with a semblance of accuracy and therefore authority, and so gave the images the same miraculous healing power as primary relics.

The reason for emphasising the 'exactness' of these numerical quantities is not to question or validate the devotional value of the object. Instead, it shows how the image is not an abstract depiction of a devotional concept, or the idea of Christ's height; it is instead a quantified and functional instrument which, if one follows the instructional text in the prayer, gives a height by which one can visualise the stature of a man in realistic terms. The image is not meant to represent Christ, but to embody him. The authority of number and scale transforms this rectangle from a representation of a concept into an instrument with relic-like potency. It therefore gained its devotional significance through its scale. Because Christ's body could be expressed numerically, and hence in the same units as the time and space of the physical world, the measurements of the instrument were held to be powerful in their own right.

In this visual tradition in which the devotional power of the image was harnessed through the accurate and 'to-scale' representation of divine forms, a growing tendency can be detected in the fourteenth century: moving away from the measurement of Christ's body in proportion to other

⁶¹⁵ *Prayers and Portraits: Unfolding the Netherlandish Diptych*, ed. J. O. Hand and C. A. Metzger (London, 2006), pp.200-05, p.200.

⁶¹⁶ *suscitans mortuos. Et sanat languares. Homo quidem statura procerus. Et spectabilis. Vultum habens venerabilem. Quem intuentes possunt diligere et formidare.* Cited in *The Image of Christ*, p.94.

images and towards a numerical description: from quality to quantity. As the methods of measuring the visible world changed, so did the method for measuring Christ.

The tendency towards precision in the sophisticated rendering of time and space has been observed throughout the thesis, not only in the drawings of Opicinus but also in other images made in Avignon: in the portolan charts (which were probably accompanied by calendars) of Sanudo's *Secreta*, in the chronological calculations and their visualisation in Paolino Veneto's *Satirica Historia*, and in the complex renderings of three-dimensional space in Henricus's *De Rotis*. In fact, these images more directly illustrate the relationship between theological ideas and the changing understanding and representation of time and space.

Areford also made this connection in his argument that the increasing precision of fifteenth-century woodcut maps affected, to an extent, the rendering of both secular and devotional images. 'Like these scale maps, the print includes precise measurements that are central to its function; but unlike the maps, it employs these measurements to establish both a spatial and devotional precision, exemplifying a late-medieval tension between the rendering of symbolic space and actual space'.⁶¹⁷ He argued the impact of accurate spatial measurement on a religious world view to be demonstrated by the *De docta ignorantia* of the German philosopher, Nicholas of Cusa (d. 1464): 'It is the blessed God who is the centre of the world. He is the centre of the earth and of all the spheres, and of all [the things] that are in the world, as He is at the same time the infinite circumference of all'.⁶¹⁸ Elsewhere, Nicholas said, 'Think of precision, for God is

⁶¹⁷ Areford, 'Printing the Side Wound of Christ,' p.232.

⁶¹⁸ For the quotation of Nicholas of Cusa, Areford cited A. Koyré, *From the Closed World to the Infinite Universe* (Baltimore, 1957), p.12. This line of argument is summarised in his quotation of Alfred Crosby, who argued that Nicholas's text represents a shift 'from thinking of the world in terms of qualities to thinking of the world in terms of quantities'. Quoted in Areford, 'Printing the Side Wound of Christ,' p.253-55.

absolute precision itself'.⁶¹⁹ According to this view, the cartographic perception of scale was directly connected to that of devotional images.

The direct connection between theology and the accurate rendering of space, which is here documented in the fifteenth century, had certainly begun already in the fourteenth century.⁶²⁰

Opicinus's chart-copying experience and hence his awareness of the most accurate forms of maps is demonstrated in his drawings through the use of portolan charts and his awareness of scale as described in his journal.⁶²¹ Building on Areford's assertion that 'certain types of empirical knowledge could also possess the miraculous powers of the relic', Whittington concluded that Opicinus's 'allegories were not truths masked by fictions, but allegorical truths embedded in empirical truths'. Opicinus used his portolan charts as a 'kind of relic' upon which to base the body worlds of his journal.⁶²² The accuracy of his maps was therefore crucial to their devotional meaning.

Although both Areford and Whittington focused on how the growing accuracy of spatial measurement influenced devotional image making, neither considered this effect in relation to time measurement and the introduction of 'clock time'. Its effect is in fact shown in the same

⁶¹⁹ Ibid., p.255. Areford cited Nicholas of Cusa, *The Layman on Wisdom and the Mind*, transl. M. L. Führer (Ottawa, 1989), p.41.

⁶²⁰ In the Vaticanus (fol. 77v), Opicinus wrote that whilst he had never seen a portolan chart being made, he learnt to copy them before his move to Avignon: *Nunquam vidi fieri mappas maris nec curavi videre fieri, eo quod ignorantia mea non permittebat me talia scire. Solus autem Deus aperuit mihi intellectum ut ad exemplar alterius illam transcriberem, nemine me docente, ignorante me tamen presens misterium nisi postquam a terribili infirmitate convalui, usque ad annum expectationis*. Transcription from Laharie, *Le journal singulier*, 2, p.804. Morse cited this in *A Complex Terrain*, p.124, n.55.

⁶²¹ Vaticanus, fol. 59r: 'In the map of the navigable ocean drawn up by the Genoese and the Majorcans, one can calculate exactly the number of feet with the aid of the miles indicated on the corners of the map. Each point (that is to say, the distance between two points) corresponds to ten miles. Then, through five of these spaces there is an elongated rectangle that measures five x ten, or fifty miles. These rectangles multiplied by seven permit one to calculate with precision a distance of seven times fifty, or 350 miles. And if one can precisely make an estimation of a distance in the sea, it is no more difficult to measure a distance on land'. *In mappa maris navigabilis secundum Ianuenses et Maioricenses, habetur certa taxatio passuum per miliaria que in lateribus huius carte. Per quodlibet punctum denotat X miliaria (scilicet in spacio inter punctum et punctum). Deinde per V spacia ipsa facit unam quadraturam oblongam, que per quinquies X computat L. Que quadrature per VII faciunt certam taxationem in longum habentem septies L, id est CCCL miliaria passuum. Habita certa descriptione maris, sine dubio intelligitur certa descriptio terre*. Whittington translated this into English (from Laharie's French) in Whittington, *Body-Worlds*, p.41. Latin transcription from Laharie, *Le journal singulier*, 2, p.586.

⁶²² He used fol. 74v as an example. Whittington, *Body-Worlds*, p.70.

genre of manuscripts in which the earliest surviving metric relics are found. In the mid-fifteenth century, illuminated clock faces, which Rudy referred to as 'Thesus-Maria Clocks', began to be pasted into Books of Hours, often following the calendar or preceding the Hours of the Virgin. One such clock face (fig. 69, c. 1460-70) was pasted into an earlier South-Netherlandish Book of Hours. Following the twelve Roman numerals, which run clockwise, the Dutch text reads: 'I guard the hours; I do not know when the Lord shall come' (*Ik wacht die ure/ Ice n weet wanneer sal comen die heer*).⁶²³ This is in reference to the wise and foolish Virgins. According to Matthew 25: 1-13, they waited for the bridegroom to appear and did not know when he would arrive (as echoed in the clock's legend). When the Lord came, the wise virgins had their lamps ready and the unwise did not, so only the wise could go with the Lord.

If metric relics reveal the heightened importance of scale in certain devotional images, the clock-face illuminations demonstrate the corresponding consequence of mechanical time-keeping. The changing ideas and representations of time during the fourteenth and fifteenth centuries directly informed fifteenth-century devotional image making through the inclusion of pictures of the new time-keeping technology. Although Opicinus made his drawings a century earlier, this tendency can already be detected in them. This is evident in the influence of 'clock time' in Opicinus's drawings, considered in the previous chapter, and also in the degree of precision by which he measured the figures of Christ in relation to his calendars, showing the significance of temporal accuracy to his creations. Although Opicinus did not draw a clock, his drawings are harbingers of these theologically-conceived clock illuminations. The integration of maps and clocks into objects for veneration shows the growing desire for devotional precision in the fourteenth and fifteenth centuries.

⁶²³ Rudy, 'Thesus-Maria Clocks and Wounds,' p.142. The manuscript (c. 1440) in which the clock face is pasted is in a private collection in France.

Conclusion

The idea that the intangible divine could be understood through the physical world had been present throughout the Middle Ages, as had been discussed by Augustine, Jerome and, much later, the 'Oxford Platonists'. Later in the Middle Ages, the changing attitudes towards empirical measurement had a bearing on the study of the sacred, from which there emerged an increasing concern for theological precision. In terms of images, this meant that theological ideas could be visibly measured in the same way as the physical world. The visual language used to represent the natural world in *mensura et numero et pondere*, a phrase Opicinus inserted into one of his last diagrams (fol. 1^v), was inextricably bound to that used to represent the divine.⁶²⁴ Just as a map modelled the earth and the calendar modelled time, so could an image model Christ. Scale was thus an important feature of certain late-medieval images.

Opicinus's drawings, as well as other creations of his immediate cultural environment, were predicated on the conviction of the harmonious interrelatedness of divine creation, and can thus be aligned with the holism of the Platonic Christian tradition. Opicinus valued the accuracy not only of his maps and calendars, which were surely amongst the most detailed of his time, but also of his images of Christ. In each diagrammatic component concerning time, space and God, he was as precise as he could possibly be, before he integrated the parts as meaningfully as he could.

Opicinus's measurement of Christ's body against calendars and maps was exceptional. However, his particular method of using the most up-to-date technology for rendering the physical world to measure divine concepts can be ascribed to the intellectual currents of the fourteenth century

⁶²⁴ Wisd. 11:21

and their crystallisation at the Avignon court. The surviving manuscripts made in Avignon record calendar reform, chronological calculation, and the integration of detailed calendars and maps within manuscripts, all of which were founded upon the study of the physical world but which had a distinctly theological purpose. This can be gauged in the visual culture of the court before one even considers the Palatinus. Whilst there is only a partial picture of this phenomenon, these visual sources are united within Pope John's project to gather all *scientia* to picture the cosmos with theological precision.

Conclusion

Opicinus built his cosmologies by integrating all of the most accurate information at his disposal related to time, space and scripture into one unified entity. Considering the drawings separately, one can decipher multi-layered diagrams built on a foundation of technological drawings: monumental calendars and portolan charts. These were imbued with theological meaning through the incorporation of images which Opicinus believed to represent God's Incarnation: the wheels of scripture, Gospel beasts and bodies of Christ. This thesis has evaluated exactly how Opicinus aligned these components, by focusing on his representation of time. Through the coordination of the minute measures of various systems of time: astronomical, liturgical, biblical and cosmological, he demonstrated the divine order of the universe through the complex interrelation between the physical and spiritual worlds. Significantly unique to Opicinus was his inclusion of features which he rendered to scale with the sensible world. These drawings were not abstract re-presentations, but embodiments of the cosmos which visualised and configured the intangible mechanisms which governed the universe: models of the *machina mundi*.

Although this investigation contributes to the school of thought which argues for Opicinus's rationality, it is not simply an extension of its previous studies. Whittington's and Harding's invaluable analyses of the components of Opicinus's drawings laid the necessary groundwork for their further investigation. Yet it is no longer enough to show that an internal logic exists within the Palatinus, or that the drawings exhibit certain medieval conventions. It is time that Opicinus is recognised as an intellectual of the Avignon court who, while exposed to traditional images and ideas there, was also a participant in cutting-edge research on the natural world and the divine.

In isolation, the Palatinus drawings are fascinating puzzles which have captivated their would-be

interpreters. They are, however, more significant as testimonies to their surrounding visual and intellectual culture. This study has evaluated what they can tell us about the activities at the Avignon court and the perception and use of medieval diagrams there. Their contextualisation has revealed new insights into the major concerns of the court during this time, such as chronology, liturgical reform and calendar reform, and into particular sources associated with the court and drawn upon by Opicinus, including the astronomical calendars of Pietro Vesconte, the latest horological devices, the workshops of the *Queste* and St George Masters, and the *De Rotis*.

Considered together, the convergence of these Avignonese sources focuses attention upon an intellectual and artistic project which was closely connected with the pontificate of John XXII. This thesis has pieced together a clearer, if only partial, picture of this episode to hypothesise that John, in addition to his larger task to build Avignon as a new intellectual (no less than bureaucratic) capital of the world, was the architect of a project which re-examined the place of the Roman Church in the cosmos. He convened diverse intellectuals and leading members of the papal Curia at the court, where he would involve them in his theological *disputationes* and commission them to create image-instruments (or to produce copies of diagrams they had already made) to inform this discussion. Opicinus, as has been demonstrated by a contextualised review of his drawings, began the Palatinus as a contribution to this project. With John's encouragement and support upon his arrival at the penitentiary, Opicinus looked to the diagrammatic works of his predecessors, some made less than a decade before, to create his own.

This has revealed the initial motive for Opicinus's project, but there is still important work to be done on the works produced in Avignon during the pontificates of Benedict XII and Clement VI, and how Opicinus responded to these. While there seems to have been a falling-away of new large-scale manuscript diagrams from the mid-1330s, which is probably indicative of their particular interest to John, Opicinus continued to integrate new research into his drawings. This

is demonstrated by his attempt to make a significant contribution to the calendar reform in one of his last drawings (fol. 1^v). This consideration of the intellectual culture of the papal court and the variety of creative work undertaken there has required a multi-disciplinary engagement with the growing bibliographies on the artistic production, cartography and calendar reform at Avignon. The thesis is offered as a contribution to this necessarily collaborative project.

The identification and interpretation of image-instruments as a specific category of image will, I hope, contribute to art-historical literature on the function of medieval diagrams. The features of the images discussed in the preceding chapters, such as their movement, scale, inclusion of detailed measures, and three-dimensional depiction of space, allowed them to function as both images and instruments. Through their interpretation in relation to the most recently developed ideas concerning the representation of time and space in the first half of the fourteenth century, this study has shown how the history of technology significantly contributes to their understanding. In some instances of Opicinus's work at Avignon, features drawn from technological depictions of time and space were incorporated into his drawings; in others, the impact of technological change is less conspicuous, such as the recognition of 'clock time' in the *Palatinus*. The evaluation of how these images were used for theological purposes has informed a wider examination of the effect of changing ideas about time, technology and natural philosophical thought upon theological and visual culture. It has ultimately been seen that the diagrams in question were made in significant part for the quantification, and therefore the deeper and more authoritative interpretation, of God.

Technology is often neglected by art history, despite its impact on the way in which intangible forces, such as time, have been quantified, perceived and represented. As this thesis has shown, Opicinus's representation of time was affected by new ideas about time, including new methods of its keeping, in the first half of the fourteenth century. This investigation has been case-study

of how the history of technology can inform the study of visual culture. Setting aside traditional boundaries, these disciplines together have revealed something of the interrelationship between technological and theological world views in the Middle Ages. The novel conclusions on Opicinus which have been gathered through this methodology are an invitation to art historians, medieval and otherwise, to consider how technology – not as an independent historical force but in constant interaction with its surrounding culture – has conditioned the ways in which the invisible has been represented, and thus its effect on the making of images throughout history.